IECC - Commercial

2019 GROUP B PUBLIC COMMENT AGENDA

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RIO HOTEL AND CONVENTION CENTER
LAS VEGAS, NV

INTERNATIONAL CODE COUNCIL®

2019 Public Comment Agenda

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CE1-19 Part I

IECC: Part I: SECTION C101.2, C101.3, C101.4.1, C101.5, C202, C202, (New), C401.1, C401.2, C401.2.1(New),

IECC: Part II R101.2, R101.3(N1101.2) , R101.4.1, R101.5, R202 (N1101.6), R202 (N1101.6) (New), R401, R401.2.1(N1101.13.1)(New), R401.2.2(N1101.13.2)(New), R401.3(N1101.14)

Proposed Change as Submitted

Proponents: Darren Meyers, P.E., International Energy Conservation Consultants LLC, representing Self (dmeyers@ieccode.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

SECTION C101
SCOPE AND GENERAL REQUIREMENTS

C101.1 Title. This code shall be known as the Energy Conservation Code of [NAME OF JURISDICTION], and shall be cited as such. It is referred to herein as "this code."

Revise as follows:

C101.2 Scope. This code applies to *commercial buildings* and ~~the buildings' sites and associated systems and equipment.~~ *structures* , their associated *sites* , systems and equipment; and energy-using systems and equipment associated with *sites* considered areas of land under the control of a single owner or entity.

C101.3 Intent. This code shall regulate the design and construction of *buildings* , *structures* and *sites* for the effective use and conservation of energy over ~~the~~ their useful life ~~of each building~~. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

C101.4.1 Mixed residential and commercial buildings, structures and sites. Where a *building, structure* or *site* includes both *residential* ~~building~~ uses and *commercial* ~~building portions~~ uses, each ~~portion~~ use group shall be separately considered and meet the applicable provisions of IECC—Commercial Provisions or IECC—Residential Provisions.

C101.5 Compliance. *Residential buildings, structures* and *sites* shall meet the provisions of IECC—Residential Provisions. *Commercial buildings, structures* and *sites* shall meet the provisions of IECC—Commercial Provisions.

SECTION C202
GENERAL DEFINITIONS

Revise as follows:

~~BUILDING~~ SITE. A contiguous area of land that is under the ownership or control of one owner or entity.

Add new definition as follows:

[A] STRUCTURE. That which is built or constructed.

SECTION C401
GENERAL

Revise as follows:

C401.1 Scope. The provisions in this chapter are applicable to commercial *buildings, structures* and ~~their *building*~~ *sites*.

C401.2 Application. *Commercial buildings , structures* , and *sites* shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402 through C405 and C408. In addition, *commercial buildings* , associated *structures* and *sites* shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.

3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The aggregate *building* , *structure* and *site* energy cost shall be equal to or less than 85 percent of the standard reference design building.

Add new text as follows:

C401.2.1 Application to structures and sites. Energy-using systems and equipment serving s*ites* or *structures*, with or without a contiguous *building*, including site lighting; motors for pumps, fountain pumps and water moving equipment; and vertical transportation equipment, elevators and escalators, shall meet the applicable provisions of this code as described in Sections C403, C404, C405. C407 and C408

Reason:
There are areas outside of the commercial and residential buildings where energy savings is possible by applying provisions currently in the IECC. Examples include lighting in parking lots that may or may not be directly associated with a commercial or residential building or lighting and equipment associated with industrial or physical plants, public or private parks and public or private campus environments. Imagine the additional and credible energy savings that could be aquired by expanding the scope and applicaiton of the IECC, as such.

This proposal expands the scope and application of the commercial provisions of the IECC to apply to energy-using systems in areas outside of the building itself. The proposal revises an existing term "BUILDING SITE' and introduces term, “STRUCTURE” utilized throughout the ICC Family of International Codes, to define those types of environments where the building may not enclose the extent of energy-using lighting, motor, pumping and vertical transportation systems and equipment addressed in the code as currently constituted. Also, a new provision is included in both Chapter 4 [CE] and Chapter 4 [RE] “Application” to address structures and sites with or without buildings.

Cost Impact: The code change proposal will increase the cost of construction
While there will be a cost impact associated with this change when compared to current provisions, the change better positions the IECC to be clearer, more easily applied to structures and sites constructed without associated buildings, and more competitive than the 90.1 Standard alternative on the issue

CE1-19 Part I

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Submitted**

Committee Reason: Clarifies that the code covers more than just buildings. Other equipment on the site is addressed by the code. The committee noted that the resulting text of Section C101.2 may need some revision to the last line for grammar and clarity (Vote: 11-4)

Assembly Action: **None**

CE1-19 Part I

Individual Consideration Agenda

Public Comment 1:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net); William Prindle, representing EECC (wprindle@icfi.com); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it expands the scope of the IECC into uncertain territory without consideration of the potential for unintended consequences. It is hard to imagine how a building code official would assert jurisdiction over “energy-using systems and equipment associated with sites considered areas of land under the control of a single owner or entity." Specifically, we are concerned about the potential of extending the code beyond the specific building to some sort of collective compliance for a group of buildings, structures and sites under the control of a single entity. In our view, each building should individually comply with the code. The IECC-Residential Committee correctly disapproved Part 2 recognizing that "the proposed language could expand IECC enforcement duties/responsibilities into areas not appropriate for the IECC." We recommend disapproval of both parts 1 and 2.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1427

CE1-19 Part II

IECC: R101.2, R101.3 (IRC N1101.2), R101.4.1, R101.5, R202 (IRC N1101.6), R401.1, R401.2 (IRC N1101.13), R401.2.1 (IRC 1101.13.1) (New), R401.2.1 (IRC N1101.13.1, R401.3 (IRC N1101.14)

<u>Proposed Change as Submitted</u>

Proponents: Darren Meyers, P.E., International Energy Conservation Consultants LLC, representing Self (dmeyers@ieccode.com)

2018 International Energy Conservation Code

Revise as follows:

SECTION R101 (IRC N1101)
SCOPE AND GENERAL REQUIREMENTS

R101.1 Title. This code shall be known as the Energy Conservation Code of [NAME OF JURISDICTION], and shall be cited as such. It is referred to herein as "this code."

Revise as follows:

R101.2 Scope. This code applies to *residential buildings* and ~~the *building* sites and associated systems and equipment.~~ <u>*structures* , their associated *sites* , systems and equipment; and energy-using systems and equipment associated with *sites* considered areas of land under the control of a single owner or entity.</u>

R101.3 (IRC N1101.2) Intent. This code shall regulate the design and construction of *buildings*<u>, *structures*</u> <u>and</u> <u>*sites*</u> for the effective use and conservation of energy over the <u>their</u> useful life ~~of each building.~~ This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

R101.4.1 Mixed residential and commercial <u>*buildings* , *structures* and *sites*</u>. Where a *building*<u>, *structure*</u> <u>or</u> <u>*site*</u> includes both *residential* ~~*building*~~ <u>uses</u> and *commercial* ~~*building*~~ ~~portions~~ <u>uses</u>, each ~~portion~~ <u>use group</u> shall be separately considered and meet the applicable provisions of the IECC—Commercial Provisions or IECC—Residential Provisions.

R101.5 Compliance. *Residential buildings*<u>, *structures* and *sites*</u> shall meet the provisions of IECC—Residential Provisions. *Commercial buildings*<u>, *structures* and *sites*</u> shall meet the provisions of IECC—Commercial Provisions.

SECTION R202 (IRC N1101.6)
GENERAL DEFINITIONS

~~**BUILDING**~~ **SITE.** A ~~contінguous~~ <u>contiguous</u> area of land that is under the ownership or control of one <u>owner or</u> entity.

Add new text as follows:

<u>**STRUCTURE.** That which is built or constructed.</u>

Revise as follows:

SECTION R401
GENERAL

R401.1 Scope. This chapter applies to *residential* buildings<u> , *structures*</u> <u>and</u> <u>*sites* .</u>

R401.2 (IRC N1101.13) Compliance. ~~Projects~~ <u>*Buildings* , *structures*</u> <u>and</u> <u>*sites*</u> shall comply with one of the following:

1. Sections R401 through R404.
2. Section R405 and the provisions of Sections R401 through R404 indicated as "Mandatory."
3. The energy rating index (ERI) approach in Section R406.

Add new text as follows:

<u>**R401.2.1 (IRC N1101.13.1) Application to structures and sites.** Energy-using systems and equipment serving *sites* or *structures* , with or without a contiguous *residential building* , including site lighting; motors for pumps, fountain pumps and water moving equipment; and vertical transportation equipment, lifts, elevators and escalators, shall meet the applicable provisions of this code as described in Sections R403, R404, R405 and R406.</u>

Revise as follows:

~~R401.2.1~~ R401.2.2 (IRC ~~N1101.13.1~~ N1101.13.2) **Tropical zone.** *Residential buildings*, *structures* and *sites* in the tropical zone at elevations less than 2,400 feet (731.5 m) above sea level shall be deemed to be in compliance with this chapter provided that the following conditions are met:

1. Not more than one-half of the *occupied* space is air conditioned.
2. The *occupied* space is not heated.
3. Solar, wind or other renewable energy source supplies not less than 80 percent of the energy for service water heating.
4. Glazing in *conditioned* spaces has a *solar heat gain coefficient* of less than or equal to 0.40, or has an overhang with a projection factor equal to or greater than 0.30.
5. Permanently installed lighting is in accordance with Section R404.
6. The exterior roof surface complies with one of the options in Table C402.3 or the roof or ceiling has insulation with an *R-value* of R-15 or greater. Where attics are present, attics above the insulation are vented and attics below the insulation are unvented.
7. Roof surfaces have a slope of not less than onefourth unit vertical in 12 units horizontal (21-percent slope). The finished roof does not have water accumulation areas.
8. Operable fenestration provides a ventilation area of not less than 14 percent of the floor area in each room. Alternatively, equivalent ventilation is provided by a ventilation fan.
9. Bedrooms with exterior walls facing two different directions have operable fenestration on exterior walls facing two directions.
10. Interior doors to bedrooms are capable of being secured in the open position.
11. A ceiling fan or ceiling fan rough-in is provided for bedrooms and the largest space that is not used as a bedroom.

R401.3 (IRC N1101.14) Certificate (Mandatory). A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*, at the *structure* , or in a conspicuous location on *site*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall indicate the predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, crawl space walls and floors and ducts outside *conditioned spaces*; *U*-factors of fenestration and the *solar heat gain coefficient* (SHGC) of fenestration, and the results from any required duct system and *building* envelope air leakage testing performed on the *building*. Where there is more than one value for each component, the certificate shall indicate the value covering the largest area. The certificate shall indicate the types and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate “gas-fired unvented room heater,” “electric furnace” or “baseboard electric heater,” as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters.

Reason:
There are areas outside of the commercial and residential buildings where energy savings is possible by applying provisions currently in the IECC. Examples include lighting in parking lots that may or may not be directly associated with a commercial or residential building or lighting and equipment associated with industrial or physical plants, public or private parks and public or private campus environments. Imagine the additional and credible energy savings that could be aquired by expanding the scope and applicaiton of the IECC, as such.

This proposal expands the scope and application of the commercial provisions of the IECC to apply to energy-using systems in areas outside of the building itself. The proposal revises an existing term "BUILDING SITE' and introduces term, “STRUCTURE” utilized throughout the ICC Family of International Codes, to define those types of environments where the building may not enclose the extent of energy-using lighting, motor, pumping and vertical transportation systems and equipment addressed in the code as currently constituted. Also, a new provision is included in both Chapter 4 [CE] and Chapter 4 [RE] “Application” to address structures and sites with or without buildings.

Cost Impact: The code change proposal will increase the cost of construction
While there will be a cost impact associated with this change when compared to current provisions, the change better positions the IECC to be clearer, more easily applied to structures and sites constructed without associated buildings, and more competitive than the 90.1 Standard alternative on the issue

CE1-19 Part II

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **Disapproved**

Committee Reason: The proposal expands coverage of the IECC in unnecessary ways. The current code text is sufficient to address the areas of the proponent's concerns. The committee raised the concern that the proposed language could expand IECC enforcement duties/responsibilities into areas not appropriate for the IECC. (Vote: 10-1)

Assembly Action: **None**

CE1-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:
Darren Meyers, representing Self (dmeyers@ieccode.com)

requests As Submitted

Commenter's Reason: The IECC Residential Committee appeared anxious or unwilling to grasp what the IECC Commercial Committee clearly did - that there exist areas outside of residential buildings where energy savings is possible.
Examples include lighting in parking lots that may or may not be directly associated with a (group of) residential building(s) or a planned unit development with connected lighting power (3-story or less R-2; non-active parks or communal parking) or other electrical loads (pumps serving decorative waterfalls or a purposeful fountain(s) dedicated to aerating a community pond).

For our future, the IECC will be called upon (by both policy makers and our successors in code enforcement) to expand its application to additional and credible energy savings on residential sites that can be attained by expanding scope. This is our intent. It is neither unnecessary nor intent on expanding duties beyond the site for which code enforcement is already familiar.

More clearly stated, "the specific overrides the general." Where "specific" provisions applicable to site energy-using systems do not yet appear in the IECC, no such "general" regulation of these systems is intended until the respective IECC code development committees act on such "specific," future proposals.

We ask U.S. Code Enforcement to support this proposal (as did the IECC Commercial Committee) to expand the potential application of the residential provisions of the IECC and match action on CE1-19, Part I, to apply to energy-using systems in areas outside of the building itself.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
While there will be a cost impact associated with this change when compared to current provisions, the change better positions the IECC to be clearer, more easily applied to structures and sites constructed without appurtenant buildings, and more competitive than Standard 90.1 on the issue.

Public Comment# 1708

CE2-19

IECC: Section C101.3

Proposed Change as Submitted

Proponents: Sharon Bonesteel, Salt River Project, representing Salt River Project (sharon.bonesteel@srpnet.com); Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Revise as follows:

C101.3 Intent. This code shall regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building. The shift of a load from on-peak period to off-peak shall be considered a part of the effective use of energy. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: The conservation of energy and its related cost are the foundation of the IECC. Since the cost of energy is time dependent, it makes sense to include the shift of a load from *on-peak* (most expensive per kw) to *off peak* (least expensive) as a part of the effective use of energy. The definitions for *load, on-peak* and *off peak* are included in another code change proposal. Those proposed definitions are as follows:

- **LOAD** A portion of a system that consumes electric energy. The total electrical *load* of a building is the sum of all electricity consuming appliances, lights and systems, necessary for a building to function as designed.
- **ON-PEAK** The time of use during which the cost per kiloWatt-hour (kWh) is the highest and when the maximum generation resources are required to supply electricity to the customer.
- **OFF-PEAK** The time of use during which the cost per kiloWatt-hour (kWh) is the lowest and when generation resources are being underutilized.

The terms are found defined in on-line sources. These could be added to the proposal, if needed, at public comment stage.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change clarifies that load shifting is a part of the efficient use of energy and does not increase or decrease the cost of construction.

CE2-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The Intent statement adequately covers energy conservation in the broadest sense and does not need to include a list of specific methodologies. The existing language doesn't exclude the technology discussed by the proponent. The word 'shall' is problematic in the proposed sentence in that it appears to creating a new technical requirement. (Vote: 14-1)

Assembly Action: **None**

CE2-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C101.3, SECTION C202

Proponents:
Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org); Sharon Bonesteel AIA CBO CP, salt river project, representing Salt River Project (sharon.bonesteel@srpnet.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C101.3 Intent. This code shall regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building~~.~~, including ~~The~~ the shift of a *load* from an *on-peak* period to an *off-peak* period. ~~shall be considered a part of the effective use of energy.~~ This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

SECTION C202 GENERAL DEFINITIONS

LOAD. A portion of a system that consumes electric energy. The total electrical *load* of a building is the sum of all electricity consuming appliances, equipment, and systems necessary for a building to function as designed.

ON-PEAK. The time of use during which the cost per kiloWatt-hour (kWh) is the highest and when the maximum generation resources are required to supply electricity to the customer.

OFF-PEAK. The time of use during which the cost per kiloWatt-hour (kWh) is the lowest and when generation resources are being underutilized.

Commenter's Reason: This proposed modification addresses the concerns of the committee by removing the word "shall" and by adding definitions to clarify what is meant by the new language. As more renewable energy is added to the grid and to buildings, the use of of load shifting will be more important.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The change to the intent and the addition of new definitions do not change the cost of construction, as they do not add any new requirements to the code.

Public Comment# 1287

CE3-19 Part I

IECC: Part I: C101.3

IECC: Part II: R101.3(N1101.2)

Proposed Change as Submitted

Proponents: Joseph H. Cain, Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C101.3 Intent. This code shall regulate the design and construction of buildings <u>and systems</u> for the effective use and conservation of energy over the useful life of each building<u> , including effective integration of energy efficiency measures, renewable energy systems, and energy storage systems.</u> This code is intended to provide flexibility to permit the use of <u>innovative approaches and techniques, including</u> innovative approaches and techniques ~~to achieve this objective.~~ <u>that achieve the most cost-effective means of compliance.</u> This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: Renewable energy systems are an important component of the IECC, but the Intent section is presently silent on them. Effective integration of energy efficiency measures and renewable energy systems is critical to the future of energy codes and green/stretch/reach codes. At the time of submittal of these code change proposals, there are four states with 100% renewable energy goals: Hawaii, California, New Jersey, and New York. Other communities are committing to renewable energy goals through their own local renewable goals for power supply or for installation of renewable energy systems.
As grid penetration of renewable energy systems increases, the need to energy storage systems -- mostly battery storage -- also increases. The Intent section of the IECC should evolve with our societal needs, as by the time this edition is in effect there will be even more renewable energy systems and battery storage systems.

Renewable energy is already explicitly included in the IECC in multiple locations, including, but not limited to: Section C202 Definitions; Section C407.3 Performance-based compliance; Appendix CA Solar Ready Zone; Section R406 Energy Rating Index; Appendix RA Solar Ready Provisions. The Intent section needs to catch up with the provisions within the code.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal represents a forward-thinking clarification of intent only, with no increase or decrease in cost of construction.

CE3-19 Part I

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The technologies are already allowed by the existing broad text of the Intent statement. Including 'most cost effective' in the intent statement sets a dangerous threshold for judgement of future changes. Cost effective is not defined. As the Intent comes into play in the review of alternate methods and for above code programs, a determination of most cost effective would impose a difficult burden on code officials. (Vote 13-2)

Assembly Action: **None**

CE3-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC®: C101.3

Proponents:
Joseph H. Cain, P.E., Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C101.3 Intent. This code shall regulate the design and construction of buildings and systems for the effective use and conservation of energy over the useful life of each building, including effective integration of energy efficiency measures, renewable energy systems, and energy storage systems. This code is intended to provide flexibility to permit the use of innovative approaches and techniques~~, including innovative approaches and techniques that achieve the most cost-effective means of compliance~~ to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Commenter's Reason: This proposal and this public comment seeks to include "effective integration of energy efficiency measures, renewable energy systems, and energy storage systems."
This public comment reverts the second sentence back to the same text as found in the 2018 IECC intent section.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal represents a forward-thinking clarification of intent only, with no increase or decrease in cost of construction.

Public Comment# 2172

CE3-19 Part II

IECC: R101.3 (IRC N1101.2)

Proposed Change as Submitted

Proponents: Joseph H. Cain, Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

2018 International Energy Conservation Code

Revise as follows:

R101.3 (IRC N1101.2) Intent. This code shall regulate the design and construction of *buildings* and systems for the effective use and conservation of energy over the useful life of each building , including effective integration of energy efficiency measures, *renewable energy systems*, and energy storage systems. This code is intended to provide flexibility to permit the use of innovative approaches and techniques, including innovative approaches and techniques ~~to achieve this objective.~~ that achieve the most cost-effective means of compliance. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: Renewable energy systems are an important component of the IECC, but the Intent section is presently silent on them. Effective integration of energy efficiency measures and renewable energy systems is critical to the future of energy codes and green/stretch/reach codes. At the time of submittal of these code change proposals, there are four states with 100% renewable energy goals: Hawaii, California, New Jersey, and New York. Other communities are committing to renewable energy goals through their own local renewable goals for power supply or for installation of renewable energy systems.
As grid penetration of renewable energy systems increases, the need to energy storage systems -- mostly battery storage -- also increases. The Intent section of the IECC should evolve with our societal needs, as by the time this edition is in effect there will be even more renewable energy systems and battery storage systems.

Renewable energy is already explicitly included in the IECC in multiple locations, including, but not limited to: Section C202 Definitions; Section C407.3 Performance-based compliance; Appendix CA Solar Ready Zone; Section R406 Energy Rating Index; Appendix RA Solar Ready Provisions. The Intent section needs to catch up with the provisions within the code.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal represents a forward-thinking clarification of intent only, with no increase or decrease in cost of construction.

CE3-19 Part II

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The Intent paragraph is sufficient as written and does not need a list of things which address efficient use of energy. The insertion of determining whether the measures in the code or proposed for the code should not be inserted in the Intent statement. (Vote: 9-2)

Assembly Action: **None**

CE3-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC®: R101.3 (IRC N1101.2)

Proponents:
Joseph H. Cain, P.E., Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R101.3 (IRC N1101.2) Intent. This code shall regulate the design and construction of *buildings* and systems for the effective use and conservation of energy over the useful life of each building, including effective integration of energy efficiency measures, *renewable energy systems,* and energy storage systems. This code is intended to provide flexibility to permit the use of innovative approaches and techniques~~, including innovative approaches and techniques that achieve the most cost-effective means of compliance~~ to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Commenter's Reason: This proposal and this public comment seeks to include "effective integration of energy efficiency measures, renewable energy systems, and energy storage systems."
This public comment reverts the second sentence back to the same text as found in the 2018 IECC intent section.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal represents a forward-thinking clarification of intent only, with no increase or decrease in cost of construction.

Public Comment# 2173

CE5-19 Part I

IECC: Part I: Section C101.3

IECC: Part II: Section R101.3(N1101.2)

Proposed Change as Submitted

Proponents: Hope Medina, representing Self (hmedina@coloradocode.net)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C101.3 Intent. This code shall regulate the design and construction of buildings for <u>life safety along with </u>the effective use and conservation of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: There is a misconception among some end users that the energy code is not a life safety code and this is not correct. The energy code either independently or working in conjunction with the other codes assist with several aspects of what is considered the main stream life safety. It assists with tight construction for fire, moisture diffusion within assemblies, and usability during extreme conditions. The intent should identify that this code is promoting life safety as it is stated in the other I-codes.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This change just acknowledges the life safety contribution.

CE5-19 Part I

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:

C101.3 Intent. This code shall regulate the design and construction of buildings for ~~life safety along with~~ <u>the health, safety, and welfare of the public while regulating </u>the effective use and conservation of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Committee Reason: Regarding the modification, the committee felt that the change better reflected the intent of the proposal through the use of the phrase 'health, safety and welfare'. It eliminates the perceived conflict with codes that are considered to be 'life safety'.
The committee's decision was based on the concept that the IECC already does address health, safety and welfare issues through such regulations including lighting, daylighting and air quality. Making this change is important to make sure designers are keeping those topics in mind as they design under the IECC. The energy code is also an element in long term welfare through the reduction of green house gas emissions and the impacts on climate change. An extreme weather event where access to heating and cooling is lost, an IECC compliant building provides the occupants with better protection. It is not the intent to bring into the IECC regulations which are just health, safety and welfare, but don't have an energy conservation element to them. A public comment to clarify that distinction may be needed. (Vote: 10-5)

Assembly Action: **None**

CE5-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC®: C101.3

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C101.3 Intent. This code shall regulate the design and construction of buildings for ~~the health, safety, and welfare of the public while regulating~~ the effective use and conservation of energy over the useful life of each building<u> to protect and promote the public safety, health and general welfare of the public</u>. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Commenter's Reason: We agree that, like the other I-codes, the IECC is intended to promote the health, safety, and welfare of the public as addressed in CE5p1 as modified by the Committee. However, in our view, CE5 Parts 1 and 2 should be further modified so that the effective use and conservation of energy remains first, since that is the primary objective the IECC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment is largely a clarification of the original proposal and will not increase costs. The required information is already available to the builder at construction, and the builder will only need to make sure that the information is captured on the certificate.

Public Comment# 1431

Public Comment 2:

Proponents:
Harold Jepsen, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us); Megan Hayes, representing NEMA (megan.hayes@nema.org)

requests Disapprove

Commenter's Reason: This modification not only excessively and confusingly expands the code's scope into areas it is not designed, by attempting to regulate health, safety and public welfare, but this change also contradicts and discredits the language existing and remaining in the very same section it modifies.
This change unnecessarily and dramatically expands the code’s scope beyond energy conservation to also REGULATE “health, safety and welfare of the public”. This not only creates significant confusion for building and inspecting officials of which code to look for enforcement of these elements but goes against the language still left in the code which states: that its scope “is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances”. Which is it? Is it intended to REGULATE all these elements, which are already appropriately found in other codes, or is it intended to NOT ABRIDGE them? Confusing. This places an undue burden on building officials to look across multiple codes to determine compliance and enforcement for the same regulated elements.

We urge the public vote to disapprove this and not make a headache or mess of all other codes work to be clear and distinct on their specific purpose and scope of what they regulate.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1375

Public Comment 3:

Proponents:
Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

requests Disapprove

Commenter's Reason: This is redundant language and is not necessary to add into the intent. The IECC is an energy conservation code focused on conserving energy in buildings without compromising the health and safety of the building which is already addressed in the last sentence of this section that reads "This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances".

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1446

Public Comment 4:

Proponents:
Tim Ryan, International Association of Building Officials, representing IABO

requests Disapprove

Commenter's Reason: One of the primary reasons given for this proposed change is due to the lack of adoptions of the energy code based on the view that that the energy provisions are not considered to be related to life safety. There are many factors that impact the adoption of the codes by local and state politicians, i.e., benefit cost ratios, initial costs of construction versus the immediacy of life threatening conditions, etc. We do not believe that merely changing this language will influence local and state politicians to adopt the IECC. To the contrary, it may impact the credibility of the code that will impede adoptions. The proponents gave very little testimony on where life safety is impacted by energy provisions. In fact, the proponent stated in her testimony that the IECC is limited in life safety provisions. Further, the issue of life safety is adequately addressed in the last sentence of Section C101.3. IABO full supports the current intent and adoption of the our energy codes however, we do not subscribe to the thought that energy provisions within the IECC should be elevated to the same level as the life safety requirements within our other codes.
By adding the proposed language it makes the section confusing and substantially changes the scope of the code without supporting testimony. By including this language, it will create confusion within the code development process as to what discipline will be responsible for hearing such changes in the future and eventually create confusion for the enforcement of the code. For these reasons we recommend disapproval of CE5-19.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1775

CE5-19 Part II

IECC: R101.3 (IRC N1101.2)

Proposed Change as Submitted

Proponents: Hope Medina, representing Self (hmedina@coloradocode.net)

2018 International Energy Conservation Code

Revise as follows:

R101.3 (IRC N1101.2) Intent. This code shall regulate the design and construction of *buildings* for <u>life safety along with</u> the effective use and conservation of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: There is a misconception among some end users that the energy code is not a life safety code and this is not correct. The energy code either independently or working in conjunction with the other codes assist with several aspects of what is considered the main stream life safety. It assists with tight construction for fire, moisture diffusion within assemblies, and usability during extreme conditions. The intent should identify that this code is promoting life safety as it is stated in the other I-codes.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This change just acknowledges the life safety contribution.

CE5-19 Part II

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The revision would could have unforeseen consequences in the evaluation of future proposed changes to the IECC. (Vote: 9-2)

Assembly Action: **None**

CE5-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC®: R101.3 (IRC N1101.2)

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R101.3 (IRC N1101.2) Intent. This code shall regulate the design and construction of *buildings* for ~~life safety along with~~ the effective use and conservation of energy over the useful life of each building <u>to protect and promote the public safety, health and general welfare of the public</u>. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Commenter's Reason: We agree with the proponent and the Commercial IECC Committee that, like the other I-codes, the IECC is intended to promote the health, safety, and welfare of the public. However, in our view, CE5 Parts 1 and 2 should be further modified so that the effective use and conservation of energy remains first, since that is the primary specific objective the IECC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
As this public comment only clarifies the intent statement and clarifications do not affect material or labor costs, the net effect of both the public comment and the proposal has no impact the cost of construction.

Public Comment# 1428

Public Comment 2:

IECC®: R101.3 (IRC N1101.2)

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

R101.3 (IRC N1101.2) Intent. This code shall regulate the design and construction of *buildings* for ~~life safety along with~~ the health, safety, and welfare of the public while regulating the effective use and conservation of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Commenter's Reason: It is important to recognize the IECC as a part of the I-codes family that contain provisions to ensure safety of the occupants.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
There is no cost effect associated with the recognition of the energy code.

Public Comment# 1206

Public Comment 3:

Proponents:
Harold Jepsen, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us); Megan Hayes, representing NEMA (megan.hayes@nema.org)

requests Disapprove

Commenter's Reason: This modification not only excessively and confusingly expands the code's scope into areas it is not designed, (by attempting to regulate health, safety and public welfare) but this change also contradicts and discredits the remaining language ein the very same section it modifies.
This change unnecessarily and dramatically expands the code’s scope beyond energy conservation to also REGULATE “health, safety and welfare of the public”. This not only creates significant confusion for building and inspecting officials of which code to look for enforcement of these elements, but goes against the language still left in the code which states: that its scope “is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances”. Which is it? Is it intended to REGULATE all these elements, which are already appropriately found in other codes, or is it intended to NOT ABRIDGE them? Confusing. This places an undue burden on building officials to look across multiple codes to determine compliance and enforcement for the same regulated elements.

We urge the public vote to disapprove this and not make a headache or mess of all other code's work to be clear and distinct on their specific purpose and scope of what they regulate.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

CE6-19 Part I

IECC: Part I: Section C101.3

IECC: Part II: Section R101.3(N1101.2)

Proposed Change as Submitted

Proponents: Darren Meyers, P.E., International Energy Conservation Consultants LLC, representing Self (dmeyers@ieccode.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C101.3 Intent. This code shall regulate the design and construction of buildings for the effective use and conservation of energy primarily for human comfort over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: Indeed it remains the intent of the IECC to apply to energy using systems designed primarily for human occupancy (i.e., thermal comfort, visual comfort and service hot-water comfort), and -- unless specifically noted to otherwise -- does not apply to energy using systems designed for commercial, business, educational or industrial processes. This interpretation of the IECC, the Code Council has offered in the past remains the same.
While there remain some direct and indirect inferences to commercial, business, educational or industrial process energy uses throughout the IECC, there exist no "explicit" or "all-inclusive" delineations as to energy end uses designe primarily for humans to live, sleep, eat, work, and play in and around buildings and building sites. Some examples of these direct and indirect inferences to commercial, business, educational or industrial process energy uses, include:

1. C402.1.1 Greenhouses.
2. C402.1.2 [*telecommunications*] Equipment buildings.
3. C403.5 Economizers (Prescriptive), Exception 2; "... spaces designed to be humidified above 35°F (1.7°C) dewpoint temperature to satisfy "process needs."
4. C403.5.4.1 Design capacity; for:
   - "Systems primarily serving computer rooms ...",
   - "Systems where dehumidification requirements cannot be met using outdoor air temperatures of 50°F (10°C) dry bulb/45°F (7°C) wet bulb
     and where 100 percent of the expected system cooling load at 45°F (7°C) dry bulb/40°F (4°C) wet bulb is met with evaporative water economizers."
5. C403.7.1 Demand control ventilation (Mandatory), Exception 5; Ventilation provided only for "process loads."
6. C403.10.1 or C403.10.2 for Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers.
7. C405.3.1 Total connected interior lighting power, Several exemptions:
   - Lighting for photographic processes,
   - Lighting for plant growth,
   - Lighting for food warming, and
   - Lighting in demonstration equipment for education,
8. C405.4.1 Total connected exterior lighting power, Several exemptions:
   - Lighting associated with transportation,
   - Temporary lighting,
   - Industrial production, material handling and transportation lighting,
   - Theme element lighting in theme parks.
9. C406.7.1 Load fraction, Exception 2; "Waste heat recovery from ... building equipment, or process equipment."
10. C407.1 Scope; with referenct to:
    - "... receptacle loads and process loads," and
    - Energy used to recharge or refuel vehicles used for on-road and off-site transportation purposes.

Therefore, as was the case with the 2003 IECC, it is our opinion that niether the 2006 IECC nor it's 2009, 2012, 2015, 2018 or forthcoming 2021 editions are intended to require greenhouses (heated/cooled primarily to preserve the commodity-plants) to meet the envelope provisions of the code.

Section 101.3 the 2006 IECC (our opinion) was inadvertently truncated by the Department of Energy in an effort to improve the utility and enforceability of the IECC vis-a-vis a 'MONSTROUS' scoping and technical content change (see EC48-03/04).

So then, without the proposed language, and interpreted literally, the IECC could indeed be read as limiting the amount of energy put into a blast furnace at a foundry, energy dedicated to civilian booster pumping stations and wastewater treatment facilities keeping our civilian water supply clean, energy to operate fermenting casks at a distillery, energy to run a conveyor at a packaging plant, or even the energy to modulate cabinet temperatures within telecommunication shelters dedicated to switching and signal receiving. However, this is simply not pragmatic and not the case.

Bibliography: A copy of p.1 from the 2003 ICC International Energy Conservation Code.

SECTION 101
GENERAL

101.1 Title. These regulations shall be known as the *Energy Conservation Code* of [NAME OF JURISDICTION], and shall be cited as such. It is referred to herein as "this code."

101.2 Scope. This code establishes minimum prescriptive and performance-related regulations for the design of energy-efficient buildings and structures or portions thereof that provide facilities or shelter for public assembly, educational~~, business,~~ mercantile, institutional, storage and residential occupancies, as well as those portions of factory and industrial occupancies designed primarily for human occupancy. This code thereby addresses the design of energy-efficient building envelopes and the selection and installation of energy-efficient mechanical, service water-heating, electrical distribution and illumination systems and equipment for the effective use of energy in these buildings and structures.

comfort

Exception: Energy conservation systems and components in existing buildings undergoing repair, alteration or additions, and change of occupancy, shall be permitted to comply with the *International Existing Building Code*.

101.2.1 Exempt buildings. Buildings and structures indicated in Sections 101.2.1.1 and 101.2.1.2 shall be exempt from the building envelope provisions of this code, but shall comply with the provisions for building, mechanical, service water heating and lighting systems.

101.2.1.1 Separated buildings. Buildings and structures, or portions thereof separated by building envelope assemblies from the remainder of the building, that have a peak design rate of energy usage less than 3.4 Btu/h per square foot (10.7 W/m^2) or 1.0 watt per square foot (10.7 W/m^2) of floor area for space conditioning purposes.

101.2.1.2 Unconditioned buildings. Buildings and structures or portions thereof which are neither heated nor cooled.

101.2.2 Applicability. The provisions of this code shall apply to all matters affecting or relating to structures and premises, as set forth in Section 101. Where, in a specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern.

[EB] 101.2.2.1 Existing installations. Except as otherwise provided for in this chapter, a provision in this code shall not require the removal, alteration or abandonment of, nor prevent the continued utilization and maintenance of, an existing building envelope, mechanical, service water-heating, electrical distribution or illumination system lawfully in existence at the time of the adoption of this code.

[EB] 101.2.2.2 Additions, alterations or repairs. Additions, alterations, renovations or repairs to a building envelope, mechanical, service water-heating, electrical distribution or illumination system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing system to comply with all of the requirements of this code. Additions, alterations or repairs shall not cause any one of the aforementioned and existing systems to become unsafe, hazardous or overloaded.

[EB] 101.2.2.3 Historic buildings. The provisions of this code relating to the construction, alteration, repair, enlargement, restoration, relocation or movement of buildings or structures shall not be mandatory for existing buildings or structures specifically identified and classified as historically significant by the state or local jurisdiction, listed in *The National Register of Historic Places* or which have been determined to be eligible for such listing.

[EB] 101.2.2.4 Change in occupancy. It shall be unlawful to make a change in the occupancy of any building or structure which would result in an increase in demand for either fossil fuel or electrical energy supply unless such building or structure is made to comply with the requirements of this code or otherwise approved by the authority having jurisdiction. The code official shall certify that such building or structure meets the intent of the provisions of law governing building construction for the proposed new occupancy and that such change of occupancy does not result in any increase in demand for either fossil fuel or electrical energy supply or any hazard to the public health, safety or welfare.

101.2.3 Mixed occupancy. When a building houses more than one occupancy, each portion of the building shall conform to the requirements for the occupancy housed therein. Where minor accessory uses do not occupy more than 10 percent of the area of any floor of a building, the major use shall be considered the building occupancy. Buildings, other than detached one- and two-family dwellings and townhouses, with a height of four or more stories above grade shall be considered commercial buildings for purposes of this code, regardless of the number of floors that are classified as residential occupancy.

101.3 Intent. The provisions of this code shall regulate the design of building envelopes for adequate thermal resistance and low air leakage and the design and selection of mechanical, electrical, service water-heating and illumination systems and equipment which will enable effective use of energy in new building construction. It is intended that these provisions provide flexibility to permit the use of innovative approaches and techniques to achieve effective utilization of energy. This code is not intended to abridge safety, health or environmental requirements under other applicable codes or ordinances.

2003 INTERNATIONAL ENERGY CONSERVATION CODE® 1

Cost Impact: The code change proposal will not increase or decrease the cost of construction
There is no cost implication aligned with this proposal. Rather, it is an exercise steeped in clarification of the IECC Purpose and Scope. The resulting exclusions would mean the process energies assigned to foundries, booster pumping stations, wastewater treatment facilities, distilleries, packaging plants, greenhouses and telecommunication shelters would be "excluded" from the scope and applicability of the IECC, without the need for explicitly articulates lists or exceptions. No change to stringency is proposed.

CE6-19 Part I

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The change does not belong in the Intent statement. If provisions of the code should only apply where the concern is human comfort, then specific regulations or exceptions should be placed at those provisions. There was concern that this would be in conflict with actions taken on CE1-19. (Vote: 15-0)

Assembly Action: **None**

CE6-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC®: C101.3, C401.3 (New)

Proponents:
Darren Meyers, representing Self (dmeyers@ieccode.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C101.3 Intent. This code shall regulate the design and construction of buildings for the effective use and conservation of energy ~~primarily for human comfort~~ over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

<u>**C401.3** **Car wash buildings.** Free-standing and appurtenant manual and automatic car wash facilities or portions thereof separated from the remainder of a building by *building thermal envelope* assemblies complying with this section, shall be exempt from *building thermal envelope* provisions of Section C402 and the interior lighting control provisions of Sections C405.2.1, C405.2.2, C405.2.3 and interior lighting power provisions of Section C405.3.</u>

Commenter's Reason: The code does not intend to regulate the commercial process of a car wash facilities as it intends buildings where spaces are heated for human comfort and illuminated for the visual acuity of building occupants (to read, work, eat or play).
Moreover, the equipment (applicators, blowers, sprayers, washers, scrubbers and conveyors) utilized for the commercial enterprise of car washing tend to break down, freeze or fail, prematurely if they are not provided with a minimum level of heat for operational performance.

This proposal targets car wash facilities, specifically. The level of space conditioning for a car wash facility is not designed for human comfort, but rather to sustain the commercial enterprise and operational performance of a for-profit car wash facility. Vehicle owners do not need the level of illumination necessary to read, work, eat or play during the 2-5 minutes their vehicle is proceeding through wash cycle. Hence, there is no pragmatic reason to require building insulation, window U-factor/SHGC, air-leakage control, interior lighting power, daylight responsive controls, occupancy/vacancy sensing or interior lighting shut-off control for these facilities.

The IECC Commercial Committee asked the proponent to derive specific language from the more general "human comfort" language for the facilities where application of the IECC is not practical, feasible, or would otherwise encumber commerce.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

There is no cost implication aligned with this proposal. The resulting exclusions would mean the process energies assigned to car wash buildings would be "excluded" from the scope and applicability of the IECC. No change to stringency is proposed.

Public Comment# 1713

Public Comment 2:

IECC®: C101.3, C402.1.3 (New)

Proponents:
Darren, International Energy Conservation Consultants LLC, representing Self (dmeyers@ieccode.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C101.3 Intent. This code shall regulate the design and construction of buildings for the effective use and conservation of energy ~~primarily for human comfort~~ over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

C402.1.3 Water treatment buildings. Structures surrounding and covering water storage facilities, water clarifiers, water treatment plants, sewage treatment plants (including pumping stations and collector systems) and similar facilities not used for human occupancy shall be exempt from *building thermal envelope* provisions of Section C402.

Commenter's Reason: The code does not intend to regulate facilities harboring the commercial process of water treatment as it intends buildings where spaces are heated for human comfort. Moreover, the equipment (tanks, stirrers, clarifiers, blowers, separators and sprayers, filters and conveyors) utilized for the private and public enterprise of water treatment tend to break down, freeze or fail, prematurely if they are not provided with a minimum level of heat for operational performance.
This proposal targets water treatment, pumping and booster facilities, specifically. There is no pragmatic reason to require building insulation, window U-factor/SHGC, air-leakage control, day-lighting for these facilities.

The IECC Commercial Committee asked the proponent to derive specific language from the more general "human comfort" language for the facilities where application of the IECC is not practical, feasible, or would otherwise encumber commerce.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

There is no cost implication aligned with this proposal. The resulting exclusions would mean the process energies assigned to water treatment buildings would be "excluded" from the scope and applicability of the IECC. No change to stringency is proposed.

Public Comment# 1734

NOTE: CE6-19 PART II DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

CE6-19 Part II

IECC: R101.3 (IRC N1101.2)

Proposed Change as Submitted

Proponents: Darren Meyers, P.E., International Energy Conservation Consultants LLC, representing Self (dmeyers@ieccode.com)

2018 International Energy Conservation Code

Revise as follows:

R101.3 (IRC N1101.2) Intent. This code shall regulate the design and construction of *buildings* for the effective use and conservation of energy primarily for human comfort over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: Indeed it remains the intent of the IECC to apply to energy using systems designed primarily for human occupancy (i.e., thermal comfort, visual comfort and service hot-water comfort), and -- unless specifically noted to otherwise -- does not apply to energy using systems designed for commercial, business, educational or industrial processes. This interpretation of the IECC, the Code Council has offered in the past remains the same.
While there remain some direct and indirect inferences to commercial, business, educational or industrial process energy uses throughout the IECC, there exist no "explicit" or "all-inclusive" delineations as to energy end uses designe primarily for humans to live, sleep, eat, work, and play in and around buildings and building sites. Some examples of these direct and indirect inferences to commercial, business, educational or industrial process energy uses, include:

1. C402.1.1 Greenhouses.
2. C402.1.2 [*telecommunications*] Equipment buildings.
3. C403.5 Economizers (Prescriptive), Exception 2; "... spaces designed to be humidified above 35°F (1.7°C) dewpoint temperature to satisfy "process needs."
4. C403.5.4.1 Design capacity; for:
    - "Systems primarily serving computer rooms ...",
    - "Systems where dehumidification requirements cannot be met using outdoor air temperatures of 50°F (10°C) dry bulb/45°F (7°C) wet bulb
      and where 100 percent of the expected system cooling load at 45°F (7°C) dry bulb/40°F (4°C) wet bulb is met with evaporative water economizers."
5. C403.7.1 Demand control ventilation (Mandatory), Exception 5; Ventilation provided only for "process loads."
6. C403.10.1 or C403.10.2 for Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers.
7. C405.3.1 Total connected interior lighting power, Several exemptions:
    - Lighting for photographic processes,
    - Lighting for plant growth,
    - Lighting for food warming, and
    - Lighting in demonstration equipment for education,
8. C405.4.1 Total connected exterior lighting power, Several exemptions:
    - Lighting associated with transportation,
    - Temporary lighting,
    - Industrial production, material handling and transportation lighting,
    - Theme element lighting in theme parks.
9. C406.7.1 Load fraction, Exception 2; "Waste heat recovery from ... building equipment, or process equipment."
10. C407.1 Scope; with referenct to:
    - "... receptacle loads and process loads," and
    - Energy used to recharge or refuel vehicles used for on-road and off-site transportation purposes.

Therefore, as was the case with the 2003 IECC, it is our opinion that niether the 2006 IECC nor it's 2009, 2012, 2015, 2018 or forthcoming 2021 editions are intended to require greenhouses (heated/cooled primarily to preserve the commodity-plants) to meet the envelope provisions of the code.

Section 101.3 the 2006 IECC (our opinion) was inadvertently truncated by the Department of Energy in an effort to improve the utility and enforceability of the IECC vis-a-vis a 'MONSTROUS' scoping and technical content change (see EC48-03/04).

So then, without the proposed language, and interpreted literally, the IECC could indeed be read as limiting the amount of energy put into a blast furnace at a foundry, energy dedicated to civilian booster pumping stations and wastewater treatment facilities keeping our civilian water supply clean, energy to operate fermenting casks at a distillery, energy to run a conveyor at a packaging plant, or even the energy to modulate cabinet temperatures within telecommunication shelters dedicated to switching and signal receiving. However, this is simply not pragmatic and not the case.

Bibliography: A copy of p.1 from the 2003 ICC International Energy Conservation Code.

SECTION 101
GENERAL

101.1 Title. These regulations shall be known as the *Energy Conservation Code* of [NAME OF JURISDICTION], and shall be cited as such. It is referred to herein as "this code."

101.2 Scope. This code establishes minimum prescriptive and performance-related regulations for the design of energy-efficient buildings and structures or portions thereof that provide facilities or shelter for public assembly, educational, ~~business,~~ mercantile, institutional, storage and residential occupancies, as well as those portions of factory and industrial occupancies designed primarily for human occupancy. This code thereby addresses the design of energy-efficient building envelopes and the selection and installation of energy-efficient mechanical, service water-heating, electrical distribution and illumination systems and equipment for the effective use of energy in these buildings and structures.

comfort

Exception: Energy conservation systems and components in existing buildings undergoing repair, alteration or additions, and change of occupancy, shall be permitted to comply with the *International Existing Building Code*.

101.2.1 Exempt buildings. Buildings and structures indicated in Sections 101.2.1.1 and 101.2.1.2 shall be exempt from the building envelope provisions of this code, but shall comply with the provisions for building, mechanical, service water heating and lighting systems.

101.2.1.1 Separated buildings. Buildings and structures, or portions thereof separated by building envelope assemblies from the remainder of the building, that have a peak design rate of energy usage less than 3.4 Btu/h per square foot (10.7 W/m^2) or 1.0 watt per square foot (10.7 W/m^2) of floor area for space conditioning purposes.

101.2.1.2 Unconditioned buildings. Buildings and structures or portions thereof which are neither heated nor cooled.

101.2.2 Applicability. The provisions of this code shall apply to all matters affecting or relating to structures and premises, as set forth in Section 101. Where, in a specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern.

[EB] 101.2.2.1 Existing installations. Except as otherwise provided for in this chapter, a provision in this code shall not require the removal, alteration or abandonment of, nor prevent the continued utilization and maintenance of, an existing building envelope, mechanical, service water-heating, electrical distribution or illumination system lawfully in existence at the time of the adoption of this code.

[EB] 101.2.2.2 Additions, alterations or repairs. Additions, alterations, renovations or repairs to a building envelope, mechanical, service water-heating, electrical distribution or illumination system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing system to comply with all of the requirements of this code. Additions, alterations or repairs shall not cause any one of the aforementioned and existing systems to become unsafe, hazardous or overloaded.

[EB] 101.2.2.3 Historic buildings. The provisions of this code relating to the construction, alteration, repair, enlargement, restoration, relocation or movement of buildings or structures shall not be mandatory for existing buildings or structures specifically identified and classified as historically significant by the state or local jurisdiction, listed in *The National Register of Historic Places* or which have been determined to be eligible for such listing.

[EB] 101.2.2.4 Change in occupancy. It shall be unlawful to make a change in the occupancy of any building or structure which would result in an increase in demand for either fossil fuel or electrical energy supply unless such building or structure is made to comply with the requirements of this code or otherwise approved by the authority having jurisdiction. The code official shall certify that such building or structure meets the intent of the provisions of law governing building construction for the proposed new occupancy and that such change of occupancy does not result in any increase in demand for either fossil fuel or electrical energy supply or any hazard to the public health, safety or welfare.

101.2.3 Mixed occupancy. When a building houses more than one occupancy, each portion of the building shall conform to the requirements for the occupancy housed therein. Where minor accessory uses do not occupy more than 10 percent of the area of any floor of a building, the major use shall be considered the building occupancy. Buildings, other than detached one- and two-family dwellings and townhouses, with a height of four or more stories above grade shall be considered commercial buildings for purposes of this code, regardless of the number of floors that are classified as residential occupancy.

101.3 Intent. The provisions of this code shall regulate the design of building envelopes for adequate thermal resistance and low air leakage and the design and selection of mechanical, electrical, service water-heating and illumination systems and equipment which will enable effective use of energy in new building construction. It is intended that these provisions provide flexibility to permit the use of innovative approaches and techniques to achieve effective utilization of energy. This code is not intended to abridge safety, health or environmental requirements under other applicable codes or ordinances.

2003 INTERNATIONAL ENERGY CONSERVATION CODE® 1

Cost Impact: The code change proposal will not increase or decrease the cost of construction
There is no cost implication aligned with this proposal. Rather, it is an exercise steeped in clarification of the IECC Purpose and Scope. The resulting exclusions would mean the process energies assigned to foundries, booster pumping stations, wastewater treatment facilities, distilleries, packaging plants, greenhouses and telecommunication shelters would be "excluded" from the scope and applicability of the IECC, without the need for explicitly articulates lists or exceptions. No change to stringency is proposed.

CE6-19 Part II

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The term 'human comfort' is not defined. The committee concluded that inserting the term into the Intent statement could affect existing code text and the review of future changes in unforeseen ways. (Vote: 11-0)

Assembly Action: **None**

CE6-19 Part II

CE7-19 Part I

IECC: Part I: Section C101.3

IECC: Part II: Section R101.3(IRC N1101.2)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C101.3 Intent. This code shall regulate the design and construction of buildings for the effective use, conservation, production, and ~~conservation~~ storage of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: Part I:
This proposal updates the intent to account for what is happening at commercial buildings in many parts of the US.

In Section C406.1, one of the options to comply with the "additional efficiency package options" is to add an on-site renewable energy **production** system in accordance with Section C406.5. Renewable energy production systems such as PV panels are a form of energy production, not energy conservation. As a result, the code is now starting to regulate energy production,
since there is a minimum requirement in C406.5, and this change should be reflected in the intent of the code.

Also, the growth of energy storage systems, both on the grid side as well as the customer side of the meter, is increasing rapidly. Energy storage systems can be used to help with on-site renewable energy production systems, grid-based renewable energy production systems, or both.

Utilities are now offering commercial customers incentives for installing energy storage systems. Here are links to 2 examples:

https://www.coned.com/en/save-money/rebates-incentives-tax-credits/rebates-incentives-tax-credits-for-commercial-industrial-buildings-customers/demand-management-incentives (for Con Edison in New York)

https://energycenter.org/sgip/incentives (for SDG&E in California)

As more buildings install renewable energy production systems and energy storage systems, code officials will need to be familiar with the requirements and enforce code requirements.

Part II:

This proposal updates the intent to show that the IECC is now starting to regulate energy production and energy stoage systems that are installed in new homes. This update is needed to account for trends in certain areas of the US.

For example, Appendix RB contains requirements for solar-ready provisions installed on single-family homes and townhouses. In Section 406, the Energy Rating Index Compliance Alternative, renewable energy production can be used to obtain a better score. Therefore, the code is now starting to regulate renewable energy production systems that are installed in residential facilities.

Renewable energy systems are a form of energy production, not building energy use. The production of renewable energy does not conserve the amount of energy a building or end-use system or appliance will use. The intent of the code should be updated to account for the recent code changes.

In addition, in California's Title 24, PV energy production systems are now required on new homes (with some exceptions). One of the options with this mandate is to include an on-site energy storage system in the home, as shown below:

From CA Title 24-2019:

"PV sizes from Equation 150.1-C may be reduced by 25 percent if installed in conjunction with a battery storage system. The battery storage system shall meet the qualification requirements specified in Joint Appendix JA12 and have a minimum capacity of 7.5 kWh."

Therefore, code officials will be enforcing the installation of on-site renewable energy production systems, along with the installation of on-site energy storage systems in some cases. This will in addition to enforcing the energy conservation requirements of the energy code.

Bibliography: Part I:
US DOE Better Buildings Program, *On-Site Energy Storage Decision Guide*, April 2017

https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/BB%20Energy%20Storage%20Guide.pdf

Part II:

California Energy Commission, "*2019 BUILDING ENERGY EFFICIENCY STANDARDS FOR RESIDENTIAL AND NONRESIDENTIAL BUILDINGS*", December 2018

https://www.energy.ca.gov/2018publications/CEC-400-2018-020/CEC-400-2018-020-CMF.pdf

Cost Impact: The code change proposal will not increase or decrease the cost of construction
In this proposal, the requirements in the code are not being changed. This proposal only clarifies the intent of the energy code to account for what is already occurring in certain building energy codes.

CE7-19 Part I

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Modified**

Committee Modification:

C101.3 Intent. This code shall regulate the design and construction of buildings for the effective use of energy, conservation of energy, production of energy, and storage of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Committee Reason: The original proposal text was found to be confusing. The modification clarifies that the focus of the intent is only energy; its effective use, conservation, production and storage. The proposal as modified simply speaks to existing provisions of the code which address all these aspects of energy conservation. This allows the use of renewable energy to be a clear intent of the code. (Vote: 8-7)

Assembly Action: **None**

CE7-19 Part I

Individual Consideration Agenda

Public Comment 1:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it adds unnecessary and potentially confusing language to the Intent section of the IECC, which will also distract from the primary purpose of the code -- specifically “the use and conservation of energy.”
The IECC-Residential Committee recommended that CE7 Part 2 be disapproved because it was concerned that “production” of energy was not

defined and could be read in a way that expands the scope of the IECC well beyond the building site. The current language, which focuses on the effective use and conservation of energy over the useful life of the building, maintains the proper focus on the building itself and on use and conservation, not production and storage of energy. Just as the code does not list other measures affecting the use and conservation of energy, it should not specifically call out energy production and storage, which would overemphasize what are, at best, secondary considerations.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1432

CE7-19 Part II

IECC: R101.3 (IRC N1101.2)

Proposed Change as Submitted

Proponents: Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Revise as follows:

R101.3 (IRC N1101.2) Intent. This code shall regulate the design and construction of *buildings* for the effective use , conservation, production, and ~~conservation~~ storage of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Reason: Part I:
This proposal updates the intent to account for what is happening at commercial buildings in many parts of the US.

In Section C406.1, one of the options to comply with the "additional efficiency package options" is to add an on-site renewable energy **production** system in accordance with Section C406.5. Renewable energy production systems such as PV panels are a form of energy production, not energy conservation. As a result, the code is now starting to regulate energy production,
since there is a minimum requirement in C406.5, and this change should be reflected in the intent of the code.

Also, the growth of energy storage systems, both on the grid side as well as the customer side of the meter, is increasing rapidly. Energy storage systems can be used to help with on-site renewable energy production systems, grid-based renewable energy production systems, or both.

Utilities are now offering commercial customers incentives for installing energy storage systems. Here are links to 2 examples:

https://www.coned.com/en/save-money/rebates-incentives-tax-credits/rebates-incentives-tax-credits-for-commercial-industrial-buildings-customers/demand-management-incentives (for Con Edison in New York)

https://energycenter.org/sgip/incentives (for SDG&E in California)

As more buildings install renewable energy production systems and energy storage systems, code officials will need to be familiar with the requirements and enforce code requirements.

Part II:

This proposal updates the intent to show that the IECC is now starting to regulate energy production and energy stoage systems that are installed in new homes. This update is needed to account for trends in certain areas of the US.

For example, Appendix RB contains requirements for solar-ready provisions installed on single-family homes and townhouses. In Section 406, the Energy Rating Index Compliance Alternative, renewable energy production can be used to obtain a better score. Therefore, the code is now starting to regulate renewable energy production systems that are installed in residential facilities.

Renewable energy systems are a form of energy production, not building energy use. The production of renewable energy does not conserve the amount of energy a building or end-use system or appliance will use. The intent of the code should be updated to account for the recent code changes.

In addition, in California's Title 24, PV energy production systems are now required on new homes (with some exceptions). One of the options with this mandate is to include an on-site energy storage system in the home, as shown below:

From CA Title 24-2019:

"PV sizes from Equation 150.1-C may be reduced by 25 percent if installed in conjunction with a battery storage system. The battery storage system shall meet the qualification requirements specified in Joint Appendix JA12 and have a minimum capacity of 7.5 kWh."

Therefore, code officials will be enforcing the installation of on-site renewable energy production systems, along with the installation of on-site energy storage systems in some cases. This will in addition to enforcing the energy conservation requirements of the energy code.

Bibliography: Part I:
US DOE Better Buildings Program, *On-Site Energy Storage Decision Guide*, April 2017

https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/BB%20Energy%20Storage%20Guide.pdf

Part II:

California Energy Commission, "*2019 BUILDING ENERGY EFFICIENCY STANDARDS FOR RESIDENTIAL AND NONRESIDENTIAL BUILDINGS*", December 2018

https://www.energy.ca.gov/2018publications/CEC-400-2018-020/CEC-400-2018-020-CMF.pdf

Cost Impact: The code change proposal will not increase or decrease the cost of construction
In this proposal, the requirements in the code are not being changed. This proposal only clarifies the intent of the energy code to account for what is already occurring in certain building energy codes.

CE7-19 Part II

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **Disapproved**

Committee Reason: The committee concluded that this proposal did not improve the intent statement. They were concerned about the term 'production' which is not defined. The code does not regulate production of power by power utilities. The committee speculated on other terms than production but did not suggest a solution. (Vote: 7-4)

Assembly Action: **None**

CE7-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC®: R101.3 (IRC N1101.2)

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R101.3 (IRC N1101.2) Intent. This code shall regulate the design and construction of *buildings* for the effective use of energy, conservation of energy, production of energy, and storage of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

Commenter's Reason: This modification will improve the language by making the intent consistent with the language that was approved for the commercial energy code in CE7-19, Part I. The modified language means the effective use, conservation, production, and storage of energy at the building or building site, not upstream or off-site.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This change to the intent has no new code requirements, and will not have any impact on the cost of construction.

Public Comment# 1288

CE9-19 Part II

IECC®: R102.1

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org)

2018 International Energy Conservation Code

Revise as follows:

R102.1 General. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code. The *code official* shall have the authority to approve an alternative material, design or method of construction upon application of the owner or the owner's authorized agent. The code official shall first find that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code for strength, effectiveness, fire resistance, durability , energy conservation and safety. Where the alternative material, design or method of construction is not *approved*, the *code official* shall respond to the applicant, in writing, stating the reasons why the alternative was not *approved*.

Reason: The purpose of this code change proposal is to help ensure that energy conservation will be considered in any request for approval of alternative materials, designs, or methods of construction. Although the current language of section R102.1/C102.1 requires alternatives to be "not less than the equivalent" of the code requirement for quality, strength, effectiveness, fire resistance, durability, and safety, it is important that the energy conservation impact be considered as well – particularly in the International Energy Conservation Code.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal merely clarifies that energy conservation must be considered in assessing alternatives to IECC requirements.

Staff Analysis: There is not a coordinate section in IRC Chapter 11, however IRC Section R104.11 covers the subject matter.

CE9-19 Part II

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Initially there was concern that inserting energy conservation in this sentence was simply redundant, but upon further consideration, the committee sees this particular sentence as addressing other topics beyond energy conservation and therefore adding the phrase to the sentence is inappropriate. (Vote: 11-0)

Assembly Action: **None**

CE9-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved because it recognizes the obvious – that a material or method must be equivalent in terms of energy conservation if it is to be accepted as an alternative under the energy conservation code. This is consistent with the action of the IECC-Commercial Committee, which approved CE9 Part 1 because the "added text assures that energy conservation is on equal footing in an alternate analysis."

When a code official is considering approval of alternative methods to comply with the energy conservation code, the code official clearly should consider whether the alternative provides adequate/equivalent energy conservation. However, as Section R102.1 is currently written, it is not entirely clear that energy conservation is a part of that consideration at all. With the proposed language, a building code official still has full discretion as to whether the proposed alternative material or design is equivalent in terms of energy conservation, just as the code official must determine whether the alternative is equivalent to the code's requirements for "strength, effectiveness, fire resistance, durability, and safety." But we believe (and the IECC-Commercial Committee agreed) that energy conservation must be included among the list of considerations for the building code official.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
As stated in the original proposal, this proposal merely clarifies that energy conservation must be considered in assessing alternatives to IECC requirements.

Public Comment# 1443

NOTE: CE9-19 PART I DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

CE9-19 Part I

IECC: Part I: Section C102.1

IECC: Part II: Section R102.1

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C102.1 General. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where the *code official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, *fire resistance*, durability<u>, energy conservation</u> and safety. Where the alternative material, design or method of construction is not *approved*, the *code official* shall respond in writing, stating the reasons why the alternative was not *approved*.

Reason: The purpose of this code change proposal is to help ensure that energy conservation will be considered in any request for approval of alternative materials, designs, or methods of construction. Although the current language of section R102.1/C102.1 requires alternatives to be “not less than the equivalent” of the code requirement for quality, strength, effectiveness, fire resistance, durability, and safety, it is important that the energy conservation impact be considered as well – particularly in the International Energy Conservation Code.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal merely clarifies that energy conservation must be considered in assessing alternatives to IECC requirements.

CE9-19 Part I

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: Approval of alternative methods should determine energy conservation equivalency as well as the other things on this list. The added text assures that energy conservation is on equal footing in an alternate analysis. A public comment to further revise for further consistency with the approved revisions to the Intent statement should be considered. (Vote: 8-7)

Assembly Action: **None**

CE9-19 Part I

CE12-19 Part II

IECC: R102.1.1 (IRC N1101.4)

Proposed Change as Submitted

Proponents: Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

R102.1.1 (IRC N1101.4) Above code programs. The code official or other authority having jurisdiction shall be permitted to deem a national, state or local energy-efficiency program to exceed the energy efficiency required by this code. Buildings approved in writing by such an energy-efficiency program shall be considered to be in compliance with this code where such buildings also meet the requirements identified as "mandatory" in Chapter 4 ~~shall be met.~~ and the building thermal envelope is greater than or equal to levels of efficiency and Solar Heat Gain Coefficients in Table 402.1.1 or 402.1.3 of the 2009 International Energy Conservation Code.

Reason: Part I:
The purpose of this code change proposal is to establish a reasonable level of efficiency for the permanent thermal envelope in buildings constructed to "above code" programs. The IECC already requires that buildings constructed to the standards of an above-code program demonstrate compliance with the "mandatory" measures of the IECC; this proposal applies a minimum thermal envelope backstop similar to the one that applies to the Energy Rating Index in residential section R406.

We have followed the approach of section R406 to use the 2009 IECC as a backstop, but we would also support referencing the 2012 IECC. As the IECC improves in efficiency, so also should the backstops and consumer protection provisions of the code.

Part II

The purpose of this code change proposal is to establish a reasonable level of efficiency for the permanent thermal envelope in buildings constructed to "above code" programs. The IECC already requires that buildings constructed to the standards of an above-code program demonstrate compliance with the "mandatory" measures of the IECC; this proposal applies a minimum thermal envelope backstop similar to the one that applies to the Energy Rating Index in Section R406. If a minimum backstop is necessary for the ERI, it stands to reason that a minimum backstop would be even more valuable in an even less fully defined and potentially less rigorous "above code" program.

We have proposed the 2009 IECC in this proposal to maintain consistency with the current section R406, but we would also support referencing the 2012 IECC. (We have proposed updating the Section R406 backstop to the 2012 IECC in a separate proposal because we believe that as the IECC improves in efficiency, so also should the backstops and consumer protection provisions of the code.)

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Because the 2018 IECC is the baseline for any above-code program (and any cost impact statement), and because this backstop is far less stringent than the base code requirements, we do not expect any added construction costs as a result.

CE12-19 Part II

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: Disapproved

Committee Reason: The language is unnecessary for the provisions of above code programs as reflected in testimony on this proposal and previous proposals on this topic. The proposed modification did not provide improvement. (Vote 11-0)

Assembly Action: None

CE12-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC®: R102.1.1 (IRC N1101.4)

Proponents:
Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R102.1.1 (IRC N1101.4) Above code programs. The code official or other authority having jurisdiction shall be permitted to deem a national, state or local energy-efficiency program to exceed the energy efficiency required by this code. Buildings approved in writing by such an energy-efficiency program shall be considered to be in compliance with this code where:

1. Such buildings also meet the requirements identified as “mandatory” in Chapter 4~~; and the building thermal envelope is greater than or equal to levels of efficiency and Solar Heat Gain Coefficients in Table 402.1.1 or 402.1.3 of the 2009 International Energy Conservation Code~~
2. The proposed total building thermal envelope UA, which is sum of U-factor times assembly area, is less than or equal to the building thermal envelope UA using the prescriptive U-factors from Table R402.1.4 multiplied by 1.15 in accordance with Equation 1-1; and
3. The area-weighted maximum glazed fenestration SHGC permitted is 0.30 in Climate Zones 1 through 3.

$UA_{\text{Proposed design}} \leq 1.15 \times UA_{\text{Prescriptive reference design}}$ Equation 1-1

Commenter's Reason: This proposal should be approved as submitted or as modified because it establishes an important consumer protection (a thermal envelope backstop) that will help ensure a reasonable level of envelope efficiency in homes that are certified to “above-code programs.” Given the range of programs and program requirements that might be considered as “above-code”, it is critical to ensure that a minimum level of energy efficiency for the thermal envelope is required for compliance under such programs.

While the original proposal is reasonable, we offer the modification above, which applies a more flexible approach to the thermal envelope backstop, based on the approach recommended for approval in RE150-19 for the standard ERI backstop.

Not all voluntary “above-code” programs are created alike. Any program that claims to be above code should achieve greater energy savings overall as compared to the IECC. However, CE12 Part 2 as modified still allows considerable flexibility – the thermal envelope is allowed to be *15% less efficient* than a home built to the prescriptive code. We think it is reasonable and not onerous for these programs to demonstrate such a minimum level of efficiency as to the thermal envelope in order to be designated as “above-code.”

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Because the 2018 IECC is the baseline for any above-code program (and any cost impact statement), and because this backstop is no more stringent than the base code requirements, we do not expect any added construction costs as a result.

Public Comment# 1688

Public Comment 2:

IECC®: R102.1.1 (IRC N1101.4)

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R102.1.1 (IRC N1101.4) Above code programs. The code official or other authority having jurisdiction shall be permitted to deem a national, state or local energy-efficiency program to exceed the energy efficiency required by this code. Buildings approved in writing by such an energy-efficiency program shall be considered to be in compliance with this code where;

1. Such buildings also meet the requirements identified as "mandatory" in Chapter 4~~; and the building thermal envelope is greater than or equal to levels of efficiency and Solar Heat Gain Coefficients in Table 402.1.1 or 402.1.3 of the 2009 International Energy Conservation Code.~~
2. The proposed total building thermal envelope UA, which is sum of U-factor times assembly area, is less than or equal to the building thermal envelope UA using the prescriptive U-factors from Table R402.1.4 in accordance with equation 1-1; and
3. The area-weighted maximum glazed fenestration SHGC permitted shall be the SHGC values set forth in Table R402.1.2.

$UA_{\text{Proposed design}} \leq UA_{\text{Prescriptive reference design}}$ Equation 1-1

Commenter's Reason: This proposal should be approved as submitted or as modified because it establishes an important consumer protection (a thermal envelope backstop) that will help ensure a reasonable level of efficiency in homes that are certified to "above-code programs." Given the range of programs and program requirements that might be considered as "above-code", it is critical to ensure that a minimum level of energy efficiency for the thermal envelope is required for compliance under such programs.

While the original proposal is reasonable, we offer the proposed modification as a further improvement. The proposed backstop in this modification is based on the approach recommended by the Committee for approval in RE150-19 for the standard ERI backstop, but uses current IECC prescriptive values, which is comparable to the ERI backstop that applies where on-site renewable energy is included in the calculation (see Table R406.4 footnote a). We offer this more stringent backstop for this proposal because an above-code program may use solar or other renewable energy as part of its compliance methodology, and therefore should at least achieve the same level of envelope efficiency as required for the ERI.

Not all voluntary "above-code" programs are created alike. Any program that claims to be above code should achieve greater energy savings overall as compared to the IECC. We do not think it is an onerous requirement for these programs to demonstrate a level of efficiency as to the thermal envelope equivalent to the IECC in order to be designated as "above-code."

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Because the 2018 IECC is the baseline for any above-code program (and any cost impact statement), and because this backstop is no more stringent than the base code requirements, we do not expect any added construction costs as a result.

Public Comment# 1692

NOTE: CE12-19 PART I DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

CE12-19 Part I

IECC: Part I: Section C102.1.1, Chapter 6CE

IECC: Part II: Section R102.1.1(N1101.4)

Proposed Change as Submitted

Proponents: Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C102.1.1 Above code programs. The *code official* or other authority having jurisdiction shall be permitted to deem a national, state or local energy efficiency program to exceed the energy efficiency required by this code. Buildings *approved* in writing by such an energy efficiency program shall be considered to be in compliance with this code where such buildings meet the requirements identified as "mandatory" in Chapter 4 ~~shall be met.~~ and the *building thermal envelope* is greater than or equal to levels of efficiency and *Solar Heat Gain Coefficients* in Table 502.3 and either Table 502.1.2 or 502.2(1) of the 2009 *International Energy Conservation Code* .

Add new text as follows:

ICC

International Code Council, Inc.
500 New Jersey Avenue NW 6th Floor
Washington DC 20001

IECC-2009: **International Energy Conservation Code**

Reason: Part I:
The purpose of this code change proposal is to establish a reasonable level of efficiency for the permanent thermal envelope in buildings constructed to "above code" programs. The IECC already requires that buildings constructed to the standards of an above-code program demonstrate compliance with the "mandatory" measures of the IECC; this proposal applies a minimum thermal envelope backstop similar to the one that applies to the Energy Rating Index in residential section R406.

We have followed the approach of section R406 to use the 2009 IECC as a backstop, but we would also support referencing the 2012 IECC. As the IECC improves in efficiency, so also should the backstops and consumer protection provisions of the code.

Part II

The purpose of this code change proposal is to establish a reasonable level of efficiency for the permanent thermal envelope in buildings constructed to "above code" programs. The IECC already requires that buildings constructed to the standards of an above-code program demonstrate compliance with the "mandatory" measures of the IECC; this proposal applies a minimum thermal envelope backstop similar to the one that applies to the Energy Rating Index in Section R406. If a minimum backstop is necessary for the ERI, it stands to reason that a minimum backstop would be even more valuable in an even less fully defined and potentially less rigorous "above code" program.

We have proposed the 2009 IECC in this proposal to maintain consistency with the current section R406, but we would also support referencing the 2012 IECC. (We have proposed updating the Section R406 backstop to the 2012 IECC in a separate proposal because we believe that as the IECC improves in efficiency, so also should the backstops and consumer protection provisions of the code.)

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Because the 2018 IECC is the baseline for any above-code program (and any cost impact statement), and because this backstop is far less stringent than the base code requirements, we do not expect any added construction costs as a result.

Analysis: The referenced standard, IECC 2009, is currently referenced in the IECC-R portion of the 2018 IECC.

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **Disapproved**

Committee Reason: The proponent asked for disapproval in order to allow him to improve it and to submit a public comment. (Vote: 15-0)

Assembly Action: **None**

CE12-19 Part I

CE15-19 Part I

IECC: Part I: C103.2.2(New)

IECC: Part II: R103.2 (N1101.5.2.2)(New)

Proposed Change as Submitted

Proponents: Hope Medina, representing Self (hmedina@coloradocode.net)

2018 International Energy Conservation Code

Add new text as follows:

C103.2.2 Energy reference construction documents. The requirements in this code shall be represented on the construction documents and specifically identification as energy reference sheets. Each trade has the option to locate their specific requirements within their section of the construction documents.

Reason: The concept represented in this proposal is not a new concept. Construction plans will place the accessibility requirements and/or fire rated construction requirements on their own sheets with references to them throughout the construction plans. The intent of this proposal is similar to this concept. The intent of this proposal is to assist with gaining compliance with the requirements within this code. Often the requirements are placed intermittently throughout the plans and notes, which are then often inadvertently missed by plans examiners, builders, contractors, and inspectors because of the inconsistent locations they are placed. When placing all of the energy requirements within the construction plans on one or more sheets as needed will allow for the end users to be able to apply the energy requirements the architect, designers, and engineers have designed the project to. The proposal acknowledges that each trade may need to provide their respective energy requirements within their own section of the construction plans, but each trade is still required to provide the information on their sheets.
When everything is placed in one location it becomes easier to verify that all the requirements have been identified. When located in many places throughout the plans often plans examiners will write a review comment that will require the architect/designer to locate it on the plans, write a response to the comments, and take up valuable time for both the architect/designer and plans examiner. This may eliminate the needless review comments because one cannot find the information on the plans, and reduce the time needed to respond by the architect/designer. The idea is to reduce the time needed to get the project through the permitting process. This will allow for those involved with the construction process to install the energy requirements as designed, and allow the inspector to inspect for them.

Cost Impact: The code change proposal will increase the cost of construction
This proposal may increase the cost of construction on the front end with possible additional construction sheets. It may decrease the time in the permitting process which should decrease the cost of construction. It may also decrease the cost of construction for the builders when they are able to comply with the energy requirements and how the project was designed to by decreasing the number of reinspections. Which will also assist with the construction schedule.

CE15-19 Part I

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee found the proposal would be unworkable for larger buildings. For all buildings it would likely result in duplicate information on multiple sheets. This leads to a higher potential for inconsistencies and resulting confusion for plan reviewers, inspectors and subcontractors. Perhaps an index of where information can be found rather than having it duplicated on specific sheets might be explored. (Vote: 13-2)

Assembly Action: **None**

CE15-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC®: C103.2.2 (New)

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C103.2.2 Energy reference construction documents The requirements in this code shall be represented on the construction documents and specifically identification as energy reference sheets. Each discipline ~~trade~~ has the option to locate their specific requirements within their specific section of the construction documents.

Commenter's Reason: Having sheets that contain the energy requirements and having them marked as energy sheets will allow the plans examiner a better opportunity to verify that plans are compliant with the energy code in a more timely fashion. These sheets will make it easier for the contractors and builders to be able to install the various energy items as the architect has designed them. This also provides the inspectors a better opportunity to verify that the components of the energy code have been installed correctly and in accordance with how the building/systems were designed for the project.
By providing this information in one location everyone involved has a better opportunity to make sure the building and systems to work together accordingly, as the architect or engineer has designed them to.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
There is no cost effect associated with the recognition of the energy code.

Public Comment# 1208

CE15-19 Part II

IECC: R103.2.2 (IRC N1101.5.2.2) (New)

Proposed Change as Submitted

Proponents: Hope Medina, representing Self (hmedina@coloradocode.net)

2018 International Energy Conservation Code

Add new text as follows:

R103.2.2 (IRC N1101.5.2.2) Energy reference construction documents. The requirements in this code shall be represented on the construction documents and specifically identification as energy reference sheets. Each trade has the option to locate their specific requirements within their section of the construction documents.

Reason: The concept represented in this proposal is not a new concept. Construction plans will place the accessibility requirements and/or fire rated construction requirements on their own sheets with references to them throughout the construction plans. The intent of this proposal is similar to this concept. The intent of this proposal is to assist with gaining compliance with the requirements within this code. Often the requirements are placed intermittently throughout the plans and notes, which are then often inadvertently missed by plans examiners, builders, contractors, and inspectors because of the inconsistent locations they are placed. When placing all of the energy requirements within the construction plans on one or more sheets as needed will allow for the end users to be able to apply the energy requirements the architect, designers, and engineers have designed the project to. The proposal acknowledges that each trade may need to provide their respective energy requirements within their own section of the construction plans, but each trade is still required to provide the information on their sheets.
When everything is placed in one location it becomes easier to verify that all the requirements have been identified. When located in many places throughout the plans often plans examiners will write a review comment that will require the architect/designer to locate it on the plans, write a response to the comments, and take up valuable time for both the architect/designer and plans examiner. This may eliminate the needless review comments because one cannot find the information on the plans, and reduce the time needed to respond by the architect/designer. The idea is to reduce the time needed to get the project through the permitting process. This will allow for those involved with the construction process to install the energy requirements as designed, and allow the inspector to inspect for them.

Cost Impact: The code change proposal will increase the cost of construction
This proposal may increase the cost of construction on the front end with possible additional construction sheets. It may decrease the time in the permitting process which should decrease the cost of construction. It may also decrease the cost of construction for the builders when they are able to comply with the energy requirements and how the project was designed to by decreasing the number of reinspections. Which will also assist with the construction schedule.

CE15-19 Part II

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposal would result in a significant burden on the architect to provide additional sheets. Such sheets may result in redundant information in the submitted paperwork and increases the possibility of conflict within the documents. It is unclear what is really required. (Vote: 8-3)

Assembly Action: **None**

CE15-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC®: R103.2.2 (IRC N1101.5.2.2) (New)

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R103.2.2 (IRC N1101.5.2.2) Energy reference construction documents The requirements in this code shall be represented on the construction documents and specifically identification as energy reference sheets. Each discipline ~~trade~~ has the option to locate their specific requirements within their section of the construction documents.

Commenter's Reason: Having sheets that contain the energy requirements and having them marked as energy sheets will allow the plans examiner a better opportunity to verify that plans are compliant with the energy code in a more timely fashion. These sheets will make it easier for the contractors and builders to be able to install the various energy items as the architect has designed them. This also provides the inspectors a better opportunity to verify that the components of the energy code have been installed correctly and in accordance with how the building/systems were designed for the project.
By providing this information in one location everyone involved has a better opportunity to make sure the building and systems to work together accordingly, as the architect or engineer has designed them to.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
There is no cost effect associated with the recognition of the energy code.

Public Comment# 1209

CE16-19 Part I

IECC Part I: C105.4, C105.4.1(New), C105.4.2(New), C105.4.3(New)

IECC Part II: R105.4, R105.4.1(New), R105.4.2(New), R105.4.3(New)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

SECTION C105
INSPECTIONS

Revise as follows:

C105.4 Approved third-party inspection agencies. The *code official* is authorized to accept reports of third-party inspection agencies not affiliated with the building design or construction, provided that such agencies are *approved* as to qualifications and reliability relevant to the building components and systems that they are inspecting.

Add new text as follows:

C105.4.1 Authorization of approved third-party inspection agency. When the code official authorizes the use of a third-party inspection agency for all or some aspects of code compliance inspections, the agency shall be authorized as a third-party extension of the code official to verify compliance.

C105.4.2 Approved third-party inspections agreement. The third-party inspection agency and the code official shall agree upon which compliance verification measures will be incorporated within each of their inspection processes. These measures shall include mandatory or other provisions required by the specific path of compliance chosen from C401.2.

C105.4.3 Approved third-party inspections reporting. The approved agency shall submit inspection reports to the code official and to the owner's representative in accordance with Section 1704.2.4 of the *International Building Code*.

Reason: In relation to the International Energy Conservation Code, third-party inspection agencies and building officials currently have a variety of ideas regarding what should constitute the work of the agency. For the ERI path, for example, many Raters understand that they must develop an ERI score, but do not fully understand their relationship to inspection of the mandatory requirements of the IECC. Jurisdictions having authority, are often either abdicating inspections or believe that Rater's are looking at mandatory inspection items. In addition, the creation of a HERS Index score is different from the creation of an ERI score. A HERS Index score is an asset rating which allows for the derating of the R-value of poorly installed insulation in the energy model, as the objective is to benchmark the energy performance of the home on the HERS Index scale. An IECC ERI evaluation of the installation of Insulation does not allow for the deration of poorly installed insulation. If insulation is not installed in accordance with the manufactures instruction and the guidance given in table R402.4.1.1, then the installation should fail inspection and be reinstalled until it meets the mandatory requirement of the code. This disconnect in understanding is the genesis of this code change proposal.
Building on the charging language of the approved inspection agency this proposal makes it clear that the inspection agency is third party. This proposal states that when acting as a third party the agency is actually acting as an extension of the jurisdiction having full delegated authority in order to better ensurethere is no confusion between the project owner and their construction representatives on site. The most important part of this proposed language is the requirement to create a scope of work that defines the relationship between the third-party inspection agency and the authority having jurisdiction. Ultimately neither identity can rely on assumptions, and this proposal requires a level of coordination and dialog that is not overly burdensome yet extremely important.

As with the outlined special inspections of the IBC, the proposal ends by demonstrating to the project owner and their representative that defined inspection must occur either through the authority having jurisdiction or the approved third-party inspection agency and that the construction schedule can not proceeds with subsequent phases of construction until all sequential inspections take place and pass. Lastly, the proposal seeks documentation that all approved inspections occurred and meet the intent of the code.

The clarity gained in the relationship between the authority having jurisdiction and the approved third-party inspection agency is crucial as we progress into more complicated and meaningful energy codes. Nationally, jurisdictions are losing experienced professionals to retirement. Consequently, more third-party inspection agencies are stepping in to fill the gap. These third-party inspection agencies tend to be solely focused on energy and are capable, and eager to work in the energy code compliance niche. They are filling a need for jurisdictions that are either under staffed or lack a desire to fully enforce the energy components of the code. This proposal clearly defines a path forward to meet the need by defining scope and responsibilities to better ensure compliance and thus achieve expected energy savings.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This proposal does not increase cost but better allocates dollars currently being spent to ensure that the job being undertaken by approved third party inspection agencies truly meets the needs of the authority having jurisdiction.

CE16-19 Part I

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: While it attempts to define the relationship between code official and third parties, the committee believed that it doesn't belong in the code. It might be better as a jurisdiction's guidance documents. This would constrain the code official's relationship with such third parties. (Vote: 10-4)

Assembly Action: **None**

CE16-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC®: SECTION C105, C105.4, C105.4.1 (New), C105.4.2 (New), C105.4.3 (New)

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

SECTION C105
INSPECTIONS

C105.4 Approved third-party inspection agencies. The *code official* is authorized to accept reports of third-party inspection agencies not affiliated with the building design or construction, provided that such agencies are *approved* as to qualifications and reliability relevant to the building components and systems that they are inspecting or testing.

C105.4.1 Authorization of approved third-party inspection agency. When the code official authorizes the use of a third-party inspection agency for all or some aspects of code compliance ~~inspections~~, the agency shall be authorized as a third-party extension of the code official to verify compliance.

C105.4.2 Approved third-party inspections scope. ~~agreement.~~ The ~~third-party inspection agency and the~~ code official shall determine and communicate ~~agree upon~~ which compliance verification measures the third party inspection agency ~~will be~~ shall incorporate ~~d~~ within ~~each of~~ their inspection processes. ~~These measures shall include mandatory or other provisions required by the specific path of compliance chosen from C401.2.~~

C105.4.3 Approved third-party inspections reporting. The approved agency shall submit inspection reports to the code official and to the owner's representative in accordance with Section 1704.2.4 of the *International Building Code*.

Commenter's Reason: Public Comment Reason Statement
Per the committee's guidance, this proposal was streamlined to better point to specific aspects of the relationship between approved third-party inspection agencies and the code official. There are three aspects of the relationship that are specifically troublesome within the context of IECC enforcement and which this proposal addresses.

1. Assurance that a transfer of authority is established so that a third-party inspection agency is authorized to fail or pass the inspections they perform and that the party being inspected clearly understands that authority.

2. As the committee noted, the code official must clearly establish what is needed from the third-party inspection agency. R105.4.2 above has

been significantly changed to address the committee's comment. Now the section establishes a scope rather than an agreement and rightfully requires the code official to dictate the nature of the scope of work needed.

3. Lastly, anything inspected by a third-party agency must be reported to the code official and the owners representative

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal does not increase cost but better allocates dollars currently being spent to ensure that the job being undertaken by approved third party inspection agencies truly meets the needs of the Code official

Public Comment# 1764

CE16-19 Part II

IECC: R105.4, R105.4.1 (New), R105.4.2 (New), R105.4.3 (New)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

SECTION R105
INSPECTIONS

Revise as follows:

R105.4 Approved third-party inspection agencies. The *code official* is authorized to accept reports of third-party inspection agencies not affiliated with the *building* design or construction, provided that such agencies are *approved* as to qualifications and reliability relevant to the *building* components and systems that they are inspecting.

Add new text as follows:

R105.4.1 Authorization of approved third- party inspection agency. When the code official authorizes the use of a third-party inspection agency for all or some aspects of code compliance inspections, the agency shall be authorized as a third-party extension of the code official to verify compliance.

R105.4.2 Approved third-party inspections agreement. The third-party inspection agency and the code official shall agree upon which compliance verification measures will be incorporated within each of their inspection processes. These measures shall include mandatory or other provisions required by the specific path of compliance chosen from R401.2.

R105.4.3 Approved third-party inspections reporting. The approved agency shall submit inspection reports to the code official and to the owner's representative in accordance with Section 1704.2.4 of the *International Building Code.*

CE16-19 Part II

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposal requires the code official to agree with the contractor regarding the scope of work. As the code official establishes what is needed from the 3rd party, it is the code official who decides the scope of work regardless of agreement, or not, of the contractor. (Vote: 11-0)

Assembly Action: **None**

CE16-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC®: SECTION R105, R105.4, R105.4.1 (New), R105.4.2 (New), R105.4.3 (New)

Proponents:
Robert Schwarz, representing Colorado Chapter of the ICC (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

SECTION R105
INSPECTIONS

R105.4 Approved third-party inspection agencies. The *code official* is authorized to accept reports of third-party inspection agencies not affiliated with the *building* design or construction, provided that such agencies are *approved* as to qualifications and reliability relevant to the *building* components and systems that they are inspecting <u>or testing</u>.

R105.4.1 Authorization of approved third- party inspection agency. When the code official authorizes the use of a third-party inspection agency for all or some aspects of code compliance ~~inspections~~, the agency shall be authorized as a third-party extension of the code official to verify compliance.

R105.4.2 Approved third-party inspections <u>scope.</u> ~~agreement.~~ The ~~third-party inspection agency and the~~ code official shall <u>determine and communicate</u> ~~agree upon~~ which compliance verification measures <u>the third party inspection agency</u> ~~will be~~ <u>shall incorporate</u> ~~incorporated~~ within ~~each of~~ their inspection processes. ~~These measures shall include mandatory or other provisions required by the specific path of compliance chosen from C401.2.~~

R105.4.3 Approved third-party inspections reporting. The approved agency shall submit inspection reports to the code official and to the owner's representative in accordance with Section 1704.2.4 of the *International Building Code*.

Commenter's Reason: Public Comment Reason Statement
Per the committee's guidance, this proposal was streamlined to better point to specific aspects of the relationship between approved third-party inspection agencies and the code official. There are three aspects of the relationship that are specifically troublesome within the context of IECC enforcement and which this proposal addresses.

1. Assurance that a transfer of authority is established so that a third-party inspection agency is authorized to fail or pass the inspections they perform and that the party being inspected clearly understands that authority.

2. As the committee noted, the code official must clearly establish what is needed from the third-party inspection agency. R105.4.2 above has been significantly changed to address the committee's comment. Now the section establishes a scope rather than an agreement and rightfully requires the code official to dictate the nature of the scope of work needed.

3. Lastly, anything inspected by a third-party agency must be reported to the code official and the owners representative

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal does not increase cost but better allocates dollars currently being spent to ensure that the job being undertaken by approved third party inspection agencies truly meets the needs of the Code official

Public Comment# 1765

CE19-19 Part II

IECC: R202 (IRC N1101.6), ASTM Chapter 6

Proposed Change as Submitted

Proponents: Donald Sivigny, State of Minnesota, representing State of MN and Association of Minnesota Building Officials (don.sivigny@state.mn.us)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6)
GENERAL DEFINITIONS

Revise as follows:

AIR-IMPERMEABLE INSULATION. An Insulation that functions as an air barrier material having an air permeance equal to or less than 0.02L/s= m^2 at 75 Pa pressure differential as tested in accordance with ASTM E2178 or E283.

ASTM

Add new standard(s) as follows:

ASTM E2178-13 Standard Test Method for Air Permanence of Building Materials

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959

Reason: *This Change is done to simply to combine and utilize the language of the IRC and IECC definitions together for consistency, and accuracy as to what Air Impermeable Insulation must meet to reduce both, air infiltration and exfiltration. This definition will create better enforcement and understanding of the code by providing a test standard and because the definition in Section N1101.6 is incomplete, and creates confusion for both the builder and the code official.*
(Note: The Definition in Section N1101.6 should also be removed in favor of the definition as will now be written and out of IRC Chapter 2)

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This change simply better defines Air-Impermeable insulation by combining the definitions from the IECC and IRC together for consistency and uniformity.

Staff Analysis: The referenced standard, ASTM E2178-13, is currently referenced in the 2018 IECC-Commercial Provisions.

CE19-19 Part II

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: While the proposal puts a technical threshold within the definition, it is not strictly regulatory. The technical provision is needed to establish the threshold for material to be considered air impermeable insulation. (Vote: 8-3)

Assembly Action: **None**

CE19-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC®: , R303.1.5 (N1101.10.4) (New)

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

~~**AIR-IMPERMEABLE INSULATION.** An Insulation that functions as an air barrier material having an air permeance equal to or less than 0.02L/s-m^2at 75 Pa pressure differential as tested in accordance with ASTM E2178 or E283.~~

R303.1.5 (N1101.10.4) Air-Impermeable insulation Insulation having an air permeability not greater than 0.004 cfm/ft2 (0.002 L/s*m2) under pressure differential of 0.3 inch water gauge (75 PA) when tested in accordance with ASTM E2178 shall be determined air-impermeable insulation.

Commenter's Reason: The definition is not the correct location to place technical provisions, but this proposal does have some merit for the Residential provisions of the IECC and Chapter 11 of the IRC. I think the correct location for this information is in Chapter 3 that contains other testing requirements to determine the rating of various products i.e. insulation r-value, fenestration u-factor, or fenestration SHGC.
The testing criteria were altered to reflect the air impermeable criteria found in the commercial provisions of this code.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment relocates the original proposal's clarification (a definition) as to what constitutes "air-impermeable insulation, to a better location in the code. Clarifications to the code do not impact construction cost as additional material or labor is not required by a clarification.

Public Comment# 1782

Public Comment 2:

Proponents:
Theresa Weston, representing Air Barrier Association of America (ABAA) (theresa.a.weston@dupont.com)

requests Disapprove

Commenter's Reason: As stated in the Committee's disapproval for Part I, the added technical provision shouldn't be in the definition, but instead in the appropriate section of the code. Additionally, this proposalmay set up a conflict of a material test (ASTM E2178) versus an assembly test (ASTM 283).

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 2035

NOTE: CE19-19 PART I DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

CE19-19 Part I

IECC: Part I: C202(New)

IECC: Part II: R202 (N1101.6); Chapter 6RE(New)

Proposed Change as Submitted

Proponents: Donald Sivigny, State of Minnesota, representing State of MN and Association of Minnesota Building Officials (don.sivigny@state.mn.us)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

SECTION C202
GENERAL DEFINITIONS

Add new definition as follows:

AIR-IMPERMEABLE INSULATION. An Insulation that functions as an air barrier material having an air permeance equal to or less than 0.02L/s= m^2 at 75 Pa pressure differential as tested in accordance with ASTM E2178 or E283.

Reason: *This Change is done to simply to combine and utilize the language of the IRC and IECC definitions together for consistency, and accuracy as to what Air Impermeable Insulation must meet to reduce both, air infiltration and exfiltration. This definition will create better enforcement and understanding of the code by providing a test standard and because the definition in Section N1101.6 is incomplete, and creates confusion for both the builder and the code official.*
(Note: The Definition in Section N1101.6 should also be removed in favor of the definition as will now be written and out of IRC Chapter 2)

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This change simply better defines Air-Impermeable insulation by combining the definitions from the IECC and IRC together for consistency and uniformity.

Analysis: The referenced standard, ASTM E2178-2013, is currently referenced in other 2018 I-codes.

CE19-19 Part I

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The definition includes a technical provision that this committee felt shouldn't be in the definition, but instead in the appropriate section of the code. It may set up a conflict of a material test versus an assembly test. (Vote: 13-2)

Assembly Action: **None**

CE19-19 Part I

CE21-19

IECC: C202(New), C202

Proposed Change as Submitted

Proponents: jim edelson, representing New Buildings Institute (jim@newbuildings.org)

2018 International Energy Conservation Code

SECTION C202
GENERAL DEFINITIONS

Add new definition as follows:

BIOMASS GAS. A medium Btu gas containing methane and carbon dioxide, resulting from the action of microorganisms on organic materials such as a landfill.

BIOMASS WASTE. Organic non-fossil material of biological origin that is a byproduct or a discarded product. Biomass waste includes municipal solid waste from biogenic sources, landfill gas, sludge waste, agricultural crop byproducts, straw, and other biomass solids, liquids, and gases; but excludes wood and wood-derived fuels (including black liquor), biofuels feedstock, biodiesel, and fuel ethanol.

Revise as follows:

ON-SITE RENEWABLE ENERGY. Energy derived from solar radiation, wind, waves, tides, ~~landfill~~ biomass gas, ~~biogas,~~ biomass waste or ~~the internal heat of the~~ extracted from hot fluid or steam heated within the earth. The energy system providing on-site renewable energy shall be located on the ~~project~~ building site.

Reason: The existing definition in IECC dates to the 2012 IECC. It was proposed by the team of New Buildings Institute, US Depatment of Energy and American Institute of Architects. It was one clause in a comprehensive overhaul of the 2009 IECC. When it was written in 2010, it was the first time that renewable energy had been defined in an I-code, and it reflected a very early understanding of a much less mature industry. It has not been significantly revised since.
This proposal does indeed update the language by further refining biomass energy sources with terms that were not available at the time it was drafted in 2010. Revised language makes the proper distinction between geothermal energy sources and geothermal heat pumps. The revison also limits the biomass sources to those that meet specifications as waste products. There are many flavors of biomass energy, but this proposal ensures that virgin material of unknown origin is not used as a steady source of energy, which in the provisions of C406 is a trade-off for energy efficency features of the building. The definitions of *biomass gas* and *biomass waste* are taken from the glossary of the Energy Information Administration.

This proposal does not restrict the geographic sourcing of the waste material, but it does ensure that the system converting the fuel is located on the building site.

This proposal impacts and clarifies only the "landfill gas, biogas and biomass" terms in the on-site renewable definition. It is independent of another proposal to restructure and revise other terms in the same definition.

Bibliography: U.S. Energy Information Administration Glossary; https://www.eia.gov/tools/glossary/

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal is a definition of renewable energy that will no have an impact on construction costs. The modification of the definition only applies only to the fuel used after occupancy.

CE21-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **Disapproved**

Committee Reason: The definition may conflict with state and federal rules on these topics. CE31-19 adequate addresses the topic. (Vote 15-0)

Assembly Action: **None**

CE21-19

Individual Consideration Agenda

Public Comment 1:

IECC®: 202, (New)

Proponents:
jim edelson, representing New Buildings Institute (jim@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

ON-SITE RENEWABLE ENERGY. Energy derived from solar radiation, wind, waves, tides, ~~biomass gas~~, biogas, biomass ~~waste~~ or extracted from hot fluid or steam heated within the earth. The energy system providing on-site renewable energy shall be located on the ~~building~~ project site.

BIO~~MASS~~ GAS. A ~~medium Btu gas containing methane and carbon dioxide, resulting from the action of microorganisms on organic materials such as a landfill~~mixture of hydrocarbons that is a gas at 60 degrees Fahrenheit and 1 atmosphere of pressure that is produced through the anaerobic digestion of organic matter.

BIOMASS ~~WASTE~~. Non-fossilized and biodegradable organic material originating from plants, animals and/or micro-organisms, including products, by-products, residues and waste from agriculture, forestry and related industries as well as the non-fossilized and biodegradable organic fractions of industrial and municipal wastes, including gases and liquids recovered from the decomposition of non-fossilized and biodegradable organic material. ~~that is a byproduct or a discarded product. Biomass waste includes municipal solid waste from biogenic sources, landfill gas, sludge waste, agricultural crop byproducts, straw, and other biomass solids, liquids, and gases; but excludes wood and wood-derived fuels (including black liquor), biofuels feedstock, biodiesel, and fuel ethanol.~~

Commenter's Reason: The existing definition of onsite renewable energy in IECC dates back to the 2012 IECC. It does not provide any qualifications for two generic terms in the definition – biomass and biogas. The proposed definitions are taken from U.S. Government sources. Adding these definitions will provide projects and code officials clear guidance for determining what qualifies as biomass and biogas for the purposes of IECC compliance.

Bibliography: U.S. Code of Federal Regulations; 40 CFR § 80.1401 - Definitions
U.S. Environmental Protection Agency; https://www3.epa.gov/carbon-footprint-calculator/tool/definitions/biomass.html

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
"As this public comment only clarifies the proposed definitions and clarifications do not affect material or labor costs, thus the net effect of both the public comment and the proposal will not impact the cost of construction."

Public Comment# 2085

CE35-19

IECC: C202

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing Northwest Energy Codes Group (ericM@newbuildings.org)

2018 International Energy Conservation Code

SECTION C202
GENERAL DEFINITIONS

Revise as follows:

WALL, ABOVE-GRADE. A wall associated with the *building thermal envelope* that is more than 15 percent above grade and is on the exterior of the building or any wall that is associated with the *building thermal envelope* that is not on the exterior of the building. This includes, but is not limited to, between-floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts.

Reason: The current definition of above-grade wall is general and vague and allows for an interpretation that ignores the thermal performance of important building elements. For example, the existing definition is not clear that exposed floor edges are part of the above-grade wall. Depending on how the code is interpreted/enforced, this could leave this building element unregulated.
This change to the definition clarifies it and closes this potential loophole. It is explicitly clear that the critical elements of a building that function as part of the wall component of the thermal envelope, even though they may not be thought of as walls, are regulated as walls. These elements will need to be either insulated to meet the above-grade wall requirements or be incorporated into weighted averages for the performance of the above-grade wall.

The language was drawn from the definition currently used in the WA state energy code.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This modification clarifies the code and should not increase the cost of construction.

CE35-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
WALL, ABOVE-GRADE. A wall associated with the *building thermal envelope* that is more than 15 percent above grade and is on the exterior of the building or any wall that is associated with the *building thermal envelope* that is not on the exterior of the building. This includes, but is not limited to, between-floor spandrels, peripheral edges of floors, roof ~~and basement~~ knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts.

Committee Reason: The modification removes terminology unique to the residential provisions of the code. The revisions brings needed clarity to the term and its application. The testimony was a good example of how the existing term is variously interpreted. (Vote 15-0)

Assembly Action: **None**

CE35-19

Individual Consideration Agenda

Public Comment 1:

IECC®: 202

Proponents:
Tien Peng, representing NRMCA (tpeng@nrmca.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

WALL, ABOVE-GRADE. A wall associated with the *building thermal envelope* that is more than 15 percent above grade and is on the exterior of the building or any wall that is associated with the *building thermal envelope* that is not on the exterior of the building. This includes, but is not limited to, between-floor spandrels, ~~peripheral edges of floors,~~ roof knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts.

Commenter's Reason: While there is a need to consider the "peripheral edges of floors", treating this element as the same as the "Above Grade Wall" for concrete slabs is not practical with current technology. Instead of eliminating the thermal bridging, we should act to enable the current range of manufactured thermal breaks (up to R-5) technology as the cost effective solution.

Bibliography: *The Importance Of Balcony And Slab Edge Thermal Bridges In Concrete Construction*, G. Finch, MASc., et. al., RDH Building Engineering. 2013. The Importance of Slab Edge and Balcony Thermal Bridges, Reports. Available at www.rdh.com.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
According to the RDH Building Engineering study presented at the 14th Canadian Conference on Building Science and Technology, the cost for the manufactured thermal breaks (up to R-5) is $38-60/ft. This is an amount greater than what the proponent claimed as no affect on construction cost so this PC is decreasing the cost.

Public Comment# 2099

Public Comment 2:

IECC®: 202

Proponents:
Martha VanGeem, representing Masonry Alliance for Codes and Standards

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

WALL, ABOVE-GRADE. A wall associated with the *building thermal envelope* that is more than 15 percent above grade and is on the exterior of the building or any wall that is associated with the *building thermal envelope* that is not on the exterior of the building. This includes, but is not limited to, between-floor spandrels, ~~peripheral edges of floors,~~ roof knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts.

Commenter's Reason: We ask that the phrase "peripheral edges of floors" be removed from the definition of above grade wall. When cost effectiveness for wall insulation was prepared for the IECC and ASHRAE 90.1, it was not prepared for the peripheral edges of floors. It was prepared for the clear field portion of walls which is the portion of the walls between floors and between columns and taking into account studs or fasteners in this region.

Insulating the edges of floors can be more expensive than insulating walls because they are smaller edges and have fire proofing requirements, and this was not taken into account in the cost effectiveness of the wall insulation. In addition, floor edges cannot utilize interior insulation, which is often the least expensive method for insulating for mass walls. The cost of a weather resistant material outboard of the slab insulation has also not been included. It is my understanding that some areas of the Pacific NW require slab edge insulation, but only R3 or R5 is required rather than the full amount of wall insulation. This insulation might be traded off (not used) with COMCheck, but it would be better to tell the owner/contractor/code official what exactly is required prescriptively and not presume they use COMCheck. Some building owners and contractors just want to know what to do to comply and therefore need reasonable prescriptive requirements. Code officials need to know what compliance looks like.

It is also not clear as to how balconies would be handled and whether they are peripheral edges of floors. If they are, how are they supposed to be insulated? Without this modification, the definition of wall is not clear.

This proposal will increase the cost of construction whereas the proposal said it would not. Cost effectiveness was not provided especially for the case of peripheral edges of floors. These floor edges are not specifically addressed in the current code, and where there are new R-value requirements, cost justification should be provided.

Therefore, we ask that "peripheral edges of floors" be deleted until more cost justification is provided.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The cost impact statement in the original proposal is incorrect as the “included” construction elements will require insulation which adds materials and labor. This public comment removes one item from the “included” list so there will not be added costs for insulating that item. As such, in the larger picture of many building projects, this public comment slightly reduces the cost increase of the original proposal because only some projects will have that particular construction detail. However, the net effect of both (public comment and proposal) is still an increase in the cost of construction.

Public Comment# 1284

Public Comment 3:

Proponents:
Emily Lorenz, PCI, representing PCI (emilyblorenz@gmail.com)

requests Disapprove

Commenter's Reason: Asking for disapproval for the following reasons:
Particularly for peripheral edges of floors, when cost effectiveness for wall insulation was prepared for the IECC and ASHRAE 90.1, it was not prepared for the peripheral edges of floors. It was prepared for the clear field portion of walls, which is the portion of the walls between floors and between columns, and it takes into account studs or fasteners in this region.
Insulating the edges of floors can be more expensive than insulating walls because they are smaller edges and have fire proofing requirements, and this was not taken into account in the cost effectiveness of the wall insulation. In addition, floor edges cannot utilize interior insulation, which is often the least expensive method for insulating mass walls, and the cost of a weather resistant material outboard of the slab insulation has also not been included.

It is my understanding that some areas of the Pacific NW require slab edge insulation, but only R3 or R5 is required rather than the full amount of wall insulation. This insulation might be traded off (not used) with COMCheck, but it would be better to tell the owner/contractor/code official what exactly is required prescriptively and not presume they use COMCheck.
It is also not clear as to how balconies would be handled and whether they are peripheral edges of floors. If they are, how are they supposed to be insulated?

This proposal will increase the cost of construction whereas the proposal said it would not. Cost effectiveness was not provided especially for the case of peripheral edges of floors. These floor edges are not specifically addressed in the current code, and where there are new R-value requirements, cost justification should be provided.
Therefore, we ask for disapproval until more cost justification is provided.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The net effect of a Disapprove action is that the code will not be changed, therefore there are no potential cost impacts.

Public Comment# 1828

CE43-19

IECC: C401.2, Chapter 6CE (New)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Revise as follows:

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of ANSI/ASHRAE 90.4 for Data Centers.
3. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.
4. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

Add new text as follows:

ASHRAE

ASHRAE
1791 Tullie Circle NE
Atlanta GA 30329

90.4-16: Energy Standard for Data Centers-

Reason: ASHRAE Standard 90.4, *Energy Standard for Data Centers*, was published in 2016 and is on continuous maintenance. It establishes the minimum energy efficiency requirements of data centers for design and construction and for creation of a plan for operation and maintenance, and for utilization of on-site or off-site renewable energy resources.

Data center applications are unlike their commercial building counterparts in two significant ways. First, they include significantly higher plug loads (e.g., computer servers and UPS equipment). Second, they employ rapidly changing technology for the IT equipment and associated power/cooling approaches.

There is also a recognition that current industry modeling tools do not possess all the necessary mathematical models to accurately and appropriately model data center HVAC and electrical equipment design. As a result, demonstrating compliance to the 90.1 Chapter 11 or energy cost budget (ECB) approaches is usually impractical.

Along with ASHRAE 90.1, designers and owners of data centers should have the option to use ANSI/ASHRAE 90.4 as a compliance path.

Bibliography: American Society of Heating, Refrigeration, and Air Conditioning Engineers, *Energy Standard for Data Centers*, July 2016.
https://www.techstreet.com/ashrae/standards/ashrae-90-4-2016?product_id=1922463

Cost Impact: The code change proposal will increase the cost of construction
This proposal increases the costs of data centers due to its higher efficiency requirements.

Analysis: A review of the standard proposed for inclusion in the code, ASHRAE 90.4, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

CE43-19

Public Hearing Results

Committee Action: Disapproved

Committee Reason: This may provide an incomplete solution for managing data in energy centers, and does not belong in C401.2. The code does not have a definition of data center or know what version of 90.4 is included (Vote: 14-1).

Assembly Action: None

Individual Consideration Agenda

Public Comment 1:

IECC®: 202 (New), C401.2, C401.3 (New), ASHRAE Chapter 06 (New)

Proponents:
Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

DATA CENTER. A room or building, or portions thereof, including *computer rooms* being served by *data center* systems, serving a total information technology equipment load greater than 10 kiloWatts and 20 Watts/ft^2 (215 Watts/m^2) of *conditioned floor area.*

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
~~2. The requirements of ANSI/ASHRAE 90.4 for Data Centers.~~
~~3~~ 2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.
~~4~~ 3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

C401.3 Application to data centers. Data centers shall be allowed to comply with the requirements of ANSI/ASHRAE 90.4.

ASHRAE

ASHRAE
1791 Tullie Circle NE
Atlanta GA 30329

90.4- 2016: Energy Standard for Data Centers

Commenter's Reason: This proposal addresses the concerns of the committee by making the following changes:
-It moves the language out of Section C401.2 and into a new section C401.3 to ensure that it only applies to data centers.

-It adds a definition of data center that is technically consistent with the definition of data centers in ANSI/ASHRAE Standard 90.4.

-It makes an editorial change to the standard reference (changing "16" to "2016").

Bibliography: ASHRAE
90.4-2016: Energy Standard for Data Centers

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The code change proposal and public comment will increase the cost of construction. The code change proposal (and public comment) increases the cost of data centers due to efficiency requirements in the 2016 version of the standard.

Public Comment# 1241

Public Comment 2:

Proponents:
Colin Laisure-Pool, MPSW, Inc., representing Self (clpool@gmail.com)

requests As Submitted

Commenter's Reason: I'd like to express support for this proposal, as revised/submitted by Steven Rosenstock. ASHRAE 90.4-2016 is a comprehensive standard regarding data centers that defines what specifically is being focused on, and provides helpful informative notes, tables, and example calculations. Simply copy/pasting the efficiency tables leaves out important context that will undoubtedly lead to confusion among designers and AHJs. See the following:
2018 International Energy Conservation Code

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.

2. ~~The requirements of ANSI/ASHRAE 90.4 for Data Centers.~~

~~3~~ 2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.

~~4~~ 3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

Add new text as follows: C401.3 Application to *Data Centers*.

Data Centers* shall be allowed to comply with the requirements of ANSI/ASHRAE 90.4-2016 Energy Standard for *Data Centers

SECTION C202 GENERAL DEFINITIONS

DATA CENTER. A room or building, or portions thereof, including *computer rooms* being served by *data center* systems, serving a total information technology equipment load greater than 10 kiloWatts and 20 Watts/ft^2 (215 Watts/m^2) of *conditioned floor area.*

Bibliography: ASHRAE 90.4 - 2016

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Any required increase in HVAC or Electrical system efficiency will tend to increase the initial cost of construction.

Public Comment# 1278

CE44-19

C401.1, C401.2, RE RESNET Ch 6

Proposed Change as Submitted

Proponents: Gayathri Vijayakumar, Steven Winter Associates, Inc., representing Steven Winter Associates, Inc. (gayathri@swinter.com); Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

C401.1 Scope. The provisions in this chapter are applicable to commercial buildings and their building sites.

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.

   Exception: Dwelling units and sleeping units in Group R-2 buildings shall be deemed to be in compliance with this chapter provided they comply with Section R406.

3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

RESNET

Residential Energy Services Network, Inc.
P.O. Box 4561
Oceanside, CA 92052-4561

ANSI/RESNET/ICC ~~301—2014~~ 301—2019: Standard for the Calculation and Labeling of the Energy Performance of ~~Low-rise Residential Buildings~~ Dwelling and Sleeping Units using an Energy Rating ~~Index First Published March 7, 2014—Republished January 2016~~ Index

Reason: Multifamily buildings (Group R-2) have historically been split between the residential and commercial provisions of the IECC, based on their height, resulting in very different compliance requirements for similar buildings. Prior change proposals seeking to provide consistency for this building type have struggled to find a simple approach. This proposal provides a simple optional alternative for dwelling and sleeping units within these "commercial buildings" to instead meet the same energy efficiency requirements of dwelling and sleeping units under the Residential provisions, specifically section R406, the Energy Rating Index Compliance Alternative. This section R406 still requires compliance with mandatory items, including but not limited to those listed in sections R401 through R404. The other spaces in the building, such as corridors, stairwells, lobbies, community spaces, and sometimes, retail, still are required to comply with the commercial provisions. While this proposal was not possible before now, ANSI/RESNET/ICC 301-2019, which is the Standard for calculating the ERI, has recently expanded its scope to include dwelling and sleeping units in any height building, which means those units in 'commercial buildings' are now eligible for an ERI. While efficiency requirements can vary for the same building components, whether you are in the Residential or Commercial provisions, this is is the 1st step in providing dwelling units in multifamily buildings the same path to code compliance, regardless of their building height. This results in a dwelling unit in a 3 story building and the same exact dwelling unit in a 4 story building to both be deemed code compliant, with the same exact building components.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The cost impact depends on the code compliance currently being followed.

For those doing building simulations in accordance with C407, this may present a decrease in the costs to demonstrate compliance.

Those not choosing this alternative will experience no change in costs.

Those choosing this alternative will likely do so if they are able to utilize the same energy rating index being used in other multifamily programs, such as ENERGY STAR and LEED, or utility-sponsored incentive programs that require an ERI, as their code compliance option. This will also therefore result in no additional costs.

Staff Analysis: The proposal is dependent upon the RESNET standard referenced in R406 being updated as shown.

CE44-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **Disapproved**

Committee Reason: There are concern for combining combining compliance paths and it being used to create a loophole in high rise buildings. It would not apply to buildings with central heat and water. There are too many questions about equivalency, difference between HERS and ERI. There is no cost data, and other performance paths available. There were clear examples of when it wouldn't work, and questions of applicability (Vote: 13-2).

Assembly Action: **None**

CE44-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C401.1, C401.2

Proponents:
Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C401.1 Scope. The provisions in this chapter are applicable to commercial buildings and their building sites.

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.

   ~~Exception:~~ Dwelling units and sleeping units in Group R-2 buildings <u>that comply with Section R406</u> shall be deemed to be in compliance with this chapter ~~provided they comply with Section R406~~.

3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

Commenter's Reason: While I am a proponent of this code change proposal, the edits shown in this public comment are the result of working with ICC staff on a floor mod prior to the CAH to make the wording more clear that this code change proposal introduces an option and not a mandatory requirement.
I was not present at the CAH during testimony on CE44 and therefore missed the opportunity to answer some important questions that were raised. Upon viewing the 26 minutes of testimony, I am using this public comment to <u>correctly</u> answer those questions and address the concerns raised. As the current Chair of RESNET SDC300 tasked with revising and developing ANSI 301-2019 and also a mechanical engineer, ASHRAE Building Energy Modeling Professional (BEMP), and a HERS Rater, I am well positioned to answer these questions. I also do not represent RESNET on this proposal.

The Committee's concerns were noted in the Reason statement above, which I copied and addressed below.

1. "**There are concerns for combining compliance paths."** Multifamily buildings under Residential code deal with this already where the units are subject to Residential provisions and the non-dwelling spaces are subject to the Commercial provisions. Even throughout the code there are specific items that re-direct dwelling units from commercial code back to residential code (ie. lighting, C405.1) or send HVAC systems from Residential to Commercial (R403.8). Multifamily buildings are caught between the two codes and this code change proposal was finally providing them a

streamlined option, where a 3 story MF could reach code compliance in the same exact way as a 4 story MF. In practice, code compliance would use the same compliance reports that are used in R406 for the dwelling units and COMCheck that is typically used for the commercial building, would be used for the non-dwelling spaces.

2. **"...and it being used to create a loophole in high rise buildings**." A loophole implies that less stringent requirements are being met by choosing this option. The option being chosen is in fact already deemed to be a code compliant path for residential MF in the IECC. The reason we have different requirements is because at some point code arbitrarily split MF at 4 stories. The ERI Path will generally result in more stringent requirements, not just because it requires air leakage tests, but it also uses a Reference Design which will have in-unit systems (ie. SEER 13 AC, 78% AFUE furnace, 80% boiler), with no energy allowance for central pumping energy. In contrast, ASHRAE 90.1 Appendix G, depending on climate zone, assumes a central boiler with pumping power to serve HW PTAC's. There would be no advantage for a high-rise to switch to the ERI Path. Same for curtainwall buildings. While not explicitly limited to a % window area when following R406, the ERI Reference Design has a cap (~18%) and the climate zone permitted ERI's were not based on that building type. Ask any Rater if they could build an ERI model for an apartment with curtainwall and easily get below 57. And similar to ASHRAE 90.1 Appendix G, the Reference Design is NOT intended to reflect the same values in the Commercial provisions, which is why the proposal didn't provide that comparison. Both ERI and 90.1 landed on needing a stable baseline and to instead adjust the % better than the baseline as the means to attain higher energy efficiency (The Baseline in 90.1 landed on 2004 levels and ERI Reference is roughly 2006 IECC). See Table 4.2.2(2) of ANSI 301-2019 for specific envelope values. Again, ask any Rater how "easy" it is to get to ERI of 57-62. The answer generally is that it's too hard and it's 'easier' to just do the Prescriptive Path. So, this option is certainly not a loophole.

3. "**It would not apply to buildings with central heat and water...and questions of applicability**." It was mis-stated during CAH testimony on CE44 that this ERI Path is not permitted for buildings with central systems. That is incorrect. All building types/systems are permitted. ANSI 301-2019 has clear guidance that allows central systems to be modeled, and their shared energy pro-rated to the dwelling unit.

4. "**There are too many questions about equivalency, difference between HERS and ERI**." While there may be some confusion about HERS vs ERI, it's still a code-compliant path that is being offered in IECC-R. The approved software tools are not confused and it's as simple as printing out a report that says 2018 IECC ERI vs HERS. HERS and ERI will always have different numerical values as RESNET "HERS" will always use the most current version of ANSI 301, with amendments, whereas the IECC is stuck with the most recent copy available as of January 2019 (frozen at the 2019 edition, with no amendments). In all likelihood, by the time states adopt 2021 IECC, RESNET will have progressed to using ANSI 301-2022. As for equivalency and consistency across Raters calculating ERI on dwelling units, I have reviewed plenty of ASHRAE 90.1 Appendix G energy models and inconsistency across modeling software and energy modelers is NOT limited to the ERI Path! Modeling tools are only as good as what you enter and this inconsistency is a problem for the ASHRAE Path too. At least the ERI Path has some semblance of a QA plan and the software tools all automate the Reference Design (not the case with most 90.1 tools). There are no requirements (that I know of) in ASHRAE 90.1 or in C407 that requires the modeler to have any training or certification or continuous oversight of their work by a third-party.

5. "**There is no cost data, and other performance paths available**." As noted above, there was no need to compare to other Commercial performance paths since the point was to simply allow these mid and high rise to use the same Reference as permitted by code of low-rise MF. The cost data was mentioned at a high-level in the proposal - it would likely cost less to do the ERI Path as typically a group of models that reflect typical floor plans are eventually duplicated to create the other units in the building. It could cost more because imbedded in R406 are a handful of mandatory items, like air leakage test. It's difficult to determine the cost impact of something that is simply an option, not a requirement.

I urge your support of this code change proposal, as modified by this public comment, so that we can at a minimum, finally offer Multifamily a code compliance option that is the same for their low-rise multifamily buildings as it is for their mid and high-rise. This sets the precedence for future amendments to continue this work and address any remaining concerns.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is an option, not a requirement. Those that feel like the option will increase their costs will not choose it.

Public Comment# 2021

Public Comment 2:

IECC®: C401.2

Proponents:
Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.

   ~~**Exception:**~~ Dwelling units and sleeping units in Group R-2 buildings without systems serving multiple units shall be deemed to be in compliance with this chapter provided they comply with Section R406.

3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

Commenter's Reason: To avoid repeating my prior public comment reason statement, which rebutted the Committee reasons for disapproving CE44, this public comment provides a modification to the code change proposal that limits its applicability to dwelling and sleeping units that have their own individual systems. While this limitation is not necessary, it does seem to address some concerns raised by the Committee and opponents giving testimony, while still at least offering this option to dwelling units that are very similar in construction as those in low-rise MF and therefore well suited to the ERI Path.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Again, as this is an optional path, not a requirement, there is no increase or decrease to the cost of construction. If the costs increase for a certain building, the option would not be selected.

Public Comment# 2055

CE49-19

IECC®: C401.2, C407.3

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.
3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than ~~85~~ 80 percent of the standard reference design building.

C407.3 Performance-based compliance. Compliance based on total building performance requires that a proposed building (*proposed design*) be shown to have an annual energy cost that is less than or equal to 80 percent of the annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's *State Energy Price and Expenditure Report. Code officials* shall be permitted to require time-of-use pricing in energy cost calculations. The reduction in energy cost of the proposed design associated with *on-site renewable energy* shall be not more than 5 percent of the total energy cost. The amount of renewable energy purchased from off-site sources shall be the same in the *standard reference design* and the *proposed design*.

Exception: Jurisdictions that require site energy (1 kWh = 3413 Btu) rather than energy cost as the metric of comparison.

Reason: The purpose of this code change proposal is to improve the efficiency of buildings designed to comply under the IECC performance path by altering the multiplier for the standard reference design building from 85% to 80%. Starting with the 2012 IECC, rather than undertake a complete retooling of the performance path, advocates added a percentage multiplier to the standard reference design to reduce the energy budget for the baseline. This approach provided maximum flexibility to the code user. Improvements could be made to any part of the building to achieve the 15% improvement. This approach also established a means of easily updating the performance path in the future: As additional efficiency is needed, the multiplier can be lowered to meet those needs.
Since the 2012 IECC, the 85% multiplier has not been changed, even though other parts of the commercial IECC have undergone improvements. This proposal updates the multiplier by essentially improving efficiency by about 5% (as compared to the original baseline code, the 2009 IECC).

This proposal also includes the same multiplier in Section C407.3. We believe this is a more appropriate place for the multiplier, since it is closer to the other assumptions included in the standard reference design. However, we would prefer to see it included in both C407.3 and C401.2 to make sure that code users understand the requirements of the performance path.

Cost Impact: The code change proposal will increase the cost of construction
Adding additional efficiency measures will increase construction cost. However, we expect that design professionals and builders will select the improvements that are the most cost-effective and the easiest to implement into specific designs.

CE49-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The claim the envelope is maxed out is false. There is no cost analysis. We need to know the relationship between compliance paths before making such changes. (Vote 8-7)

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

IECC®: C401.2, C407.3

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.
3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than ~~80~~ 95 percent of the standard reference design building.

C407.3 Performance-based compliance. Compliance based on total building performance requires that a proposed building (*proposed design*) be shown to have an annual energy cost that is less than or equal to ~~80~~ 95 percent of the annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration’s *State Energy Price and Expenditure Report. Code officials* shall be permitted to require time-of-use pricing in energy cost calculations. The reduction in energy cost of the proposed design associated with *on-site renewable energy* shall be not more than 5 percent of the total energy cost. The amount of renewable energy purchased from off-site sources shall be the same in the *standard reference design* and the *proposed design*.

Exception: Jurisdictions that require site energy (1 kWh = 3413 Btu) rather than energy cost as the metric of comparison.

Commenter's Reason: As the IECC and ASHRAE 90.1 require more efficiency and more stringent controls, it makes it more difficult to use this path. This modification will ensure lower energy costs, with a more realistic reduction requirement.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The original proposal further tightens the energy cost requirement for designing a proposed building using the performance path option. This results in an exponentially greater cost of construction (per square foot) because it generally costs exponentially more to achieve a very high level of energy efficient construction (the best windows, the best insulation, extremely tight construction, etc.). Such extremely high costs will eliminate the performance path as a viable, cost effective code compliance option. The baseline energy cost for the proposed design has already been lowered since the 2012 IECC by more stringent and reasonably achievable requirements for energy efficient construction in the standard reference design. These improvements haven’t been properly accounted for in the proponent’s percentage adjustments. This public comment adjusts the percentage higher than the current code to properly account for the cost effective and greater levels of efficiency of the 2018 (and 2021) standard reference design. In this way, the public comment negates the proponent’s increase of cost of construction.

Public Comment# 1710

Public Comment 2:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it is a straightforward improvement in efficiency for commercial buildings designed using the performance path that will reduce energy costs for these buildings by roughly 5%. The 85% multiplier was originally incorporated into the performance path in the 2012 IECC as a means of improving efficiency while maintaining flexibility. Since the 2012 IECC, there have been quite a few changes to other parts of the code, but the 85% multiplier in the performance path has remained the same. CE49 is a sensible, easy-to-implement efficiency improvement for the performance path; it is reasonable to improve this figure now after 9 years of no change.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
As stated in the original proposal, adding additional efficiency measures will increase construction cost. However, we expect that design professionals and builders will select the improvements that are the most cost-effective and the easiest to implement into specific designs.

Public Comment# 1448

CE53-19

IECC: C202(New), C401.2.2(New), C406.5

Proposed Change as Submitted

Proponents: jim edelson, representing New Buildings Institute (jim@newbuildings.org)

2018 International Energy Conservation Code

SECTION C202
GENERAL DEFINITIONS

Add new definition as follows:

RENEWABLE ENERGY CERTIFICATE (REC). An instrument that represents the environmental attributes of one megawatt-hour of renewable electricity; also known as an energy attribute certificate (EAC).

Add new text as follows:

C401.2.2 On-site renewable energy Each building site shall have equipment for on-site renewable energy with a rated capacity of not less than 0.25 W/ft² (2.7 W/m²) multiplied by the sum of the gross conditioned floor area of the three largest floors. Documentation shall be provided to the code official that indicates that renewable energy certificates (RECs) associated with the on-site renewable energy will be retained and retired by or on behalf of the owner or tenant.

Exceptions:

1. Any building located where an unshaded flat plate collector oriented towards the equator and tilted at an angle from horizontal equal to the latitude receives an annual daily average incident solar radiation less than 3.5 kWh/m²·day (1.1 kBtu/ft²·day).
2. Any building where more than 80 percent of the roof area is covered by any combination of equipment other than for on-site renewable energy systems, planters, vegetated space, skylights or occupied roof deck.
3. Any building where more than 50 percent of roof area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2,500 annual hours between 8:00 AM and 4:00 PM.

Revise as follows:

C406.5 On-site renewable energy. The total minimum ratings of *on-site renewable energy* systems , not including *on-site renewable energy* system capacity used for compliance with Section C401.2.2, shall be one of the following:

1. Not less than 1.71 Btu/h per square foot (5.4 W/m^2) or 0.50 watts per square foot (5.4 W/m^2) of conditioned floor area.
2. Not less than 3 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.

Reason: Onsite renewable energy installations are becoming widespread in many parts of the country, and mandatory in other parts. This proposal creates a mandatory requirement for a system that is approximately one-half of the capacity that has been a compliance package selection in Section 406 since the 2012 IECC.
This language is largely based on Addendum "by" now pending to modify ASHRAE 90.1-2016. The three exceptions are written to ensure that the requirement is not being applied to buildings without adequate space on the roof, to buildings that are in areas of the country where unblocked insolation levels do not provide enough energy to make the equipment cost-effective (according to ASHRAE cost-effective criteria), and to buildings where solar access is wholly or partially blocked. The economic analysis supporting the Addendum is what was used to derive the specifications in the measure's exceptions. The analysis included multi-variate calculations on the PNNL 3-Story Medium Office Bldg Prototype and modeled @ 0.25W/SF of renewable capacity for conditioned area on all 3 floors. The solar equipment on the prototype models passed the ASHRAE Economic Scalar in 5 of 6 insolation zones. The sixth zone aligns with the third exception in the proposal .

Section 406.5 is modified so that the renewable capacity used for compliance with the new minimum requirement is not also counted towards compliance with Section 406.

The proposal also ensures that renewable energy used for compliance with another obligation (eg. through the transfer of RECs then applied to a state Renewable Portfolio Standard) is not double counted towards compliance with the IECC. While this proposal does not cite Green-E, the Green-E Standard describes how double counting occurs when RECs associated with an on-site system have been transferred to another party in the transaction for the onsite renewable system (such as a lease or financing contract) and are then counted towards code compliance:

Examples of prohibited double uses include, but are not limited to:

1) When the same REC is sold by one party to more than one party, or any case where another party has a conflicting contract for the RECs or the *renewable electricity;*

2) When the same REC is claimed by more than one party, including any expressed or implied environmental claims made pursuant to electricity coming from a renewable energy resource, environmental labeling or disclosure requirements. This includes representing the energy from which RECs are derived as renewable in calculating another entity's product or portfolio resource mix for the purposes of marketing or disclosure;

3) When the same REC is used by an electricity provider or utility to meet an environmental mandate, such as an RPS, and is also used to satisfy customer sales under Green-e Energy; or

4) Use of one or more attributes of the renewable energy or REC by another party. This includes when a REC is simultaneously sold to represent "renewable electricity" to one party, and one or more Attributes associated with the same MWh of generation (such as CO2 reduction) are also sold, to another party.

Bibliography: Addendum *by* to Standard 90.1-2016, Energy Standard for Buildings Except Low-Rise Residential Buildings; ASHRAE, January 2018. (pending at the time of submittal)
Green-e Renewable Energy Standard for Canada and the United States, Version 3.2; March 20, 2018.

Cost Impact: The code change proposal will increase the cost of construction
The representative average price for onsite renewable energy systems as analyzed in 2018 by the ASHRAE 90.1 working group was $2.50 per installed watt of capacity, before incentives. The workgroup also indicated that the required capacity levels were cost-effective, according to ASHRAE criteria, for buildings in the areas that were subject to the requirement (i.e. not excepted from the requirement).

CE53-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **Disapproved**

Committee Reason: There are too many open ends on this, there is a chance to fix some of the problems identified in testimony such as including the modifications that did not get ruled in order Edwards 5, the other proposals referenced but not identified, and the REC issue. In addition reconsider item 2 there is concern that plans examiner would not read the it as intended. There are exceptions for high rise building need to be included, taking into such issues as recreational spaces, terracing, etc and the departments having ability to identify buildings for which not feasible (Vote: 13-2).

Assembly Action: **None**

CE53-19

Individual Consideration Agenda

Public Comment 1:

IECC®: SECTION, (New), C401.2.2 (New), C407.3

Proponents:
Eric Makela, representing New Buildings Institute (ericm@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

SECTION ~~C202~~
~~GENERAL DEFINITIONS~~

~~**RENEWABLE ENERGY CERTIFICATE (REC).** An instrument that represents the environmental attributes of one megawatt-hour of renewable electricity; also known as an energy attribute certificate (EAC).~~

C401.2.2 On-site renewable energy Each building site shall have ~~equipment for~~ one or more on-site renewable energy systems with a total rated capacity of not less than 0.25 W/ft² (2.7 W/m²) multiplied by the sum of the gross conditioned floor area of the three largest floors. ~~Documentation shall be provided to the code official that indicates that renewable energy certificates (RECs) associated with the on-site renewable energy will be retained and retired by or on behalf of the owner or tenant.~~

Exceptions:

1. Any building located where an unshaded flat plate collector oriented towards the equator and tilted at an angle from horizontal equal to the latitude receives an annual daily average incident solar radiation less than 3.5 kWh/m²·day (1.1 kBtu/ft²·day).
2. Any building where more than 80 percent of the roof area is covered by any combination ~~of equipment other than for on-site renewable energy systems~~, planters, vegetated space, skylights, walkways, ~~or~~ occupied roof ~~deck~~ area, mandatory access or set back as required by the International Fire Code, or *equipment* other than for *on-site renewable energy systems* .
3. Any building where more than 50 percent of roof area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2,500 annual hours between 8:00 AM and 40 PM.
4. New construction or additions in which the sum of the conditioned floor area of the three largest floors of the construction or addition is less than 10,000 ft2 (1,000 m2).
5. Alterations

C407.3 Performance-based compliance. Compliance based on total building performance requires that a proposed building (*proposed design*) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's *State Energy Price and Expenditure Report*. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations. The reduction in energy cost of the proposed design associated with *on-site renewable energy* shall be not more than 5 percent of the total energy cost and shall not include reduction in energy cost associated with on-site renewable energy system capacity used for compliance with Section C401.2.2. The amount of renewable energy purchased from off-site sources shall be the same in the *standard reference design* and the *proposed design*.

Exception: Jurisdictions that require site energy (1 kWh = 3413 Btu) rather than energy cost as the metric of comparison.

Commenter's Reason: Onsite renewable energy installations are becoming widespread in many parts of the country, and mandatory in other parts. This proposal creates a mandatory requirement for a system that is approximately one-half of the capacity that has been a compliance package selection in Section 406 since the 2012 IECC. This language is largely based on Addendum "by" now pending to modify ASHRAE 90.1-2016.

The proposed Public Comment addresses comments from the IECC Code Development Committee and opponents and brings the proposed change in line with Addendum BY for ASHRAE 90.1. The Public Comment also includes floor modifications that were developed to further bring CE53 in line with Addendum BY but that were ruled out of order at the Code Development Hearings.

This Public Comment does the following:

1. Strikes the definition and the requirement for Renewable Energy Credits.
2. Specifically calls out that buildings must have one or more on-site renewable systems instead of stating that the building must have equipment for on-site renewable systems. The term "system" is broader and implies that equipment be installed to generate energy and then transport that energy to the energy using features in the building.
3. Modified Exception 2 to better address high rise commercial construction and with the recognition that the roof area is limited in high rise construction. Language was reviewed for a similar provision from New York City. The proposed new language is consistent with ASHRAE Addendum BY.
4. Adds an exception for smaller commercial buildings (less than 10,000 ft2) for new construction and additions and also alternations.
5. Added language to C407.3 Performance-based compliance that only allows credit for renewables above what is required in C401.2.2.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The representative average price for onsite renewable energy systems as analyzed in 2018 by the ASHRAE 90.1 working group was $2.50 per installed watt of capacity, before incentives. The workgroup also indicated that the required capacity levels were cost-effective, according to ASHRAE criteria, for buildings in the areas that were subject to the requirement (i.e. not excepted from the requirement).

Public Comment# 1889

CE54-19 Part II

IECC: R401.2, R401.2.1 (IRC N1101.13.1) (New), R401.2.1.1 (IRC N1101.13.1.1) (New), R401.2.1.2 (IRC N1101.13.1.2) (New)

Proposed Change as Submitted

Proponents: Craig Conner, representing self (craig.conner@mac.com)

2018 International Energy Conservation Code

R401.2 Compliance. Projects shall comply with one of the following:

1. Sections R401 through R404.
2. Section R405 and the provisions of Sections R401 through R404 indicated as "Mandatory."
3. The energy rating index (ERI) approach in Section R406.
4. The tropical zone alternative in accordance with Section R401.2.1.

Revise as follows:

R401.2.1 (IRC N1101.13.1) Tropical zone. *Residential buildings* in the tropical zone at elevations less than 2,400 feet (731.5 m) above sea level shall be deemed to be in compliance with this chapter ~~provided that~~ where the ~~following~~ conditions of either Section R401.2.1.1 or R401.2.1.2 are met ~~:~~.

1. ~~Not more than one-half of the *occupied* space is air conditioned.~~
2. ~~The *occupied* space is not heated.~~
3. ~~Solar, wind or other renewable energy source supplies not less than 80 percent of the energy for service water heating.~~
4. ~~Glazing in *conditioned* spaces has a *solar heat gain coefficient* of less than or equal to 0.40, or has an overhang with a projection factor equal to or greater than 0.30.~~
5. ~~Permanently installed lighting is in accordance with Section R404.~~
6. ~~The exterior roof surface complies with one of the options in Table C402.3 or the roof or ceiling has insulation with an *R-value* of R-15 or greater. Where attics are present, attics above the insulation are vented and attics below the insulation are unvented.~~
7. ~~Roof surfaces have a slope of not less than onefourth unit vertical in 12 units horizontal (21-percent slope). The finished roof does not have water accumulation areas.~~
8. ~~Operable fenestration provides a ventilation area of not less than 14 percent of the floor area in each room. Alternatively, equivalent ventilation is provided by a ventilation fan.~~
9. ~~Bedrooms with exterior walls facing two different directions have operable fenestration on exterior walls facing two directions.~~
10. ~~Interior doors to bedrooms are capable of being secured in the open position.~~
11. ~~A ceiling fan or ceiling fan rough-in is provided for bedrooms and the largest space that is not used as a bedroom.~~

R401.2.1.1 (IRC N1101.13.1.1) Limited air-conditioning option. Where a portion of the dwelling unit is provided with air-conditioning, all of the following shall be met:

1. Not more than one-half of the *occupied* space is air conditioned.
2. The *occupied* space is not heated.
3. Solar, wind or other renewable energy source supplies not less than 80 percent of the energy for service water heating.
4. Glazing in *conditioned* spaces has a *solar heat gain coefficient* of less than or equal to 0.40, or has an overhang with a projection factor equal to or greater than 0.30.
5. Permanently installed lighting is in accordance with Section R404.
6. The exterior roof surface complies with one of the options in Table C402.3 or the roof or ceiling has insulation with an *R-value* of R-15 or greater. Where attics are present, attics above the insulation are vented and attics below the insulation are unvented.
7. Roof surfaces have a slope of not less than one-fourth unit vertical in 12 units horizontal (21-percent slope). The finished roof does not have water accumulation areas.
8. Operable fenestration provides a ventilation area of not less than 14 percent of the floor area in each room. Alternatively, equivalent ventilation is provided by a ventilation fan.
9. Bedrooms with exterior walls facing two different directions have operable fenestration on exterior walls facing two directions.
10. Interior doors to bedrooms are capable of being secured in the open position.
11. A ceiling fan or ceiling fan rough-in is provided for bedrooms and the largest space that is not used as a bedroom.

Add new text as follows:

R401.2.1.2 (IRC N1101.13.1.2) Dwelling units without air-conditioning option. Where none of the occupied space of the dwelling unit is air-conditioned or heated, all of the following shall be met:

1. There are no requirements for glazing U-factor, SHGC or air tightness.
2. Permanently installed lighting is in accordance with Section R404.
3. The exterior roof and wall surfaces shall have an 0.85 initial and 0.70 aged reflectivity or have insulation with an R-value of R-5 or greater.
4. Roof surfaces have a slope of not less than one-fourth unit vertical in 12 units horizontal (21-percent slope). The finished roof does not have water accumulation areas.

5. <u>Operable fenestration provides ventilation in each room. There shall be at least one window per face of the dwelling unit.</u>
6. <u>Bedrooms with exterior walls facing two different directions have operable fenestration on exterior walls facing two directions.</u>
7. <u>Interior doors to bedrooms are capable of being secured in the open position.</u>
8. <u>Ceiling fans are provided for a bedroom and the largest space that is not used as a bedroom.</u>

Reason: Very low income housing needs a path to both house people and fall under the code. Some of these units are being built "informally", with everyone knowing they are not even attempting compliance. It is better to give them a very low cost path to improving peoples housing. Housing which does not heat or cool is already saving considerable energy over the "mainland" style housing the code presumes.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
It is hard to judge the cost of having a code apply to housing that is not even attempting to comply with the code now. What is the cost of not having a building code?

Staff Analysis: Please note that due to the requirements of the cdpACCESS system, where a new subsection is created and is populated with existing text, the existing text must be shown as removed from the existing section and shown as new in the new section. The 11 items in the new section R401.2.1.1 are the 11 items in the current code. They are simply relocated.

CE54-19 Part II

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This change is supported as it applies to unconditioned buildings (Vote: 6-5).

Assembly Action: **None**

CE54-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because the provisions of proposed section R401.2.1.2 further roll back energy efficiency provisions for the tropical climate zone and are simply inappropriate for any energy code, let alone the national model energy code. This new and expanded loophole to efficiency requirements has the potential to leave occupants uncomfortable and will very likely lead to increased energy use as owners and occupants of these buildings add window air-conditioning units to improve comfort after-the-fact.

It is important to keep in mind the broad reach of the IECC's tropical climate zone. As currently defined in the IECC, the tropical climate zone covers all "islands in the area between the Tropic of Cancer and the Tropic of Capricorn." *See* Section R301.4. It is reasonable to expect that many homes in this region will require some amount of space cooling -- homes in the tropical zone (which overlaps with climate zone 1) can have up to 9,000 Cooling Degree Days. *See* Table R301.3(2).

It is hard to imagine why buildings in this climate zone would not be designed to maintain reasonable indoor temperatures, but proposed section R401.2.1.2 ("without air conditioning option") does exactly that: "1. There are no requirements for glazing U-factor, SHGC or air tightness." Having no window SHGC control, for example, means that the occupant is fully subjected to the discomfort of solar gain, particularly due to direct sunlight. Constructing dwelling units with little thermal or solar control and hoping that occupants actively operate windows, doors, and ceiling fans to manage indoor temperatures seems shortsighted, at best. Many of the occupants of these units will turn to window-mounted air conditioning units at some point, negating any projected "savings" from the "without air conditioning option." These units will use far more energy than buildings constructed to the minimum requirements of climate zone 1.

This proposal is a bad solution in search of a problem. The IECC already provides a compliance option for the tropical climate zone that is far less efficient than climate zone 1. The reason provided for CE54 creates a strawman argument of “informal” housing in Puerto Rico – presumably non-code-compliant buildings – and argues that if the IECC had an even weaker set of requirements for the tropical climate zone, maybe builders in Puerto Rico could be convinced to follow the code. This argument could be made for any climate zone to justify reduced stringency, but it is simply not a valid justification for reducing the minimum code requirements. “Informal” housing probably also does not meet structural, fire, or electrical code requirements – but no party would reasonably argue that this justifies setting less-safe requirements for buildings in Puerto Rico as well. And although supporters of RE54 repeatedly referenced Puerto Rico, the tropical climate zone covers a broad swath of territory that includes Hawaii. The new loophole created by CE54 is far less stringent than Hawaii’s current energy code, and it could be a huge setback for Hawaii’s energy efficiency efforts.

In sum, CE54 creates an even larger loophole in the code for homes in the tropical climate zone, and it is not supported by any data supporting claims that it would not reduce efficiency. It is simply not appropriate for the IECC, and it should be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1449

Public Comment 2:

Proponents:
Gil Rossmiller, representing Self (gilrossmiller@coloradocode.net)

requests Disapprove

Commenter's Reason:
The committee got this one wrong. As the committee reason for approval stated “This change is supported as it applies to unconditioned buildings” says it all.

The Energy Code is for the “the design and construction of buildings for the effective use and conservation of energy”. One of the requirements of the code change is that the building is <u>not</u> heated or cooled.

The proposal then sets several other design requirements, that are more of an overall design criterion that would normally be found in the IRC part III.

While I understand what the proponent is wanting to create. This does not belong in the energy code.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1310

NOTE: CE54-19 PART I DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

CE54-19 Part I

IECC®: C401.2, C401.3 (New), C401.3.1.1 (New), C401.3.2 (New)

Proposed Change as Submitted

Proponents: Craig Conner, representing self (craig.conner@mac.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C401.2 Application. Commercial buildings shall comply with one of the following:

The requirements of ANSI/ASHRAE/IESNA 90.1. 2.
The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.
The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.
Tropical zone alternative in C401.3

Add new text as follows:

C401.3 Tropical zone alternative. Group R-2 buildings in the tropical zone at elevations less than 2,400 feet (731.5 m) above sea level shall be deemed to be in compliance with this chapter where the conditions of either Section C401.3.1 or C401.3.2 are met.

C401.3.1.1 Limited air-conditioning option. Where a portion of the dwelling unit is provided with air-conditioning, all the following shall be met:

1. Not more than one-half of the occupied space is air conditioned.
2. The occupied space is not heated.
3. Solar, wind or other renewable energy source supplies not less than 80 percent of the energy for service water heating.
4. Glazing in conditioned spaces has a solar heat gain coefficient of less than or equal to 0.30, or has an overhang with a projection factor equal to or greater than 0.30.
5. Permanently installed lighting is in accordance with Section R404.
6. The exterior roof surface complies with one of the options in Table C402.3 or the roof or ceiling has insulation with an R-value of R-15 or greater. Where attics are present, attics above the insulation are vented and attics below the insulation are unvented.
7. Roof surfaces have a slope of not less than one-fourth unit vertical in 12 units horizontal (21-percent slope). The finished roof does not have water accumulation areas.
8. Operable fenestration provides a ventilation area of not less than 14 percent of the floor area in each room. Alternatively, equivalent ventilation is provided by a ventilation fan.
9. Bedrooms with exterior walls facing two different directions have operable fenestration on exterior walls facing two directions.
10. Interior doors to bedrooms are capable of being secured in the open position.
11. A ceiling fan or ceiling fan rough-in is provided for bedrooms and the largest space that is not used as a bedroom.

C401.3.2 Dwelling units without air-conditioning option. Where none of the occupied space is air conditioned or heated, all of the following shall be met:

1. There are no requirements for glazing U-factor, SHGC or air tightness.
2. Permanently installed lighting is in accordance with Section R404.
3. The exterior roof and wall surfaces have an 0.85 initial and 0.70 aged reflectivity or have insulation with an R-value of R-5 or greater.
4. Roof surfaces have a slope of not less than one-fourth unit vertical in 12 units horizontal (21-percent slope). The finished roof does not have water accumulation areas.
5. Operable fenestration provides ventilation in each room. There shall be at least one window per face of the dwelling unit.
6. Bedrooms with exterior walls facing two different directions have operable fenestration on exterior walls facing two directions.
7. Interior doors to bedrooms are capable of being secured in the open position.
8. Ceiling fans are provided in at least one bedroom and in the largest space that is not used as a bedroom.

Reason: Very low income housing needs a path to both house people and fall under the code. Some of these units are being built "informally", with everyone knowing they are not even attempting compliance. It is better to give them a very low cost path to improving peoples housing. Housing which does not heat or cool is already saving considerable energy over the "mainland" style housing the code presumes.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
It is hard to judge the cost of having a code apply to housing that is not even attempting to comply with the code now. What is the cost of not having a building code?

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposal would create uncomfortable and inefficient conditions, there are aftermarket concerns, and this is not the appropriate for medium and high rise residential construction (Vote: 14-1).

Assembly Action: **None**

CE54-19 Part I

CE55-19

IECC C401.3(New)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Add new text as follows:

C401.3 Thermal envelope certificate (Mandatory). A permanent thermal envelope certificate shall be completed by an *approved* party. Such certificate shall be posted on a wall in the space where the space conditioning equipment is located, a utility room or other *approved* location. If located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. A copy of the certificate shall also be included in the construction files for the project. The certificate shall include:

1. R-values of insulation installed in or on ceilings, roofs, walls, foundations and slabs, *basement walls*, crawl space walls and floors and ducts outside *conditioned spaces*;
2. U-factors and *solar heat gain coefficients* (SHGC) of fenestration;
3. Results from any *building* envelope air leakage testing performed on the *building*

Where there is more than one value for any component of the building envelope, the certificate shall indicate the area-weighted average value where available. If the area-weighted average is not available, the certificate shall list each value that applies to 10% or more of the total component area.

Reason: The purpose of this code change proposal is to add a permanent certificate to commercial buildings that will record basic information related to the building thermal envelope. This is similar to the requirement for residential buildings in Section R401.3, which has been in the IECC since at least the 2006 edition and has been successfully integrated into software programs such as REScheck. A significant percentage of commercial buildings will undergo system commissioning under Section C408, which will include documentation of mechanical and lighting systems. However, there is no similar requirement or documentation for the building's thermal envelope components. We acknowledge that the commercial provisions of the IECC are intended to cover an extremely broad range of commercial buildings, so the certificate requirement has been simplified to cover only the basic elements of the thermal envelope.
The information contained in this certificate will be readily available at construction, but as the building ages and ownership is transferred, some of this critical information could be lost. As future owners or lessors undertake load calculations for HVAC sizing or other measures that require a working knowledge of the building's thermal envelope characteristics, this information will be important. Recording the information in a permanent manner in an approved location at the building, as well as including documentation in the construction files for the project would not be overly burdensome but would provide valuable information to future building owners.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The information required to be included in the thermal envelope certificate will be readily available at construction and can be easily integrated into compliance software. This same information could be difficult to obtain several years down the road and recording it at construction will save future owners and lessors of a commercial building both time and money.

CE55-19

Public Hearing Results

Committee Action: As Submitted

Committee Reason: This is a good direction to go, it gives future designers direction on the envelope when spaces change out occurs (Vote: 15-0).

Assembly Action: None

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

CE55-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Craig Conner, representing self (craig.conner@mac.com)

requests Disapprove

Commenter's Reason: Why must it be completed by a third party?
Located in room with "conditioning equipment", "utility room", and maybe "an electrical panel"? Is this a game of “Where's Waldo"? How many locations could this be in a large building?

If there are different values this specifies an "area weighted average”. A replacement product is seldom going to be the average of all products in a building.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
There could a some cost to gather the information. Presumably the required third part will want to be paid.

Public Comment# 2109

CE56-19

IECC®: 202, 202, 202 (New), C402.1.1, 402.1.1.1 (New), TABLE C402.1.1.1 (New)

Proposed Change as Submitted

Proponents: Nicholas O'Neil, NW Energy Codes Group, representing NW Energy Codes Group (noneil@energy350.com)

2018 International Energy Conservation Code

FENESTRATION. Products classified as either skylights or vertical fenestration.

Skylights Glass or other transparent or translucent glazing material installed at a slope of less than 60 degrees (1.05 rad) from horizontal, including unit skylights, tubular daylighting devices and glazing materials in solariums, sunrooms, roofs , *greenhouses* , and sloped walls.

Vertical fenestration Windows that are fixed or operable, opaque doors, glazed doors, glazed block and combination opaque and glazed doors composed of glass or other transparent or translucent glazing materials and installed at a slope of not less than 60 degrees (1.05 rad) from horizontal.

Revise as follows:

GREENHOUSE. A structure or a thermally isolated area of a building that maintains a specialized sunlit environment exclusively used for, and essential to, the cultivation, protection or maintenance of plants. *Greenhouses* are those that are erected for a period of 180 days or more.

Add new definition as follows:

INTERNAL CURTAIN SYSTEM. An *internal curtain system* consists of moveable panels of fabric or plastic film used to cover and uncover the space enclosed in a *greenhouse* on a daily basis.

Revise as follows:

C402.1.1 Low-energy buildings and greenhouses. The following low-energy buildings, or portions thereof separated from the remainder of the building by *building thermal envelope* assemblies complying with this section, shall be exempt from the *building thermal envelope* provisions of Section C402.

1. Those with a peak design rate of energy usage less than 3.4 Btu/h • ft^2 (10.7 W/m^2) or 1.0 watt per square foot (10.7 W/m^2) of floor area for space conditioning purposes.
2. Those that do not contain *conditioned space*.
3. ~~Greenhouses.~~

Add new text as follows:

402.1.1.1 Greenhouses *Greenhouse* structures or areas that are mechanically heated or cooled and that comply with all of the following shall be exempt from the building envelope requirements of this code:

1.Exterior opaque envelope assemblies comply with Sections C402.2 and C402.4.5.

Exception: Low energy *greenhouses* that comply with Section C402.1.1.

2.Interior partition *building thermal envelope* assemblies that separate the *greenhouse* from conditioned space comply with Sections C402.2, C402.4.3 and C402.4.5.
3.Fenestration assemblies that comply with the thermal envelope requirements in Table C402.1.1.1. The U-factor for a roof shall be for the roof assembly or a roof that includes the assembly and an *internal curtain system.*

Exception: Unconditioned *greenhouses.*

TABLE C402.1.1.1
FENESTRATION THERMAL ENVELOPE MAXIMUM REQUIREMENTS

Component	U-factor (BTU/h-ft2-°F)
Skylight	0.5
Vertical fenestration	0.7

Reason: Greenhouses are currently exempt from the energy code through the low-energy building path even though they can use substantial amounts of energy. This proposal places commonplace envelope requirements on the structure when it is being mechanically heated or cooled. Low-energy use greenhouses structures are still exempt if they have a low energy usage per square foot in line with C402.1.1.

Cost Impact: The code change proposal will increase the cost of construction
Costs of $1.27/sqft are based on a one-time installation cost of double IR poly-film at $0.10/sqft and a thermal curtain at $1.17/sqft. These costs are based on product offerings and utility rebate program findings. Total size of greenhouse assumed to be an average size single bay with dimensions of 35 feet wide, 100 feet long, 4-foot sidewalls and 14-foot total ceiling height.

CE56-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Encourage the proponent to bring it back in public comment with corrected formatting, issues include using italics in the definition, putting the 180 day requirement in the definition, the definition of internal curtain system, and there is some disconnected code language (Vote: 12-3).

Assembly Action: **None**

CE56-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C402.1.1, 402.1.1.1 (New)

Proponents:
Nicholas O'Neil, representing Energy 350 (noneil@energy350.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C402.1.1 Low-energy buildings. The following low-energy buildings, or portions thereof separated from the remainder of the building by *building thermal envelope* assemblies complying with this section, shall be exempt from the *building thermal envelope* provisions of Section C402.

1. Those with a peak design rate of energy usage less than 3.4 Btu/h • ft^2 (10.7 W/m^2) or 1.0 watt per square foot (10.7 W/m^2) of floor area for space conditioning purposes.
2. Those that do not contain *conditioned space*.
3. Greenhouses that are not expected to operate more than 3 months per year and are not mechanically heated.

402.1.1.1 Greenhouses *Greenhouse* structures or areas that ~~are mechanically heated or cooled and that~~ comply with ~~all of~~ the following shall be exempt from the building envelope requirements of this code:

1. <u>All non-opaque *building thermal envelope* assemblies have an average U-factor less than or equal to 0.7 BTU/hr-ft2-ºF.</u>~~Exterior opaque envelope assemblies comply with Sections C402.2 and C402.4.5.~~

   ~~**Exception:** Low energy *greenhouses* that comply with Section C402.1.1.~~

   ~~2.Interior partition *building thermal envelope* assemblies that separate the *greenhouse* from conditioned space comply with Sections C402.2, C402.4.3 and C402.4.5.~~

   ~~3.Fenestration assemblies that comply with the thermal envelope requirements in Table C402.1.1.1. The U-factor for a roof shall be for the roof assembly or a roof that includes the assembly and an *internal curtain system.*~~

   ~~**Exception:** Unconditioned *greenhouses.*~~

Commenter's Reason: To address public comment, language has been substantially revised and clarified to remove duplicate information. The requirements set forth in this proposal would impact only greenhouses that use mechanical heating for a large part of the year. This proposal is not intended to impact small greenhouse facilities or part year operations.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The non-opaque assembly U-factor is based on readily available materials in the market. Costs of $1.27/sqft were based on a one-time installation cost of double IR poly-film at $0.10/sqft and a thermal curtain at $1.17/sqft. These costs are based on product offerings and utility rebate program findings. Greenhouses can meet the minimum non-opque thermal provisions specified in here without a thermal curtain and double-wall poly film, making payback less than 2 years. Total size of greenhouse assumed to be an average size single bay with dimensions of 35 feet wide, 100 feet long, 4-foot sidewalls and 14-foot total ceiling height.

Public Comment# 2156

Public Comment 2:

Proponents:
Matthew Stuppy, Stuppy, Inc., representing National Greenhouse Manufacturing Association (mjstuppy@stuppy.com)

requests Disapprove

Commenter's Reason: CE56 should remain disapproved. The proposal has many issues that require an extensive re-write rather than a public comment.
Some of the issues include:

1. Lumping greenhouses in with skylights and sunrooms. A greenhouse has a stand-alone function of growing and maintaining plants. A greenhouse is not an accessory to a building.

2. Removing greenhouses from C402.1.1 and moving it into the title of the section. This undoes the work in previous code revisions to acknowledge that greenhouses have a primary function of growing plants and that energy in a greenhouse is used for plant production, not simply conditioning space.

3. There are no considerations for crop type, seasonal production, and geographic location.

4. There is no consideration for the size of the greenhouse operation, which affects cost efficiencies and implementation of energy screens.

The benefits of a greenhouse included reduced water consumption, use of solar energy for growing plants, and the ability to efficiently produce fruits, vegetables and flowers year-round. Greenhouse businesses, like all manufacturing and production business require energy inputs. The primary energy input is the Sun and greenhouses require specialized glazing in order to maximize the Sun's benefits. Regulating greenhouses on their primary production function is analogous to regulating an automotive manufacturers assembly line, or a baking company's ovens.

Included for reference is a brochure published by the NGMA to promote energy savings. The NGMA welcomes working with other groups in the next code cycle to enhance energy saving techniques used for greenhouses.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

No Change to code text.

The original proposal's cost impact analysis is understated.

The cost of double IR poly-film would be closer to $0.20 for the materials. Those materials would need to be replaced every three to five years. Typical installation costs vary between 100% and 150% of the material costs. Additionally, an inflation fan is required to run twenty-four hours a day. Growers in colder climates have already adopted double poly as a standard practice. Under this proposal some growers who have seasonal production with a short heating period would be forced to adopt these glazing changes without a payback on their investment.

The cost of a retractable heat retention system is understated. Materials for the 35 ft x 100 ft long structure example would be closer to $2.80 per square foot plus taxes and shipping costs. Labor would be an additional $1.50 to $3.20 per square foot. Besides the energy curtain, control systems would have to be installed or modified at an additional expense. There are also annual maintenance costs associated with the systems. While these systems do provide heat retention in the winter months, they would have limited to no payback for growers who do not grow year-round.

Public Comment# 1568

CE57-19

IECC C402.1.1

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Revise as follows:

C402.1.1 Low-energy buildings. The following low-energy buildings, or portions thereof separated from the remainder of the building by *building thermal envelope* assemblies complying with this section, shall be exempt from the *building thermal envelope* provisions of Section C402.

1. Those with a peak design rate of energy usage less than 3.4 Btu/h • ft^2 (10.7 W/m^2) or 1.0 watt per square foot (10.7 W/m^2) of floor area for space conditioning purposes.
2. Those that do not contain *conditioned space*.
3. Greenhouses.
4. Buildings with a floor area not greater than 1,100 square feet (102.2 square meters) in size and solely used to house electric distribution system equipment.

Reason: These buildings are used to house electric distribution equipment, not people. They are equipment sheds or equipment vaults. Any space conditioning installed is only meant to prevent damage to equipment due to extreme weather or storms. The amount of time that people work in these buildings (for maintenance or testing or repair) is minimal.
Based on feedback from EEI member companies, anywhere from 50% to 100% of utility vaults or enclosed switching stations or substations are not conditioned at all. For electric equipment buildings that are conditioned, the temperature settings are typically much higher in the summer (85 degrees F or higher) and much lower in the winter (60 degrees F or lower) than spaces that are meant for human comfort to be maintained on a regular basis.

Some of the electric equipment vaults being used by utilities are as large as 18 feet by 60 feet, or 1,080 square feet. The size limit of 1,100 square feet will ensure that the exemption is limited to these types of buildings.

Bibliography: Specifications for vaults from from different utilities can be found at the following web site links:
https://www.coned.com/-/media/files/coned/documents/es/specs/electricbluebook.pdf

https://www.smud.org/-/media/Documents/Business-Solutions-and-Rebates/PDFs/Customer-Built-Vaults.ashx?la=en&hash=ACE6D4512846A1FC65A8A37EEE224AC31C2791BF

https://www.nationalgridus.com/media/pronet/constr_esb754759.pdf

Cost Impact: The code change proposal will decrease the cost of construction
This proposal is adding an exemption to the envelope requirements of Section Chapter 4, and as a result, will decrease the cost of construction for these low energy buildings.

CE57-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This opens a new unnecessary loophole without analysis (Vote: 15-0).

Assembly Action: **None**

CE57-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C402.1.1 (New)

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C402.1.1 Low-energy buildings. The following low-energy buildings, or portions thereof separated from the remainder of the building by *building thermal envelope* assemblies complying with this section, shall be exempt from the *building thermal envelope* provisions of Section C402.

1. Those with a peak design rate of energy usage less than 3.4 Btu/h • ft^2 (10.7 W/m^2) or 1.0 watt per square foot (10.7 W/m^2) of floor area for space conditioning purposes.
2. Those that do not contain *conditioned space*.
3. Greenhouses.
4. Buildings owned by utilities with a floor area not greater than ~~1,100~~ 1,200 square feet (~~102.2~~ 110 square meters) in size and solely used to house electric or gas distribution system equipment.

Commenter's Reason: This language will be consistent with the language that was approved in CE-58. Also, in terms of energy usage in these buildings, they are located on the utility side of the meter, not on the customer side. So any energy consumed at these utility buildings will not be part of any baseline or proposed building design, since they are not part of the building energy consumption.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
These buildings are owned and constructed by utilities, even though they are located at the building site. The costs of construction for these buildings are taken care of by the utility, not the building owner.

Public Comment# 1289

Public Comment 2:

Proponents:
Charles Foster, representing EEI (cfoster20187@yahoo.com)

requests As Submitted

Commenter's Reason: These buildings are used to house electric distribution equipment, not people. They are equipment sheds or equipment vaults. Any space conditioning installed is only meant to prevent damage to equipment due to extreme weather or storms. The amount of time that people work in these buildings (for maintenance or testing or repair) is minimal.
Based on feedback from EEI member companies, anywhere from 50% to 100% of utility vaults or enclosed switching stations or substations are not conditioned at all. For electric equipment buildings that are conditioned, the temperature settings are typically much higher in the summer (85 degrees F or higher) and much lower in the winter (60 degrees F or lower) than spaces that are meant for human comfort to be maintained on a regular basis.

Some of the electric equipment vaults being used by utilities are as large as 18 feet by 60 feet, or 1,080 square feet. The size limit of 1,100 square feet will ensure that the exemption is limited to these types of buildings.

Bibliography: Specifications for vaults from different utilities can be found at the following web site links:
https://www.coned.com/-/media/files/coned/documents/es/specs/electricbluebook.pdf

https://www.smud.org/-/media/Documents/Business-Solutions-and-Rebates/PDFs/Customer-Built-Vaults.ashx?la=en&hash=ACE6D4512846A1FC65A8A37EEE224AC31C2791BF

https://www.nationalgridus.com/media/pronet/constr_esb754759.pdf

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This proposal is adding an exemption to the envelope requirements of Section Chapter 4, and as a result, will decrease the cost of construction for

these low energy buildings.

CE61-19

IECC®: TABLE C402.1.3, TABLE C402.1.4

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

(Portions of table not shown remain unchanged)

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD[a, i]

	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
CLIMATE ZONE	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**
Metal buildings[b]	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-25 + R-11 LS	~~R-25 + R-11 LS~~ R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	~~R-30 + R-11 LS~~ R-25 + R-11 + R-11 LS	~~R-30 + R-11 LS~~ R-25 + R-11 + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	~~R-38~~ R-49	~~R-38~~ R-49	~~R-38~~ R-49	R-49	R-49	R-49	~~R-49~~ R-60	~~R-49~~ R-60	~~R-49~~ R-60	~~R-49~~ R-60

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.
c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f² °F.
d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
e. "Mass floors" shall be in accordance with Section C402.2.3.
f. Steel floor joist systems shall be insulated to R-38.
g. "Mass walls" shall be in accordance with Section C402.2.2.
h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
i. Not applicable to garage doors. See Table C402.1.4.

(Portions of table not shown remain unchanged)

TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, *U*-FACTOR METHOD[a, b]

	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
CLIMATE ZONE	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**
Metal buildings	U- ~~0.044~~ U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.031	U- ~~0.031~~ U-0.029	U-0.029	U-0.029	~~U-0.029~~ U-0.026	~~U-0.029~~ U-0.026
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U- ~~0.027~~ U-0.021	U- ~~0.027~~ U-0.021	U- ~~0.027~~ U-0.021	U-0.021	U-0.021	U-0.021	U- ~~0.021~~ U-0.017	U- ~~0.021~~ U-0.017	U- ~~0.021~~ U-0.017	U- ~~0.021~~ U-0.017

For SI: 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
d. "Mass floors" shall be in accordance with Section C402.2.3.
e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
f. The first value is for perimeter insulation and the second value is for full slab insulation.
g. "Mass walls" shall be in accordance with Section C402.2.2.

Reason: The purpose of this code change proposal is to reduce energy costs for commercial building owners and improve long-term energy efficiency by adopting the more efficient and cost-effective opaque envelope requirements from ASHRAE Standard 90.1-2016 or the IECC for roofs. The building envelope typically remains the same for many years after construction and it is particularly important to capture as much cost-effective energy efficiency as possible at construction. After all, the intent of the IECC (C101.3) is to “regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.”
The commercial opaque envelope requirements of the IECC have not been comprehensively improved since the 2012 edition, even though ASHRAE has continued to make cost-effective improvements during that same period. This proposal leverages ASHRAE’s thorough energy savings and cost-effectiveness analyses to make improvements to the opaque envelope table where ASHRAE improves upon the IECC requirement, but without rolling back the IECC requirements where they meet or exceed the ASHRAE requirement.

We applied a consistent set of actions to each of the values in this table:

- Where ASHRAE Standard 90.1-2016 has a more efficient U-factor for an assembly, we propose adopting the ASHRAE U-factor.
- Where an improved U-factor is adopted, we incorporate an equivalent R-value based on Normative Appendix A of ASHRAE Standard 90.1-2016.

The resulting table provides moderate improvements in energy efficiency based on an established model energy code and corrects inconsistencies and errors in the current IECC prescriptive tables.

Cost Impact: The code change proposal will increase the cost of construction
The improved U-factors and R-values in Tables C402.1.3 and C402.1.4 will typically require the addition of more insulation or other efficiency improvements in the IECC’s performance-based compliance paths. However, each U-factor selected by ASHRAE for Standard 90.1 has gone through a rigorous energy-savings and cost-effectiveness analysis and consensus vetting from affected interests, so even in cases where construction costs are increased, the improvements will be achievable and cost-effective over the useful life of the product.

CE61-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Submitted**

Committee Reason: When we have cost effectiveness analysis for more efficient features we need to go with them (Vote: 14-1).

Assembly Action: **None**

CE61-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE C402.1.3, TABLE C402.1.4

Proponents:
Jonathan Humble, FAIA, NCARB, LEED AP-BD+C, representing American Iron and Steel Institute and the Metal Building Manufacturers Association (jhumble@steel.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD[a, i]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**
Metal buildings[b]	~~R-19 + R-11 LS~~ R-10+R-19FC	~~R-19 + R-11 LS~~ R-10+R-19FC	~~R-19 + R11 LS~~ R-10+R-19FC	~~R-19 + R-11 LS~~ R-10+R-19FC	~~R-19 + R-11 LS~~ R-10+R-19FC	~~R-19 + R-11LS~~ R-10+R-19FC	R-19 + R-11 LS or R-25+R-8LS	R-19 + R-11 LS or R-25+R-8LS	R-19 + R-11 LS or R-25+R-8LS	R-19 + R-11 LS or R-25+R-8LS	R-25 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-25 + R-11 + R-11 LS	R-25 + R-11 + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49	R-60	R-60	R-60	R-60

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.

ci = Continuous insulation, NR = No Requirement, LS = Liner System, FC = Filled Cavity with insulation perpendicular to purlins.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. "Mass floors" shall be in accordance with Section C402.2.3.

f. Steel floor joist systems shall be insulated to R-38.

g. "Mass walls" shall be in accordance with Section C402.2.2.

h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.

i. Not applicable to garage doors. See Table C402.1.4.

TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, *U*-FACTOR METHOD[a, b]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above roof deck	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings	~~U-0.035~~ U-0.041	~~U-0.035~~ U-0.41	~~U-0.035~~ U-0.041	~~U-0.035~~ U-0.041	~~U-0.035~~ U-0.041	~~U-0.035~~ U-0.041	~~U-0.035~~ U-0.037	~~U-0.035~~ U-0.037	~~U-0.035~~ U-0.037	~~U-0.035~~ U-0.037	U-0.031	U-0.029	U-0.029	U-0.029	U-0.026	U-0.026
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.017	U-0.017	U-0.017	U-0.017
Walls, above grade																
Mass[g]	U-0.151	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	U-0.061	U-0.061
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.039	U-0.052	U-0.039
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.052	U-0.064	U-0.045
Wood framed and other[c]	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.036	U-0.036
Walls, below grade																
Below-grade wall[c]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.092	C-0.092	C-0.092	C-0.092
Floors																
Mass[d]	U-0.322[e]	U-0.322[e]	U-0.107	U-0.087	U-0.076	U-0.076	U-0.076	U-0.074	U-0.074	U-0.064	U-0.064	U-0.064	U-0.055	U-0.051	U-0.055	U-0.051
Joist/framing	U-0.066[e]	U-0.066[e]	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033
Slab-on-grade floors																
Unheated slabs	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.54	F-0.54	F-0.54	F-0.54	F-0.54	F-0.52	F-0.40	F-0.40	F-0.40	F-0.40
Heated slabs[f]	F-1.02 0.74	F-1.02 0.74	F-1.02 0.74	F-1.02 0.74	F-0.90 0.74	F-0.90 0.74	F-0.86 0.64	F-0.86 0.64	F-0.79 0.64	F-0.79 0.64	F-0.79 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55
Opaque doors																
Swinging door	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Garage door <14% glazing	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31

For SI: 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.

b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.

c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.

d. “Mass floors” shall be in accordance with Section C402.2.3.

e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.

f. The first value is for perimeter insulation and the second value is for full slab insulation.

g. “Mass walls” shall be in accordance with Section C402.2.2.

Commenter's Reason: The proposed modification brings the remaining U-factors and R-values from ASHRAE Standard 90.1 which that were not included in the original code change proposal.
The reason for this public comment is based on the testimony of the proponents and supporters of the original code change proposal which used the ASHRAE Standard 90.1 methodology as a basis for substantiation. Their statement was that the proposal leveraged “…ASHRAE’s thorough energy savings and cost-effectiveness analysis…” to support the need to bring over the values.

Since that Standard 90.1 methodology they describe applies the all the R-values and U-factors contained in Standard 90.1 opaque envelope tables it appropriate then to bring over “all” the values since they “all” represent energy efficient and cost effective opaque envelope requirements.

A footnote was also added to address the new acronym "FC".

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The public comment is in line with the original proposal which has updated the opaque envelope requirements and therefore because of those modifications will increase the cost of construction.

Public Comment# 1970

Public Comment 2:

IECC®: TABLE C402.1.3, TABLE C402.1.4

Proponents:
Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD[a, i]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**
Metal buildings[b]	~~R-19 + R-11 LS~~ R-10 + R-19 FC	~~R-19 + R-11 LS~~ R-10 + R-19 FC	~~R-19 + R11 LS~~ R-10 + R-19 FC	~~R-19 + R-11 LS~~ R-10 + R-19 FC	~~R-19 + R-11 LS~~ R-10 + R-19 FC	~~R-19 + R-11 LS~~ R-10 + R-19 FC	R-19 + R-11 LS or R-25 + R-8 LS	R-19 + R-11 LS or R-25 + R-8 LS	R-19 + R-11 LS or R-25 + R-8 LS	R-19 + R-11 LS or R-25 + R-8 LS	R-25 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-25 + R-11 + R-11 LS	R-25 + R-11 + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49	R-60	R-60	R-60	R-60

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. "Mass floors" shall be in accordance with Section C402.2.3.

f. Steel floor joist systems shall be insulated to R-38.

g. "Mass walls" shall be in accordance with Section C402.2.2.

h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.

i. Not applicable to garage doors. See Table C402.1.4.

TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, *U*-FACTOR METHOD[a, b]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above roof deck	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings	~~U-0.035~~ U-0.041	~~U-0.035~~ U-0.041	~~U-0.035~~ U-0.041	~~U-0.035~~ U-0.041	~~U-0.035~~ U-0.041	~~U-0.035~~ U-0.041	~~U-0.035~~ U-0.037	~~U-0.035~~ U-0.037	~~U-0.035~~ U-0.037	~~U-0.035~~ U-0.037	U-0.031	U-0.029	U-0.029	U-0.029	U-0.026	U-0.026
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.017	U-0.017	U-0.017	U-0.017
Walls, above grade																
Mass[g]	U-0.151	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	U-0.061	U-0.061
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.039	U-0.052	U-0.039
Metal framed	~~U-0.077~~ U-0.124	~~U-0.077~~ U-0.124	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.052	U-0.064	U-0.045
Wood framed and other[c]	~~U-0.064~~ U-0.089	~~U-0.064~~ U-0.089	~~U-0.064~~ U-0.089	~~U-0.064~~ U-0.089	~~U-0.064~~ U-0.089	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.036	U-0.036
Walls, below grade																
Below-grade wall[c]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.092	C-0.092	C-0.092	C-0.092
Floors																
Mass[d]	U-0.322[e]	U-0.322[e]	U-0.107	U-0.087	U-0.076	U-0.076	U-0.076	U-0.074	U-0.074	U-0.064	U-0.064	U-0.064	U-0.055	U-0.051	U-0.055	U-0.051
Joist/framing	U-0.066[e]	U-0.066[e]	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033
Slab-on-grade floors																
Unheated slabs	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.54	F-0.54	F-0.54	F-0.54	F-0.54	F-0.52	F-0.40	F-0.40	F-0.40	F-0.40
Heated slabs[f]	F-1.02 0.74	F-1.02 0.74	F-1.02 0.74	F-1.02 0.74	F-0.90 0.74	F-0.90 0.74	F-0.86 0.64	F-0.86 0.64	F-0.79 0.64	F-0.79 0.64	F-0.79 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55
Opaque doors																
Swinging door	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Garage door <14% glazing	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31

For SI: 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.

b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.

c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.

d. “Mass floors” shall be in accordance with Section C402.2.3.

e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.

f. The first value is for perimeter insulation and the second value is for full slab insulation.

g. “Mass walls” shall be in accordance with Section C402.2.2.

Commenter's Reason: The proposal as submitted cherry picked and only included changes from ASHRAE 90.1-16 that improved energy efficiency without taking into consideration the the changes in ASHRAE 90.1-16 that where also considered cost effective but somewhat lowered energy efficiency. In doing so the proposal as approved does not make IECC cost effective. The changes in ASRHAE 90.1-16 did in some cases lower insulation levels from previous editions of ASHRAE 90.1-16 based updated cost data that determined some requirements in previous editions of ASHRAE 90.1-16 were indeed not cost effective. Approval of this public comment will align IECC with the current requirements in ASHRAE 90.1 which are considered cost effective.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The proposal reduces the cost of construction by aligning the values with ASHRAE 90.1 that are less the the current values in the IECC and considered by ASHRAE to be the maximum based on the ASHRAE cost effective analysis.

Public Comment# 1162

Public Comment 3:

Proponents:
Jonathan Humble, FAIA, NCARB, LEED BD+C, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org)

requests Disapprove

Commenter's Reason: This public comment covers CE61-19, CE63-19, CE64-19, CE66-19, CE68-19 and CE69-19.
We recommend disapproval for the following reasons.

The values proposed only represent those ASRHAE Standard 90.1 values that were more stringent that the current IECC (Which represents 1/3rd of the total number of IECC table cells in both tables). When reviewing the taped testimony we found that the supporters conspicuously avoided responding directly to questions raised asking why the other values not chosen from ASRHAE Standard 90.1 were not appropriate.

The proponents stated that this proposal represents “a positive life cycle savings for the life of the building”, even though no cost analysis substantiating the proposal was cited in the reason statement.

The supporters testified they had an analysis that substantiated their proposal, however no such analysis was cited in the reason statement nor was there evidence that it was made available to the general public at the hearing.

Supporters cited the proposal represented the “best value”, however the reason statement does not substantiate what constitutes a best value.

The supporters talked of errors that they had corrected, however the reason statement fails to cite what those errors were, why the ICC membership was wrong in approving the errors at previous hearings, and if they were errors why the proponents did not submit a request to change the errors to ICC staff.

In view of the above contradictions and short falls, we recommend that these proposals be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

CE63-19

IECC®: TABLE C402.1.3, TABLE C402.1.4

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

(Portions of table not shown remain unchanged)

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD[a, i]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Walls, above grade																
Mass[g]	R-5.7ci[c]	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building	R-13+ R-6.5ci	R-13 + R-6.5ci	R13 + R-6.5ci	R-13 + R-13ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-13ci	~~R-13 + R-13ci~~ R-13 + R-14ci	~~R-13 + R-13ci~~ R-13 + R-14ci	~~R-13 + R-13ci~~ R-13 + R-14ci	~~R-13 + R-13ci~~ R-13 + R-14ci	~~R-13 + R-13ci~~ R-13 + R-14ci	~~R-13 + R-13ci~~ R-13 + R-17ci	R-13+ R-19.5ci	~~R-13 + R-13ci~~ R-13 + R-19.5ci	R-13+ R-19.5ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	~~R-13 + R-7.5ci~~ R-13 + R-10ci	~~R-13 + R-7.5ci~~ R-13 + R-10ci	~~R-13 + R-7.5ci~~ R-13 + R-12.5ci	~~R-13 + R-7.5ci~~ R-13 + R-12.5ci	~~R-13 + R-7.5ci~~ R-13 + R-12.5ci	R-13 + R-15.6ci	~~R-13 + R-7.5ci~~ R-13 + R-18.8ci	~~R-13+ R17.5ci~~ R-13 + R-18.8ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	~~R-13 + R-3.8ci or R-20~~ R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	~~R13 + R-15.6ci or R-20 + R-10ci~~ R-13 + R-18.8ci	~~R13 + R-15.6ci or R-20 + R-10ci~~ R-13 + R-18.8ci

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.
c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.
d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
e. "Mass floors" shall be in accordance with Section C402.2.3.

f. Steel floor joist systems shall be insulated to R-38.
g. "Mass walls" shall be in accordance with Section C402.2.2.
h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
i. Not applicable to garage doors. See Table C402.1.4.

(Portions of table not shown remain unchanged)

TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, *U*-FACTOR METHOD[a, b]

	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
CLIMATE ZONE	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**
Walls, above grade																
Mass[g]	U-0.151	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	~~U-0.061~~ U-0.037	~~U-0.061~~ U-0.037
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	~~U-0.052~~ U-0.050	~~U-0.052~~ U-0.050	~~U-0.052~~ U-0.050	U-0.052 U-0.050	~~U-0.052~~ U-0.050	~~U-0.052~~ U-0.044	U-0.039	~~U-0.052~~ U-0.039	U-0.039
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	~~U-0.064~~ U-0.055	~~U-0.064~~ U-0.055	~~U-0.064~~ U-0.049	~~U-0.064~~ U-0.049	~~U-0.064~~ U-0.049	~~U-0.052~~ U-0.042	~~U-0.064~~ U-0.037	~~U-0.045~~ U-0.037
Wood framed and other[c]	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	~~U-0.064~~ U-0.051	~~U-0.064~~ U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	~~U-0.036~~ U-0.032	~~U-0.036~~ U-0.032

For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
d. "Mass floors" shall be in accordance with Section C402.2.3.
e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
f. The first value is for perimeter insulation and the second value is for full slab insulation.

g. “Mass walls” shall be in accordance with Section C402.2.2.

Reason: The purpose of this code change proposal is to reduce energy costs for commercial building owners and improve long-term energy efficiency by adopting the more efficient and cost-effective opaque envelope requirements from either ASHRAE Standard 90.1-2016 or the IECC for above-grade walls. The building envelope typically remains the same for many years after construction and it is particularly important to capture as much cost-effective energy efficiency as possible at construction. After all, the intent of the IECC (C101.3) is to “regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.”
The commercial opaque envelope requirements of the IECC have not been comprehensively improved since the 2012 edition, even though ASHRAE has continued to make cost-effective improvements during that same period. This proposal leverages ASHRAE’s thorough energy savings and cost-effectiveness analyses to make improvements to the opaque envelope table where ASHRAE improves upon the IECC requirement, but without rolling back the IECC requirements where they meet or exceed the ASHRAE requirement.

We applied a consistent set of actions to each of the values in this table:

- Where we discovered clear errors or inconsistencies between the U-factor and R-value table, we corrected them.
- Where ASHRAE Standard 90.1-2016 has a more efficient U-factor for an assembly, we propose adopting the ASHRAE U-factor.
- Where an improved U-factor is adopted, we incorporate an equivalent R-value based on Normative Appendix A of ASHRAE Standard 90.1-2016.

The resulting table provides moderate improvements in energy efficiency based on an established model energy code and corrects inconsistencies and errors in the current IECC prescriptive tables.

Cost Impact: The code change proposal will increase the cost of construction
The improved U-factors and R-values in Tables C402.1.3 and C402.1.4 will typically require the addition of more insulation or other efficiency improvements in the IECC’s performance-based compliance paths. However, each U-factor selected by ASHRAE for Standard 90.1 has gone through a rigorous energy-savings and cost-effectiveness analysis and consensus vetting from affected interests, so even in cases where construction costs are increased, the improvements will be achievable and cost-effective over the useful life of the product.

CE63-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Submitted**

Committee Reason: These are cost effective values that have gone through rigorous review (Vote: 13-2).

Assembly Action: **None**

CE63-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE C402.1.3, TABLE C402.1.4

Proponents:
Jonathan Humble, FAIA, NCARB, LEED AP-BD+C, American Iron and Steel Institute, representing American Iron and Steel Institute and the Metal Building Manufacturers Association (Jhumble@steel.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD[a, i]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**
Walls, above grade																
Mass[g]	R-5.7ci[c]	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building	~~R-13+ R-6.5ci~~ R-0+R-9.8ci	~~R-13 + R-6.5ci~~ R-0+R-9.8ci	~~R13 + R-6.5ci~~ R-0+R-9.8ci	~~R-13 + R-13ci~~ R-0+R-9.8ci	~~R-13 + R-6.5ci~~ R-0+9.8ci	~~R-13 + R-13ci~~ R-0+R-13ci	~~R-13 + R-13ci~~ R-0+R-15.8ci	~~R-13 + R-14ci~~ R-0+R-19ci	~~R-13 + R-14ci~~ R-0+R-19ci	~~R-13 + R-14ci~~ R-0+R-19ci	~~R-13 + R-14ci~~ R-0+R-19ci	~~R-13 + R-14ci~~ R-0+R-19ci	~~R-13 + R-17ci~~ R-0+R-22.1ci	~~R-13+ R-19.5ci~~ R-0+R-22.1ci	~~R-13 + R-19.5ci~~ R-0+R-25ci	R-13+ R-19.5ci R-0+R-25ci
Metal framed	R-13 ~~+ R-5ci~~	R-13 ~~+ R-5ci~~	~~R-13 + R-5ci~~ R-13+R-3.8ci	~~R-13 + R-7.5ci~~ R-13+R-7.5ci	~~R-13 + R-7.5ci~~ R-13+R-5ci	~~R-13 + R-7.5ci~~ R-13+7.5ci	~~R-13+R13ci~~ R-13+R-17.5ci	R-13 + R-7.5ci	R-13 + R-10ci	R-13 + R-10ci	R-13 + R-12.5ci	R-13 + R-12.5ci	R-13 + R-12.5ci	R-13 + R-15.6ci	R-13 + R-18.8ci	R-13 + R-18.8ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-18.8ci	R-13 + R-18.8ci

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. “Mass floors” shall be in accordance with Section C402.2.3.

f. Steel floor joist systems shall be insulated to R-38.

g. “Mass walls” shall be in accordance with Section C402.2.2.

h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.

i. Not applicable to garage doors. See Table C402.1.4.

TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, *U*-FACTOR METHOD[a, b]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Walls, above grade																
Mass[g]	U-0.151	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	U-0.037	U-0.037
Metal building	~~U-0.079~~ U-0.094	~~U-0.079~~ U-0.094	~~U-0.079~~ U-0.094	~~U-0.079~~ U-0.094	~~U-0.079~~ U-0.094	~~U-0.052~~ U-0.072	~~U-0.052~~ U-0.060	U-0.050	U-0.050	U-0.050	U-0.050	U-0.050	U-0.044	~~U-0.039~~ U-0.044	U-0.039	U-0.039
Metal framed	~~U-0.077~~ U-0.124	~~U-0.077~~ U-0.124	~~U-0.077~~ U-0.084	U-0.064	~~U-0.064~~ U-0.077	U-0.064	U-0.064	U-0.064	U-0.055	U-0.055	U-0.049	U-0.049	U-0.049	U-0.042	U-0.037	U-0.037
Wood framed and other[c]	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.032	U-0.032

For SI: 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.

b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.

c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.

d. “Mass floors” shall be in accordance with Section C402.2.3.

e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.

f. The first value is for perimeter insulation and the second value is for full slab insulation.

g. “Mass walls” shall be in accordance with Section C402.2.2.

Commenter's Reason: The proposed modification brings the remaining U-factors and R-values from ASHRAE Standard 90.1 which that were not included in the original code change proposal.
The reason for this public comment is based on the testimony of the proponents and supporters of the original code change proposal which used the ASHRAE Standard 90.1 methodology as a basis for substantiation. Their statement was that the proposal leveraged “…ASHRAE’s thorough energy savings and cost-effectiveness analysis…” to support the need to bring over the values.

Since that Standard 90.1 methodology they describe applies the all the R-values and U-factors contained in Standard 90.1 opaque envelope tables it appropriate then to bring over “all” the values since they “all” represent energy efficient and cost effective opaque envelope requirements.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The public comment is in line with the original proposal which has updated the opaque envelope requirements and therefore because of those modifications will increase the cost of construction.

Public Comment 2:

IECC®: TABLE C402.1.3, TABLE C402.1.4

Proponents:
Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD[a, i]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Walls, above grade																
Mass[g]	~~R-5.7ci[e]~~ NR	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	~~R-25ci~~ R-19ci	~~R-25ci~~ R-19ci
Metal building	~~R-13+ R-6.5ci~~ R-0 + 9.8ci	~~R-13+ R-6.5ci~~ R-0 + 9.8ci	~~R-13+ R-6.5ci~~ R-0 + 9.8ci	~~R-13+ R-6.5ci~~ R-0 + 9.8ci	~~R-13+ R-6.5ci~~ R-0 + 9.8ci	~~R-13 + R-13ci~~ R-0 + R-13ci	~~R-13 + R-13ci~~ R-0 + R-15.8ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-17ci	~~R-13+ R-19.5ci~~ R-13+17ci	R-13 + R-19.5ci	R-13+ R-19.5ci
Metal framed	R-13 ~~+ R-5ci~~	R-13 ~~+ R-5ci~~	~~R-13 + R-5ci~~ R13 + R-3.8ci	R-13 + R-7.5ci	~~R-13 + R-7.5ci~~ R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-10ci	R-13 + R-10ci	R-13 + R-12.5ci	R-13 + R-12.5ci	R-13 + R-12.5ci	R-13 + R-15.6ci	R-13 + R-18.8ci	R-13 + R-18.8ci
Wood framed and other	R-13 ~~+ R-3.8ci or R-20~~	R-13 ~~+ R-3.8ci or R-20~~	R-13 ~~+ R-3.8ci or R-20~~	R-13 ~~+ R-3.8ci or R-20~~	R-13 ~~+ R-3.8ci or R-20~~	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R-20 + R-3.8ci or R-19 + R-5ci	R-13 + R-7.5ci or R-20 + R-3.8ci or R-19 + R-5ci	R-13 + R-7.5ci or R-20 + R-3.8ci or R-19 + R-5ci	R-13 + R-7.5ci or R-20 + R-3.8ci or R-19 + R-5ci	R-13 + R-7.5ci or R-20 + R-3.8ci or R-19 + R-5ci	R-13 + R-7.5ci or R-20 + R-3.8ci or R-19 + R-5ci	R-13 + R-18.8ci	R-13 + R-18.8ci

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. “Mass floors” shall be in accordance with Section C402.2.3.

f. Steel floor joist systems shall be insulated to R-38.

g. “Mass walls” shall be in accordance with Section C402.2.2.

h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.

i. Not applicable to garage doors. See Table C402.1.4.

TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, *U*-FACTOR METHOD[a, b]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**
Walls, above grade																
Mass[g]	~~U-0.151~~ U-0.580	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	~~U-0.037~~ U-0.048	~~U-0.037~~ U-0.048
Metal building	~~U-0.079~~ U-0.094	~~U-0.079~~ U-0.094	~~U-0.079~~ U-0.094	~~U-0.079~~ U-0.094	~~U-0.079~~ U-0.094	~~U-0.052~~ U-0.072	~~U-0.052~~ U-0.080	U-0.050	U-0.050	U-0.050	U-0.050	U-0.050	U-0.044	~~U-0.039~~ U-0.044	U-0.039	U-0.039
Metal framed	~~U-0.077~~ U-0.124	~~U-0.077~~ U-0.124	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.055	U-0.055	U-0.049	U-0.049	U-0.049	U-0.042	U-0.037	U-0.037
Wood framed and other[c]	~~U-0.064~~ U-0.089	~~U-0.064~~ U-0.089	~~U-0.064~~ U-0.089	~~U-0.064~~ U-0.089	~~U-0.064~~ U-0.089	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.032	U-0.032

For SI: 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
d. "Mass floors" shall be in accordance with Section C402.2.3.
e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
f. The first value is for perimeter insulation and the second value is for full slab insulation.
g. "Mass walls" shall be in accordance with Section C402.2.2.

Commenter's Reason: The proposal as submitted cherry picked and only included changes from ASHRAE 90.1-16 that improved energy efficiency without taking into consideration the changes in ASHRAE 90.1-16 that where also considered cost effective but somewhat lowered energy efficiency. In doing so the proposed as approved does not make IECC cost effective. The changes in ASHRAE 90.1-16 did in some cases lower insulation levels from previous editions of ASHRAE 90.1 based on updated cost data that determined some requirements in previous editions of ASHRAE 90.1 were indeed not cost effective. Approval of this public comment will align IECC with the current requirements in ASHRAE 90.1 which are considered cost effective.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
Minor changes in the insulation levels decreases the cost of construction but in doing so make the IECC cost effective.

Public Comment 3:

IECC®: TABLE C402.1.3, TABLE C402.1.4

Proponents:
Joel Martell, representing National Association of Home Builders (jmartell@nahb.org); Margo Thompson, representing National Multifamily Housing Council (mthompson@newportventures.net); Andrew Klein, representing Building Owners and Managers Association, International (andrew@asklein.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD[a, i]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Walls, above grade																
Mass[g]	~~R-5.7ci[e]~~ NR	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	~~R-25ci~~ R-19ci	~~R-25ci~~ R-19ci
Metal building	~~R-13+ R-6.5ci~~ R-0 + 9.8ci	~~R-13 + R-6.5ci~~ R-0 + 9.8ci	~~R13 + R-6.5ci~~ R-0 + 9.8ci	~~R-13 + R-13ci~~ R-0 + 9.8ci	~~R-13 + R-6.5ci~~ R-0 + 9.8ci	~~R-13 + R-13ci~~ R-0 + 13ci	~~R-13 + R-13c~~ R-0 + 15.8ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-17ci	~~R-13+ R-19.5ci~~ R-13 + 17ci	R-13 + R-19.5ci	R-13+ R-19.5ci
Metal framed	R-13 ~~+ R-5ci~~	R-13 ~~+ R-5ci~~	~~R-13 + R-5ci~~ R-13 + R-3.8ci	R-13 + R-7.5ci	~~R-13 + R-7.5ci~~ R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-10ci	R-13 + R-10ci	R-13 + R-12.5ci	R-13 + R-12.5ci	R-13 + R-12.5ci	R-13 + R-15.6ci	R-13 + R-18.8ci	R-13 + R-18.8ci
Wood framed and other	R-13 ~~+ R-3.8ci or R-20~~	R-13 ~~+ R-3.8ci or R-20~~	R-13 ~~+ R-3.8ci or R-20~~	R-13 ~~+ R-3.8ci or R-20~~	R-13 ~~+ R-3.8ci or R-20~~	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R-20 + R-3.8ci or R-19 + R-5ci	R-13 + R-7.5ci or R-20 + R-3.8ci or R-19 + R-5ci	R-13 + R-7.5ci or R-20 + R-3.8ci or R-19 + R-5ci	R-13 + R-7.5ci or R-20 + R-3.8ci or R-19 + R5ci	R-13 + R-7.5ci or R-20 + R-3.8ci or R-19 + R-5ci	R-13 + R-7.5ci or R-20 + R-3.8ci or R-19 + R-5ci	R-13 + R-18.8ci	R-13 + R-18.8ci

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. "Mass floors" shall be in accordance with Section C402.2.3.

f. Steel floor joist systems shall be insulated to R-38.

g. "Mass walls" shall be in accordance with Section C402.2.2.

h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.

i. Not applicable to garage doors. See Table C402.1.4.

TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, *U*-FACTOR METHOD[a, b]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Walls, above grade																
Mass[g]	~~U-0.151~~ U-0.580	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	~~U-0.037~~ U-0.048	~~U-0.037~~ U-0.048
Metal building	~~U-0.079~~ U-0.094	~~U-0.079~~ U-0.094	~~U-0.079~~ U 0.094	~~U-0.079~~ U-0.094	~~U-0.079~~ U-0.094	~~U-0.052~~ U-0.072	~~U-0.052~~ U-0.080	U-0.050	U-0.050	U-0.050	U-0.050	U-0.050	U-0.044	~~U-0.039~~ U-0.044	U-0.039	U-0.039
Metal framed	~~U-0.077~~ U-0.124	~~U-0.077~~ U-0.124	~~U-0.077~~ U-0.064	U-0.064	~~U-0.064~~ U-0.077	U-0.064	U-0.064	U-0.064	U-0.055	U-0.055	U-0.049	U-0.049	U-0.049	U-0.042	U-0.037	U-0.037
Wood framed and other[c]	~~U-0.064~~ U-0.089	~~U-0.064~~ U-0.089	~~U-0.064~~ U-0.089	~~U-0.064~~ U-0.089	~~U-0.064~~ U-0.089	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.032	U-0.032

For SI: 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.

b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.

c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.

d. “Mass floors” shall be in accordance with Section C402.2.3.

e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.

f. The first value is for perimeter insulation and the second value is for full slab insulation.

g. “Mass walls” shall be in accordance with Section C402.2.2.

Commenter's Reason: The proposal as submitted cherry picked the most stringent efficiency values from ASHRAE Standard 90.1-16 without taking into consideration the other values in the ASHRAE 90.1 tables which correlated all the values to make a cost-effective energy code according to ASHRAE cost effective methodology. When only picking the most stringent values, the code process is undermined as well as all the work that went into creating cost effective solutions to the building thermal envelope. The code change as approved does not make IECC cost effective. Approval of this public comment will align IECC with the current requirements in ASHRAE 90.1 for the whole table which is considered cost effective. Disapproving this public comment and approving the proposal as submitted only takes the most stringent values in 90.1 and makes the IECC not cost effective.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
The public comment coupled with the proposal will not effective the cost of construction. The proposal as written will increase the cost of construction because the proponents are taking the most stringent values from ASHRAE 90.1 and plugging them into the table. This would align all

the values of ASHRAE 90.1 which is proven to be cost effective.

Public Comment# 1659

Public Comment 4:

Proponents:
Jonathan Humble, FAIA, NCARB, LEED BD+C, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org)

requests Disapprove

Commenter's Reason: This public comment covers CE61-19, CE63-19, CE64-19, CE66-19, CE68-19 and CE69-19.
We recommend disapproval for the following reasons.

The values proposed only represent those ASRHAE Standard 90.1 values that were more stringent that the current IECC (Which represents 1/3rd of the total number of IECC table cells in both tables). When reviewing the taped testimony we found that the supporters conspicuously avoided responding directly to questions raised asking why the other values not chosen from ASRHAE Standard 90.1 were not appropriate.

The proponents stated that this proposal represents “a positive life cycle savings for the life of the building”, even though no cost analysis substantiating the proposal was cited in the reason statement.

The supporters testified they had an analysis that substantiated their proposal, however no such analysis was cited in the reason statement nor was there evidence that it was made available to the general public at the hearing.

Supporters cited the proposal represented the “best value”, however the reason statement does not substantiate what constitutes a best value.

The supporters talked of errors that they had corrected, however the reason statement fails to cite what those errors were, why the ICC membership was wrong in approving the errors at previous hearings, and if they were errors why the proponents did not submit a request to change the errors to ICC staff.

In view of the above contradictions and short falls, we recommend that these proposals be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1723

Public Comment 5:

Proponents:
Greg Johnson, representing Coalition for Fair Energy Codes (gjohnsonconsulting@gmail.com)

requests Disapprove

Commenter's Reason: CE63 cherry-picks values from ASHRAE 90.1 to require more insulation for some above-grade wall assemblies without providing any justification other than ‘ASHRAE did it first.’ This is problematic because:

· It makes the code less material neutral between framing systems in some climate zones; i.e. CZ 5 where current U-factors for metal and wood framed walls are identical but the change proposes different values for each material in that CZ. This violates the principle of the code (as stated in the preface) that the provisions should *“not give preferential treatment to particular types or classes of materials, products or methods of construction.”*

· It eliminates the prescriptive cavity only option for wood framed walls in CZ 5, replicating a problem the code currently has in CZ 6 and CZ 7 where state and local jurisdictions amend away the requirement for continuous insulation, leaving a prescriptive cavity requirement that is less stringent than readily available materials would dictate.

· It doesn’t provide the cost-effectiveness calculation for ICC member voting representatives to evaluate when considering whether the proposed change is merited. It does not identify how much energy is being saved and at what cost.

In the last cycle these proponents attempted a similar change (CE54-16). The hearing committee disapproved that proposal, giving this reason: "*A more specific cost effectiveness analysis is needed to justify the new numbers rather than a general analysis on 90.1 as a whole. The proposal imitates ASHRAE 90.1 where it is more stringent but does not imitate 90.1 where it is less stringent. The proposal does not align the IECC with 90.1. The proposal does not indicate how much energy is saved. Cost validation is needed.*" (http://media.iccsafe.org/codes/2015-2017/GroupB/CAH/2016-Report-CAH.pdf)

Just as with the current proposal, in PC2 to CE54-16 the proponents still did not provide the specific cost effectiveness analysis requested by the committee. This likely contributed to the 75% majority that voted to reject the proposal (https://www.iccsafe.org/wp-content/uploads/2016-GroupB-Final-Action-Results-OGCV.pdf)

Finally, the proponent notes that the envelope provisions of the IECC haven't advanced significantly since 2012. That is likely attributable to two factors: 1) Continued failure to document the cost effectiveness of proposed values. 2) The code is already at the point of diminishing returns with regard to the walls of opaque envelope; meaning the money is better spent on other energy improvements.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1845

CE64-19

IECC®: TABLE C402.1.3, TABLE C402.1.4

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

(Portions of table not shown remain unchanged)

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD[a, i]

	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
CLIMATE ZONE	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**
Walls, below grade																
Below-grade wall[d]	NR	NR	NR	NR	NR	NR	R-7.5ci	~~R-7.5ci~~ R-10ci	R-7.5ci	~~R-7.5ci~~ R-10ci	~~R-7.5ci~~ R-10ci	~~R-7.5ci~~ R-15ci	~~R-10ci~~ R-15ci	~~R-10ci~~ R-15ci	~~R-10ci~~ R-15ci	~~R-12.5ci~~ R-15ci

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.
c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.
d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
e. "Mass floors" shall be in accordance with Section C402.2.3.
f. Steel floor joist systems shall be insulated to R-38.
g. "Mass walls" shall be in accordance with Section C402.2.2.
h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
i. Not applicable to garage doors. See Table C402.1.4.

(Portions of table not shown remain unchanged)

TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, *U*-FACTOR METHOD[a, b]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**
Walls, below grade																
Below-grade wall[c]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-0.119	~~C-0.119~~ C-0.092	C-0.119	~~C-0.119~~ C-0.092	~~C-0.119~~ C-0.092	~~C-0.119~~ C-0.063	~~C-0.092~~ C-0.063	~~C-0.092~~ C-0.063	~~C-0.092~~ C-0.063	~~C-0.092~~ C-0.063

For SI: 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
d. "Mass floors" shall be in accordance with Section C402.2.3.
e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
f. The first value is for perimeter insulation and the second value is for full slab insulation.
g. "Mass walls" shall be in accordance with Section C402.2.2.

Reason: The purpose of this code change proposal is to reduce energy costs for commercial building owners and improve long-term energy efficiency by adopting the more efficient and cost-effective opaque envelope requirements from ASHRAE Standard 90.1-2016 or the IECC for below-grade walls. The building envelope typically remains the same for many years after construction and it is particularly important to capture as much cost-effective energy efficiency as possible at construction. After all, the intent of the IECC (C101.3) is to "regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building."
The commercial opaque envelope requirements of the IECC have not been comprehensively improved since the 2012 edition, even though ASHRAE has continued to make cost-effective improvements during that same period. This proposal leverages ASHRAE's thorough energy savings and cost-effectiveness analyses to make improvements to the opaque envelope table where ASHRAE improves upon the IECC requirement, but without rolling back the IECC requirements where they meet or exceed the ASHRAE requirement.

We applied a consistent set of actions to each of the values in this table:

- Where ASHRAE Standard 90.1-2016 has a more efficient U-factor for an assembly, we propose adopting the ASHRAE U-factor.
- Where an improved U-factor is adopted, we incorporate an equivalent R-value based on Normative Appendix A of ASHRAE Standard 90.1-2016.

The resulting table provides moderate improvements in energy efficiency based on an established model energy code and corrects inconsistencies and errors in the current IECC prescriptive tables.

Cost Impact: The code change proposal will increase the cost of construction
The improved U-factors and R-values in Tables C402.1.3 and C402.1.4 will typically require the addition of more insulation or other efficiency improvements in the IECC's performance-based compliance paths. However, each U-factor selected by ASHRAE for Standard 90.1 has gone through a rigorous energy-savings and cost-effectiveness analysis and consensus vetting from affected interests, so even in cases where construction costs are increased, the improvements will be achievable and cost-effective over the useful life of the product.

CE64-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Submitted**

Committee Reason: These are cost effective values that have gone through rigorous review. They have not been updated in several cycles (Vote: 14-1).

Assembly Action: **None**

CE64-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Jonathan Humble, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org)

requests Disapprove

Commenter's Reason: This public comment covers CE61-19, CE63-19, CE64-19, CE66-19, CE68-19 and CE69-19.
We recommend disapproval for the following reasons.

The values proposed only represent those ASRHAE Standard 90.1 values that were more stringent that the current IECC (Which represents 1/3rd of the total number of IECC table cells in both tables). When reviewing the taped testimony we found that the supporters conspicuously avoided responding directly to questions raised asking why the other values not chosen from ASRHAE Standard 90.1 were not appropriate.

The proponents stated that this proposal represents "a positive life cycle savings for the life of the building", even though no cost analysis substantiating the proposal was cited in the reason statement.

The supporters testified they had an analysis that substantiated their proposal, however no such analysis was cited in the reason statement nor was there evidence that it was made available to the general public at the hearing.

Supporters cited the proposal represented the “best value”, however the reason statement does not substantiate what constitutes a best value.

The supporters talked of errors that they had corrected, however the reason statement fails to cite what those errors were, why the ICC membership was wrong in approving the errors at previous hearings, and if they were errors why the proponents did not submit a request to change the errors to ICC staff.

In view of the above contradictions and short falls, we recommend that these proposals be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1910

CE65-19

IECC: TABLE C402.1.3

Proposed Change as Submitted

Proponents: Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing BCAP-IBTS (mguttpgh@aol.com)

2018 International Energy Conservation Code

Revise as follows:

(Portions of table not shown remain unchanged)

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD[a, i]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Floors																
Mass[e]	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-12.5ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
Joist/framing	~~NR~~ R-13	~~NR~~ R-13	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30[f]	R-30[f]	R-30[f]	R-30[f]	R-30[f]

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.
c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.
d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
e. "Mass floors" shall be in accordance with Section C402.2.3.
f. Steel floor joist systems shall be insulated to R-38.
g. "Mass walls" shall be in accordance with Section C402.2.2.
h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
i. Not applicable to garage doors. See Table C402.1.4.

(Portions of table not shown remain unchanged)

TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, *U*-FACTOR METHOD[a, b]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Floors																
Mass[d]	U-0.322[e]	U-0.322[e]	U-0.107	U-0.087	U-0.076	U-0.076	U-0.076	U-0.074	U-0.074	U-0.064	U-0.064	U-0.064	U-0.055	U-0.051	U-0.055	U-0.051
Joist/framing	U-0.066[e]	U-0.066[e]	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033

For SI: 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
d. "Mass floors" shall be in accordance with Section C402.2.3.
e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
f. The first value is for perimeter insulation and the second value is for full slab insulation.
g. "Mass walls" shall be in accordance with Section C402.2.2.

Reason: The purpose of this code change proposal is to improve consistency by applying an R-value for joist/framing floors in climate zone 1 in Table C402.1.3 that matches the corresponding U-factor in Table C402.1.4. The U-factor for joist/framing floors in Table C402.1.4 is consistent with a wood-framed floor insulated to R-13, despite the “NR” notation and footnote “e,” which indicate no insulation in the assembly. Because other U-factors and R-values for joist/framing floors in Table C402.1.3 are based on wood-framed assemblies, we applied the equivalent R-value requirement for a U-factor of 0.066, which is R-13. This will improve energy efficiency as compared to the current Table C402.1.3, but it will bring consistency to the two prescriptive tables and simplify enforcement.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
We believe the R-value equivalent in Table C402.1.4 is an error in the IECC and should be made consistent with the U-factor Table.

CE65-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Submitted**

Committee Reason: This corrects an error in the R-value table (Vote: 14-1).

Assembly Action: **None**

CE65-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests Disapprove

Commenter's Reason: The change as approve increases the insulation levels above the requirements in ASHRAE 90.1-16 without any cost justification and thus is not considered to be cost effective as determined by ASHRAE. See Public Comment to CE66-19 which was also approved making the same change. Public Comment to CE66-19 corrects the values to match ASHRAE 90.1-66 which is considered by ASRHAE procedures to be cost effective.

Public Comment# 1173

CE66-19

IECC®: TABLE C402.1.3, TABLE C402.1.4

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

(Portions of table not shown remain unchanged)

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD[a, i]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Floors																
Mass[e]	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	~~R-10ci~~ R-14.6ci	~~R-10.4ci~~ R-16.7ci	~~R-10ci~~ R-14.6ci	~~R-12.5ci~~ R-16.7ci	~~R-12.5ci~~ R-16.7ci	~~R-12.5ci~~ R-16.7ci	~~R-15ci~~ R-20.9ci	~~R-16.7ci~~ R-20.9ci	~~R-15ci~~ R-23ci	~~R-16.7ci~~ R-23ci
Joist/framing	~~NR~~ R-13	~~NR~~ R-13	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	~~R-30~~ R-38	~~R-30[f]~~ R-38	~~R-30[f]~~ R-38	~~R-30[f]~~ R-38	~~R-30[f]~~ R-38	~~R-30[f]~~ R-38

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.
c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f² °F.
d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
e. "Mass floors" shall be in accordance with Section C402.2.3.
f. Steel floor joist systems shall be insulated to R-38.
g. "Mass walls" shall be in accordance with Section C402.2.2.
h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
i. Not applicable to garage doors. See Table C402.1.4.

(Portions of table not shown remain unchanged)

TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, *U*-FACTOR METHOD[a, b]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Floors																
Mass[d]	U-0.322[e]	U-0.322[e]	U-0.107	U-0.087	~~U-0.076~~ U-0.074	~~U-0.076~~ U-0.074	~~U-0.076~~ U-0.057	~~U-0.074~~ U-0.051	~~U-0.074~~ U-0.057	~~U-0.064~~ U-0.051	~~U-0.064~~ U-0.051	~~U-0.064~~ U-0.051	~~U-0.055~~ U-0.042	~~U-0.051~~ U-0.042	~~U-0.055~~ U-0.038	~~U-0.051~~ U-0.038
Joist/framing	U-0.066[e]	U-0.066	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	~~U-0.033~~ U-0.027	~~U-0.033~~ U-0.027	~~U-0.033~~ U-0.027	~~U-0.033~~ U-0.027	~~U-0.033~~ U-0.027	~~U-0.033~~ U-0.027

For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
d. "Mass floors" shall be in accordance with Section C402.2.3.
e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
f. The first value is for perimeter insulation and the second value is for full slab insulation.
g. "Mass walls" shall be in accordance with Section C402.2.2.

Reason: The purpose of this code change proposal is to reduce energy costs for commercial building owners and improve long-term energy efficiency by adopting the more efficient and cost-effective opaque envelope requirements from ASHRAE Standard 90.1-2016 or the IECC for floors. Because all framed floor systems will be required to be insulated to R-38, there is no longer a need for footnote “f” in Table C402.1.3. The building envelope typically remains the same for many years after construction and it is particularly important to capture as much cost-effective energy efficiency as possible at construction. After all, the intent of the IECC (C101.3) is to “regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.”
The commercial opaque envelope requirements of the IECC have not been comprehensively improved since the 2012 edition, even though ASHRAE has continued to make cost effective improvements during that same period. This proposal leverages ASHRAE’s thorough energy savings and cost-effectiveness analyses to make improvements to the opaque envelope table where ASHRAE improves upon the IECC requirement, but without rolling back the IECC requirements where they meet or exceed the ASHRAE requirement.

We applied a consistent set of actions to each of the values in this table:

- Where we discovered clear errors or inconsistencies between the U-factor and R-value table, we corrected them.
- Where ASHRAE Standard 90.1-2016 has a more efficient U-factor for an assembly, we propose adopting the ASHRAE U-factor.
- Where an improved U-factor is adopted, we incorporate an equivalent R-value based on Normative Appendix A of ASHRAE Standard 90.1-2016.

The resulting table provides moderate improvements in energy efficiency based on an established model energy code and corrects inconsistencies and errors in the current IECC prescriptive tables.

Cost Impact: The code change proposal will increase the cost of construction
The improved U-factors and R-values in Tables C402.1.3 and C402.1.4 will typically require the addition of more insulation or other efficiency improvements in the IECC’s performance-based compliance paths.However, each U-factor selected by ASHRAE for Standard 90.1 has gone through a rigorous energy-savings and cost-effectiveness analysis and consensus vetting from affected interests, so even in cases where construction costs are increased, the improvements will be achievable and cost-effective over the useful life of the product.

CE66-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Submitted**

Committee Reason: Based on the reason statement, it makes corrections, and improves the R-values (Vote: 12-3).

Assembly Action: **None**

CE66-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE C402.1.3, TABLE C402.1.4

Proponents:
Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD[a, i]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Floors																
Mass[e]	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-14.6ci	R-16.7ci	R-14.6ci	R-16.7ci	R-16.7ci	R-16.7ci	R-20.9ci	R-20.9ci	R-23ci	R-23ci
Joist/framing	~~R-13~~ NR	~~R-13~~ NR	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-38	R-38	R-38	R-38	R-38	R-38

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. “Mass floors” shall be in accordance with Section C402.2.3.

g. “Mass walls” shall be in accordance with Section C402.2.2.

h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.

i. Not applicable to garage doors. See Table C402.1.4.

TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, *U*-FACTOR METHOD[a, b]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**
Floors																
Mass[d]	U-0.322[e]	U-0.322[e]	U-0.107	U-0.087	U-0.074	U-0.074	U-0.057	U-0.051	U-0.057	U-0.051	U-0.051	U-0.051	U-0.042	U-0.042	U-0.038	U-0.038
Joist/framing	~~U-0.066~~ U-0.282	~~U-0.066~~ U-0.282	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027

For SI: 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
d. "Mass floors" shall be in accordance with Section C402.2.3.
e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
f. The first value is for perimeter insulation and the second value is for full slab insulation.
g. "Mass walls" shall be in accordance with Section C402.2.2.

Commenter's Reason: This proposal increase the insulation levels above what is required in ASHRAE 90.1-16 and does not proved any cost justification for the change. The proposed modification returns the values for joist/frame to what is in the current version of ASHRAE 90.1-16 which by ASHRAE requirements is considered cost effective.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
The proposal reduces the insulation requirements to which are considered cost effective.

Public Comment# 1172

Public Comment 2:

Proponents:
Jonathan Humble, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org)

requests Disapprove

Commenter's Reason: This public comment covers CE61-19, CE63-19, CE64-19, CE66-19, CE68-19 and CE69-19.
We recommend disapproval for the following reasons.

The values proposed only represent those ASRHAE Standard 90.1 values that were more stringent that the current IECC (Which represents 1/3[rd] of the total number of IECC table cells in both tables). When reviewing the taped testimony we found that the supporters conspicuously avoided responding directly to questions raised asking why the other values not chosen from ASRHAE Standard 90.1 were not appropriate.

The proponents stated that this proposal represents “a positive life cycle savings for the life of the building”, even though no cost analysis substantiating the proposal was cited in the reason statement.

The supporters testified they had an analysis that substantiated their proposal, however no such analysis was cited in the reason statement nor was there evidence that it was made available to the general public at the hearing.

Supporters cited the proposal represented the “best value”, however the reason statement does not substantiate what constitutes a best value.

The supporters talked of errors that they had corrected, however the reason statement fails to cite what those errors were, why the ICC membership was wrong in approving the errors at previous hearings, and if they were errors why the proponents did not submit a request to change the errors to ICC staff.

In view of the above contradictions and short falls, we recommend that these proposals be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1726

CE68-19

IECC®: TABLE C402.1.3, TABLE C402.1.4

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

(Portions of table not shown remain unchanged)

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD[a, i]

Slab-on-grade floors																
Unheated slabs	NR	NR	NR	NR	NR	~~NR~~ R-10 for 24" below	~~R-10 for 24" below~~ R-15 for 24" below	~~R-10 for 24" below~~ R-15 for 24" below	~~R-10 for 24" below~~ R-15 for 24" below	~~R-10 for 24" below~~ R-20 for 24" below	~~R-10 for 24" below~~ R-20 for 24" below	~~R-15 for 24" below~~ R-20 for 48" below	R-15 for 24" below	R-15 for 24" below	R-15 for 24" below	R-20 for 24" below
Heated slabs[h]	R-7.5 for 12" below+ R-5 full slab	R-7.5 for 12" below+ R-5 full slab	R-7.5 for 12" below+ R-5 full slab	R-7.5 for 12" below+ R-5 full slab	R-10 for 24" below+ R-5 full slab	R-10 for 24" below+ R-5 full slab	R-15 for 24" below+ R-5 full slab	R-15 for 24" below+ R-5 full slab	R-15 for 36" below+ R-5 full slab	R-15 for 36" below+ R-5 full slab	R-15 for 36" below+ R-5 full slab	R-20 for 48" below+ R-5 full slab	R-20 for 48" below+ R-5 full slab	R-20 for 48" below+ R-5 full slab	R-20 for 48" below+ R-5 full slab	R-20 for 48" below+ R-5 full slab

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.
c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.
d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
e. "Mass floors" shall be in accordance with Section C402.2.3.
f. Steel floor joist systems shall be insulated to R-38.
g. "Mass walls" shall be in accordance with Section C402.2.2.
h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
i. Not applicable to garage doors. See Table C402.1.4.

(Portions of table not shown remain unchanged)

TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, *U*-FACTOR METHOD[a, b]

Slab-on-grade floors																
Unheated slabs	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.73[e]	~~F-0.73[e]~~ F-0.54	~~F-0.54~~ F-0.52	~~F-0.54~~ F-0.52	~~F-0.54~~ F-0.52	~~F-0.54~~ F-0.51	~~F-0.54~~ F-0.51	~~F-0.52~~ F-0.434	F-0.40	F-0.40	F-0.40	F-0.40
Heated slabs[f]	F-1.02 0.74	F-1.02 0.74	F-1.02 0.74	F-1.02 0.74	F-0.90 0.74	F-0.90 0.74	F-0.86 0.64	F-0.86 0.64	F-0.79 0.64	F-0.79 0.64	F-0.79 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55

For SI: 1 pound per square foot = 4.88 kg/m², 1 pound per cubic foot = 16 kg/m³.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
d. "Mass floors" shall be in accordance with Section C402.2.3.
e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
f. The first value is for perimeter insulation and the second value is for full slab insulation.
g. "Mass walls" shall be in accordance with Section C402.2.2.

Reason: The purpose of this code change proposal is to reduce energy costs for commercial building owners and improve long-term energy efficiency by adopting the more efficient and cost-effective opaque envelope requirements from ASHRAE Standard 90.1-2016 or the IECC for slab-on-grade floors in climate zones 3-6. The building envelope typically remains the same for many years after construction and it is particularly important to capture as much cost-effective energy efficiency as possible at construction. After all, the intent of the IECC (C101.3) is to "regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building."
The commercial opaque envelope requirements of the IECC have not been comprehensively improved since the 2012 edition, even though ASHRAE has continued to make cost-effective improvements during that same period. This proposal leverages ASHRAE's thorough energy savings and cost-effectiveness analyses to make improvements to the opaque envelope table where ASHRAE improves upon the IECC requirement, but without rolling back the IECC requirements where they meet or exceed the ASHRAE requirement.

We applied a consistent set of actions to each of the values in this table:

- Where ASHRAE Standard 90.1-2016 has a more efficient U-factor for an assembly, we propose adopting the ASHRAE U-factor.
- Where an improved U-factor is adopted, we incorporate an equivalent R-value based on Normative Appendix A of ASHRAE Standard 90.1-2016.

The resulting table provides moderate improvements in energy efficiency based on an established model energy code and corrects inconsistencies and errors in the current IECC prescriptive tables.

Cost Impact: The code change proposal will increase the cost of construction
The improved F-factors and R-values in Tables C402.1.3 and C402.1.4 will typically require the addition of more insulation or other efficiency improvements in the IECC's performance-based compliance paths.However, each U-factor selected by ASHRAE for Standard 90.1 has gone through a rigorous energy-savings and cost-effectiveness analysis and consensus vetting from affected interests, so even in cases where construction costs are increased, the improvements will be achievable and cost-effective over the useful life of the product.

CE68-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Submitted**

Committee Reason: The proposal brings forward cost effective updates for unheated slabs (Vote: 13-2).

Assembly Action: **None**

CE68-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Jonathan Humble, FAIA, NCARB, LEED BD+C, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org)

requests Disapprove

Commenter's Reason: This public comment covers CE61-19, CE63-19, CE64-19, CE66-19, CE68-19 and CE69-19.
We recommend disapproval for the following reasons.

The values proposed only represent those ASRHAE Standard 90.1 values that were more stringent that the current IECC (Which represents 1/3rd of the total number of IECC table cells in both tables). When reviewing the taped testimony we found that the supporters conspicuously avoided responding directly to questions raised asking why the other values not chosen from ASRHAE Standard 90.1 were not appropriate.

The proponents stated that this proposal represents "a positive life cycle savings for the life of the building", even though no cost analysis substantiating the proposal was cited in the reason statement.

The supporters testified they had an analysis that substantiated their proposal, however no such analysis was cited in the reason statement nor was there evidence that it was made available to the general public at the hearing.

Supporters cited the proposal represented the “best value”, however the reason statement does not substantiate what constitutes a best value.

The supporters talked of errors that they had corrected, however the reason statement fails to cite what those errors were, why the ICC membership was wrong in approving the errors at previous hearings, and if they were errors why the proponents did not submit a request to change the errors to ICC staff.

In view of the above contradictions and short falls, we recommend that these proposals be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1727

CE69-19

IECC®: TABLE C402.1.3, TABLE C402.1.4

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Harry Misuriello, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

(Portions of table not shown remain unchanged)

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD[a, i]

Slab-on-grade floors																
Unheated slabs	NR	NR	NR	NR	NR	NR	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-15 for 24" below	~~R-15 for 24" below~~ R-20 for 24" below	~~R-15 for 24" below~~ R-20 for 48" below	~~R-15 for 24" below~~ R-20 for 48" below	~~R-20 for 24" below~~ R-25 for 48" below
Heated slabs[h]	R-7.5 for 12" below+ R-5 full slab	R-7.5 for 12" below+ R-5 full slab	R-7.5 for 12" below+ R-5 full slab	R-7.5 for 12" below+ R-5 full slab	R-10 for 24" below+ R-5 full slab	R-10 for 24" below+ R-5 full slab	R-15 for 24" below+ R-5 full slab	R-15 for 24" below+ R-5 full slab	R-15 for 36" below+ R-5 full slab	R-15 for 36" below+ R-5 full slab	R-15 for 36" below+ R-5 full slab	R-20 for 48" below+ R-5 full slab	R-20 for 48" below+ R-5 full slab	R-20 for 48" below+ R-5 full slab	R-20 for 48" below+ R-5 full slab	R-20 for 48" below+ R-5 full slab

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.
c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.
d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
e. "Mass floors" shall be in accordance with Section C402.2.3.
f. Steel floor joist systems shall be insulated to R-38.
g. "Mass walls" shall be in accordance with Section C402.2.2.
h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
i. Not applicable to garage doors. See Table C402.1.4.

(Portions of table not shown remain unchanged)

TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, *U*-FACTOR METHOD[a, b]

Slab-on-grade floors																
Unheated slabs	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.54	F-0.54	F-0.54	F-0.54	F-0.54	F-0.52	~~F-0.40~~ F-0.51	~~F-0.40~~ F-0.434	~~F-0.40~~ F-0.434	~~F-0.40~~ F-0.424
Heated slabs[f]	F-1.02 0.74	F-1.02 0.74	F-1.02 0.74	F-1.02 0.74	F-0.90 0.74	F-0.90 0.74	F-0.86 0.64	F-0.86 0.64	F-0.79 0.64	F-0.79 0.64	F-0.79 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55	F-0.69 0.55

For SI: 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
d. "Mass floors" shall be in accordance with Section C402.2.3.
e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
f. The first value is for perimeter insulation and the second value is for full slab insulation.
g. "Mass walls" shall be in accordance with Section C402.2.2.

Reason: The purpose of this code change proposal is to reduce building energy costs and improve long-term energy efficiency by adopting ASHRAE's more efficient and cost-effective requirements for unheated slab insulation in climate zones 7-8. The current IECC F-factors for unheated slabs in these climate zones do not correspond with the R-value requirements in Table C402.1.3, nor do they correspond with F-factor data for common slab-on-grade floor assemblies per Normative Appendix A of ASHRAE Standard 90.1-2016. We believe the F-factors in the IECC are in error, and we propose adopting both ASHRAE's R-values and F-factors for these climate zones. The result will be improved efficiency and consistency across the IECC's prescriptive tables. The building envelope typically remains the same for many years after construction and it is particularly important to capture as much cost-effective energy efficiency as possible at construction. After all, the intent of the IECC (C101.3) is to "regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building."

Cost Impact: The code change proposal will increase the cost of construction
The improved F-factors and R-values in Tables C402.1.3 and C402.1.4 will typically require the addition of more insulation or other efficiency improvements in the IECC's performance-based compliance paths.However, each component value selected by ASHRAE for Standard 90.1 has gone through a rigorous energy-savings and cost-effectiveness analysis and consensus vetting from affected interests, so even in cases where construction costs are increased, the improvements will be achievable and cost-effective over the useful life of the product. This proposal will also correct an error in the IECC Table C402.1.4 and bring consistency between the two prescriptive tables, simplifying compliance and enforcement.

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Submitted**

Committee Reason: These are cost effective updates (11-4).

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

Proponents:
Jonathan Humble, FAIA, NCARB, LEED BD+C, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org)

requests Disapprove

Commenter's Reason: This public comment covers CE61-19, CE63-19, CE64-19, CE66-19, CE68-19 and CE69-19.
We recommend disapproval for the following reasons.

The values proposed only represent those ASRHAE Standard 90.1 values that were more stringent that the current IECC (Which represents 1/3rd of the total number of IECC table cells in both tables). When reviewing the taped testimony we found that the supporters conspicuously avoided responding directly to questions raised asking why the other values not chosen from ASRHAE Standard 90.1 were not appropriate.

The proponents stated that this proposal represents "a positive life cycle savings for the life of the building", even though no cost analysis substantiating the proposal was cited in the reason statement.

The supporters testified they had an analysis that substantiated their proposal, however no such analysis was cited in the reason statement nor was there evidence that it was made available to the general public at the hearing.

Supporters cited the proposal represented the "best value", however the reason statement does not substantiate what constitutes a best value.

The supporters talked of errors that they had corrected, however the reason statement fails to cite what those errors were, why the ICC membership was wrong in approving the errors at previous hearings, and if they were errors why the proponents did not submit a request to change the errors to ICC staff.

In view of the above contradictions and short falls, we recommend that these proposals be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1730

CE73-19

IECC®: TABLE C402.1.4

Proposed Change as Submitted

Proponents: Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing BCAP-IBTS (mguttpgh@aol.com)

2018 International Energy Conservation Code

Revise as follows:

(Portions of table not shown remain unchanged)

TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, *U*-FACTOR METHOD[a, b]

	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
CLIMATE ZONE	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**
Roofs																
Insulation entirely above roof deck	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings	~~U-0.044~~ U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.031	U-0.031	U-0.029	U-0.029	U-0.029	U-0.029
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021

For SI: 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
d. "Mass floors" shall be in accordance with Section C402.2.3.
e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
f. The first value is for perimeter insulation and the second value is for full slab insulation.
g. "Mass walls" shall be in accordance with Section C402.2.2.

Reason: The purpose of this code change proposal is to correct the U-factor for roof insulation for All Other metal buildings in climate zone 1. Even though the R-values in Table C402.1.3 for both Group R and All Other metal buildings in climate zone 1 are R-19+R 11 LS, the U-factor table applies a higher U-factor for All Other metal buildings. This proposal adopts the U-factor from Group R for both building types in climate zone 1, since it is closest to the R-19+R-11 LS U-factor equivalent in Table A2.3.3 in ASHRAE Standard 90.1 Normative Appendix A. The building envelope typically remains the same for many years after construction and it is particularly important to “get it right” at the time of construction. After all, the intent of the IECC (C101.3) is to “regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.”

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The current metal building roof U-factor for All Other buildings is an error and is inconsistent with the R-value equivalent in Table C402.1.3.

CE73-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Submitted**

Committee Reason: There was no reason for U-factor to be different than R-value, this aligned them (Vote: 13-2).

Assembly Action: **None**

CE73-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE C402.1.4

Proponents:
Jonathan Humble, FAIA, NCARB, LEED AP-BD+C, American Iron and Steel Institute, representing American Iron and Steel Institute and the Metal Building Manufacturers Association (Jhumble@steel.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, *U*-FACTOR METHOD[a, b]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above roof deck	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings	~~U-0.035~~ U-0.041	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.031	U-0.031	U-0.029	U-0.029	U-0.029	U-0.029
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021

For SI: 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.

ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
d. "Mass floors" shall be in accordance with Section C402.2.3.
e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
f. The first value is for perimeter insulation and the second value is for full slab insulation.
g. "Mass walls" shall be in accordance with Section C402.2.2.

Commenter's Reason: We are recommending this code change have a further modification.
If successful with the AISI/MBMA public comment on CE61-19, this proposal intends to align the U-factor value with the CE61-19 public comment. The basis for the CE61-19 public comment reads: "The proposed modification brings the remaining U-factors and R-values from ASHRAE Standard 90.1 which that were not included in the original code change proposal. The reason for this public comment is based on the testimony of the proponents and supporters of the original code change proposal which used the ASHRAE Standard 90.1 methodology as a basis for substantiation. Their statement was that the proposal leveraged "…ASHRAE's thorough energy savings and cost-effectiveness analysis…" to support the need to bring over the values. Since that Standard 90.1 methodology they describe applies the all the R-values and U-factors contained in Standard 90.1 opaque envelope tables it appropriate then to bring over "all" the values since they "all" represent energy efficient and cost effective opaque envelope requirements."

In light of the fact that both CE61-19 and CE73-19 use ASHRAE Standard 90.1 as a basis for change, we are further reinforcing this goal by recommending that all U-factors contained in the Standard 90.1 climate zone opaque envelope table be brought over in total.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment may or may not increase the cost of construction depending if the building design complies through efficient envelope design or through adding more insulation.

Public Comment# 2063

CE75-19

IECC®: TABLE C402.1.4

Proposed Change as Submitted

Proponents: Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing BCAP-IBTS (mguttpgh@aol.com)

2018 International Energy Conservation Code

Revise as follows:

(Portions of table not shown remain unchanged)

TABLE C402.1.4
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, *U*-FACTOR METHOD[a, b]

	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
CLIMATE ZONE	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**
Walls, above grade																
Mass[g]	U-0.151	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	U-0.061	U-0.061
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.052	U-0.039	U-0.052	U-0.039
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	~~U-0.052~~ U-0.042	U-0.064	U-0.045
Wood framed and other[c]	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	~~U-0.064~~ U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.036	U-0.036

For SI: 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Where assembly *U*-factors, *C*-factors, and *F*-factors are established in ANSI/ASHRAE/IESNA 90.1 Appendix A, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table, and provided that the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.
b. Where *U*-factors have been established by testing in accordance with ASTM C1363, such opaque assemblies shall be a compliance alternative where those values meet the criteria of this table. The *R*-value of continuous insulation shall be permitted to be added to or subtracted from the original tested design.
c. Where heated slabs are below grade, below-grade walls shall comply with the *U*-factor requirements for above-grade mass walls.
d. "Mass floors" shall be in accordance with Section C402.2.3.
e. These *C*-, *F*- and *U*-factors are based on assemblies that are not required to contain insulation.
f. The first value is for perimeter insulation and the second value is for full slab insulation.
g. "Mass walls" shall be in accordance with Section C402.2.2.

Reason: The purpose of this code change proposal is to correct two errors in the U-factor for wall insulation in climate zones 5 and 7. In both cases, the U-factor does not match the corresponding R-value of the IECC. The proposal above not only brings the U-factor into alignment with the IECC R-value, but also brings it into alignment with the applicable U-factors and R-values in ASHRAE Standard 90.1-2016.
In climate zone 7, Group R metal-framed walls are required to be insulated to R-13+R-15.6 c.i. in both the IECC and ASHRAE Standard 90.1. ASHRAE Standard 90.1 includes an equivalent U-factor of 0.042, which corresponds with the R-value according to Standard 90.1 Normative Appendix A. However, the 2018 IECC includes an equivalent U-factor of 0.052, which is inconsistent. We believe the IECC U-factor is an error and should be changed to 0.042.

In climate zone 5, Group R wood-framed walls are required to be insulated to R-13+R-7.5 c.i., or R-20+R-3.8 c.i., but the U-factor equivalent clearly does not match up. ASHRAE Standard 90.1 specifies a U-factor of 0.051, which not only corresponds with the R-value, but also corresponds with the U-factor requirements in climate zones 6 and 7 (which also require R-13+5 + R-7.5 c.i., or R-20+R-3.8 c.i.). Here again, we believe the IECC U-factor is an error, and should be changed to 0.051.

The building envelope typically remains the same for many years after construction and it is particularly important to “get it right” at the time of construction. After all, the intent of the IECC (C101.3) is to “regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.”

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The current U-factor equivalents for metal-framed walls in climate zone 7 and wood-framed walls in climate zone 5 are errors and are inconsistent with the R-value equivalent in Table C402.1.3.

CE75-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Submitted**

Committee Reason: There was no reason for U-factor to be different than R-value this aligned them. This is consistent with CE63 which will address any discrepencies (Vote: 13-2).

Assembly Action: **None**

CE75-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Jonathan Humble, FAIA, NCARB, LEED BD+C, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org)

requests Disapprove

Commenter's Reason: This code change proposal does not correct any errors. The values have been in the IECC since 2009 and 2012 respectively with plenty of opportunity to address this claim during that time. In addition the proponents did not stipulate which code change proposal created the errors, so how are we to know?

The proposal merely copies values from ASHRAE Standard 90.1 with the reason statement giving the impression that copying ASHRAE Standard 90.1 is a standard operating procedure for IECC updates to these tables. This is not the case. Previous proposals to cherry pick envelope values from ASRHAE Standard 90.1 for the last 10 years have more often than not been disapproved.

The values increase the stringency requirements, however there was no energy efficiency/cost analysis presented to substantiate the proposal, as required by ICC Council Policy 28.

In regard to the proponent's citation of ASHRAE Standard 90.1, since the supporters advertised ASHRAE Standard 90.1's methodology as being cost effective and energy efficient then the entire ASHRAE standard 90.1 opaque envelope values should have been presented and brought over in total. However the proponents did not, and therefore we should not encourage cherry picking from other published documents.

In view of the above we ask that this code change proposal be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
If approved the cost increase for additional insulation materials will not take effect.

Public Comment# 1717

Public Comment 2:

Proponents:
Greg Johnson, representing Coalition for Fair Energy Codes (gjohnsonconsulting@gmail.com)

requests Disapprove

Commenter's Reason: CE75-19 mistakenly claims to correct errors in the commercial U-factor table, but instead makes a current problem with material neutrality much worse.
Currently in CZ5 both metal and wood frame walls must meet the same performance target – a U-factor of 0.064. This is equitable and material neutral – a core principle of the code. CE75-19 however would reduce the U-factor for wood frame walls by 20 percent to U-0.051 but leave metal frame walls unchanged, creating a huge inequity in the treatment of materials, benefitting metal at the expense of wood.

CE75-19 similarly destroys material neutrality in CZ 7 by reducing the metal frame U-factor by about 20 percent to U-0.042 from U-0.052. U-0.052 is essentially the same as the CZ 7 wood frame U-factor of U-0.051 so the proposed change disadvantages metal compared to wood, thereby eliminating material neutrality.

Approving this public comment will return the IECC, per the preface, to the principles upon which it was founded (emphasis added): "This code is founded on principles intended to establish provisions consistent with the scope of an energy conservation code that **adequately conserves energy**; provisions that **do not unnecessarily increase construction costs**; provisions that do not restrict the use of new materials, products or methods of construction; and provisions that **do not give preferential treatment to particular types or classes of materials, products or methods of construction**."

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1846

CE79-19

IECC®: C402.2.4, C402.2.4.1 (New)

Proposed Change as Submitted

Proponents: Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council

2018 International Energy Conservation Code

C402.2.4 ~~Slabs-on-grade perimeter insulation.~~ Slabs-on-grade. (Prescriptive) ~~Where the slab on grade is in contact with the ground, the~~ The minimum thermal resistance (*R*-value) of the insulation ~~around the perimeter of~~ for unheated or heated slab-on-grade floors designed in accordance with the *R*-value method of Section C402.1.3 shall be as specified in Table C402.1.3. ~~The perimeter insulation shall be placed on the outside of the foundation or on the inside of the foundation wall. The perimeter insulation shall extend downward from the top of the slab for the minimum distance shown in the table or to the top of the footing, whichever is less, or downward to not less than the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. Insulation extending away from the building shall be protected by pavement or by not less than of 10 inches (254 mm) of soil.~~

> ~~**Exception:** Where the slab-on-grade floor is greater than 24 inches (61 mm) below the finished exterior grade, perimeter insulation is not required.~~

Add new text as follows:

C402.2.4.1 Insulation installation (Mandatory). Where installed, the perimeter insulation shall be placed on the outside of the foundation or on the inside of the foundation wall. The perimeter insulation shall extend downward from the top of the slab for the minimum distance shown in the table or to the top of the footing, whichever is less, or downward to not less than the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. Insulation extending away from the building shall be protected by pavement or by not less than of 10 inches (254 mm) of soil. Where installed, full slab insulation shall be continuous under the entire area of the slab-on-grade floor, except at structural column locations and service penetrations. Insulation required at the heated slab perimeter shall not be required to extend below the bottom of the heated slab and shall be continuous with the full slab insulation.

Exception: Where the slab-on-grade floor is greater than 24 inches (61 mm) below the finished exterior grade, perimeter insulation is not required.

Reason: In the last code cycle, provisions for full-slab insulation where added to Table C402.1.3 for heated slabs. However, Section C402.2.4 only addresses perimeter insulation of slabs. This proposal makes coordinating changes to Section C402.2.4 such that installation of both perimeter insulation and full-slab insulation are addressed in a manner consistent with the intent of Table C402.1.3. The designation of [Prescriptive] and [Mandatory] in the titles is used because the R-values are prescriptive, but the installation requirements should apply to any and all compliance approaches (i.e., mandatory). This approach is also intended to be consistent with a larger proposal expected from SEHPCAC which addresses the prescriptive vs. mandatory matter in other sections of the code.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal adds installation provisions for fullslab insulation in a manner consistent with Table C402.1.3. The installation provisions provided for full slab insulation may reduce cost for typical slab-on-grade floor construction by explicitly not requiring insulation under structural column footings (although this is possible using high density and compressive strength foam insulating sheathing boards as commonly done for cryogenic facilities and infrastructure frost protection).

Staff Analysis: Please note that the majority of the change is relocating existing text from Section C402.2.4 into C402.2.4.1. Because of the requirements of the cdpACCESS system, the text removed from C402.2.4 must be shown as deleted and then underlined when it reappears in Section C402.2.4.1

CE79-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
C402.2.4.1 Insulation installation (Prescriptive ~~Mandatory~~). Where installed, the perimeter insulation shall be placed on the outside of the foundation or on the inside of the foundation wall. The perimeter insulation shall extend downward from the top of the slab for the minimum distance shown in the table or to the top of the footing, whichever is less, or downward to not less than the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. Insulation extending away from the building shall be protected by pavement or by not less than of 10 inches (254 mm) of soil. Where installed, full slab insulation shall be continuous under the entire area of the slab-on-grade floor, except at structural column locations and service penetrations. Insulation required at the heated slab perimeter shall not be required to extend below the

bottom of the heated slab and shall be continuous with the full slab insulation.

Exception: Where the slab-on-grade floor is greater than 24 inches (61 mm) below the finished exterior grade, perimeter insulation is not required.

Committee Reason: The proposal provides needed clean up, it is tradable, the modification gives needed flexibility (Vote: 15-0).

Assembly Action: **None**

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

CE79-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C402.2.4, C402.2.4.1 (New), C402.2.4.2 (New)

Proponents:
Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C402.2.4 Slabs-on-grade. (Prescriptive) The minimum thermal resistance (*R*-value) of the insulation for unheated or heated slab-on-grade floors designed in accordance with the *R*-value method of Section C402.1.3 shall be as specified in Table C402.1.3.

> **Exception:** Where the slab-on-grade floor is greater than 24 inches (61 mm) below the finished exterior grade, perimeter insulation is not required.

C402.2.4.1 Slab-on-grade perimeter i~~I~~nsulation installation (~~Prescriptive~~ Mandatory). Where installed, the perimeter insulation shall be placed on the outside of the foundation or on the inside of the foundation wall. The perimeter insulation shall extend downward from the top of the slab in accordance with the proposed design or, where using the R-value method for compliance, for the minimum distance shown in Table C402.1.3 ~~the table~~ or to the top of the footing, whichever is less, or downward to not less than the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. Insulation extending away from the building shall be protected by pavement or by not less than of 10 inches (254 mm) of soil. ~~Where installed, full slab insulation shall be continuous under the entire area of the slab-on-grade floor, except at structural column locations and service penetrations. Insulation required at the heated slab perimeter shall not be required to extend below the bottom of the heated slab and shall be continuous with the full slab insulation.~~

~~**Exception:** Where the slab-on-grade floor is greater than 24 inches (61 mm) below the finished exterior grade, perimeter insulation is not required.~~

C402.2.4.2 Slab-on-grade full slab insulation installation [Mandatory] Where installed, full slab insulation shall be continuous under the entire area of the slab-on-grade floor, except at structural column locations and service penetrations. Insulation at the perimeter of a slab with full slab insulation shall be installed in accordance with Section C402.2.4.1, shall not be required to extend below the bottom of the slab edge, and shall be continuous with the full slab insulation.

Commenter's Reason: The committee recommended approval with a modification that changed proposed Section C402.2.4.1 to a prescriptive rather than mandatory requirement. The proponent provided the modification because certain aspects of the installation requirements are "tradeable" for lesser or greater performance. However, many of the basic installation requirements are not tradeable and should be considered mandatory. This public comment provides a means to use alternative installation practices by way of a proposed design (the proposed design then defines mandatory installation practice for the project). Thus, installation requirements by way of a proposed design or by use of the R-value method can both be considered mandatory as they should be. Finally, this PC improves the format of the proposal by moving the full-slab insulation installation information into its own subsection with some wording improvements. We request your support to maintain the committee's approval of CE79 as modified by this PC.

NOTE: The key substantive change is the "proposed design" phrase added to Section C402.2.4.1. The remaining changes to CE79 are non-technical and simply move existing text or proposed text to align with a better format for these provisions.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Refer to the original proposal's cost impact statement. If anything, this PC makes it clearer that there should be no cost impact by clarifying that alternative installation solutions can be used via a proposed design.

Public Comment# 1755

Public Comment 2:

Proponents:
David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

requests As Modified by Committee

Commenter's Reason: SEHPCAC supports the committee action.
Testimony at the committee action hearings revealed that some builders model different insulation installation details which affect prescriptive requirements, making this section 'tradeable.' The hearing committee rightfully identified this as 'tradeable' and therefore **not** mandatory.

In keeping with SEHPCAC's goal of clarifying the distinction between tradeable (prescriptive) and non-tradeable (mandatory) sections, and because these provisions are being 'traded,' this proposal should not be labeled 'mandatory.'

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Per the cost impact statement on the original proposal.

Public Comment# 1709

CE80-19

IECC®: C401.2, C402.2.7, C407.2

Proposed Change as Submitted

Proponents: David Collins, SEHPCAC, representing SEHPCAC (SEHPCAC@iccsafe.org); David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

2018 International Energy Conservation Code

Revise as follows:

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406 and tenant spaces shall comply with Section C406.1.1.
3. The requirements of Sections C402.2.7, C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

C402.2.7 ~~Airspaces.~~ Airspaces (Mandatory). Where the ~~thermal properties of airspaces are used to comply with this code~~ R-value of an airspace is used for compliance in accordance with Section ~~C401.2, such airspaces~~ C402.1 the airspace shall be enclosed in an unventilated cavity constructed to minimize airflow into and out of the enclosed airspace. Airflow shall be deemed minimized where the enclosed airspace is located on the interior side of the continuous air barrier and is bounded on all sides by building components.

> **Exception:** The thermal resistance of airspaces located on the exterior side of the continuous air barrier and adjacent to and behind the exterior wall-covering material shall be determined in accordance with ASTM C1363 modified with an airflow entering the bottom and exiting the top of the airspace at an air movement rate of not less than 70 mm/second.

C407.2 Mandatory requirements. Compliance with this section requires compliance with Sections C402.2.7, C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404 and C405.

Reason: When C402.2.7 was added in the 2018 edition of the code it required compliance with C401.2, but did not exclude the ASHRAE 90.1 compliance path.. Imposing the airspace requirement on designs which do not use Chapter 4, but use ASHRAE 90.1 prevents the 90.1 path from being a standalone path as intended. This is an opportunity for conflict and confusion and complicates training for both the IECC and the 90.1.
The reference "in accordance with Section C401.2" could be read to imply that this requirement overlays those of ASHRAE 90.1. The IECC does not make modifications to the ASHRAE 90.1.

Airspaces are proposed to be non-tradeable (mandatory) in the performance path because the IECC's provisions do not include performance metrics, indicating there is no tradable value.

Instead, the IECC's requirements for airspaces are installation related – 'how to do an airspace'- which apply to all installations, prescriptive and performance, which makes the provision mandatory.

While identified as "Mandatory", if the elimination of the use of the labels "prescriptive "and "mandatory" is approved, we understand this label would not be added and it would instead the provision be added to Table C407.2 to indicate its application to the Total Building Performance compliance option.

This proposal is submitted by the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx (http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx)

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This change does not increase or decrease code provisions nor impact construction methods. It clarifies language and provisions already contained in the code.

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This provides clarification to the code as to what is mandatory (Vote: 15-0).

Assembly Action: **None**

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as ‘mandatory’ will instead have their respective section numbers added to the new non-tradeable requirement tables.

CE80-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C402.2.7

Proponents:
Wesley Hall, representing Reflective Insulation Manufacturers Association (RIMA) (wes.hall@reflectixinc.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C402.2.7 Airspaces (Mandatory). Where the R-value of an airspace is used for compliance in accordance with Section C402.1 the airspace shall be enclosed in an unventilated cavity constructed to minimize airflow into and out of the enclosed airspace. Airflow shall be deemed minimized where the enclosed airspace is ~~located on the interior side of the continuous air barrier and is~~ bounded on all sides by building components.

> ~~**Exception:** The thermal resistance of airspaces located on the exterior side of the continuous air barrier and adjacent to and behind the exterior wall-covering material shall be determined in accordance with ASTM C1363 modified with an airflow entering the bottom and exiting the top of the airspace at an air movement rate of not less than 70 mm/second.~~

Commenter's Reason: RIMA-I supports this proposal in concept, provided the revisions proposed in this public comment are approved. It is not necessary to require that the airspace be located on the interior side of the air barrier. The exception is technically incorrect, has no scientific basis, and should be removed.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Most of the revisions in both the proposal and public comment are editorial. However, the exception that is being deleted is a highly proprietary and costly test. Deleting this could potentially reduce cost.

Public Comment# 1673

CE81-19

IECC®: C402.2, C402.2.8 (New)

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing New Buildings Institute (ericM@newbuildings.org)

2018 International Energy Conservation Code

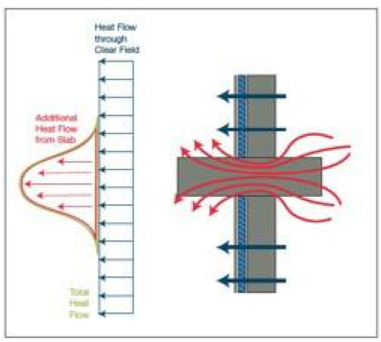
Revise as follows:

C402.2 Specific building thermal envelope insulation requirements (Prescriptive). Insulation in building thermal envelope opaque assemblies shall comply with Sections C402.2.1 through ~~C402.2.7~~ C402.2.8 and Table C402.1.3.

Add new text as follows:

C402.2.8 Concrete slab floors. Concrete floor slabs that penetrate the building thermal envelope shall be provided with either continuous insulation having a minimum thermal resistance of R-3 or a minimum R-3 thermal break located where the concrete slab penetrates the building thermal envelope.

Reason: The requirements for overall assembly insulation have been well-addressed in the code. However, the existing requirements do not adequately address significant thermal bridging issues.
Thermal bridges are created when a relatively high thermally conductive material "bridges" through the insulating materials in the thermal envelope. Whether they penetrate all the way from the exterior to the interior of the building or only partially through the thermal envelope, thermal bridges make it easier for heat to travel in or out of the building. The impact of thermal bridges has a greater energy impact than a simple weighted U-factor calculation would suggest. Weighted U-factor calculations assume that heat travels in parallel paths through an assembly. In reality, heat also moves laterally, resulting in additional heat transmission through the assembly.



This has an impact on the heating and cooling loads of the building, as well as on the perceived comfort of space occupants. Humans perceive heat primarily through conduction, then radiation, then convection. So the presence of hot or cold surfaces due to thermal bridges can have a significant impact on thermal comfort. When the thermal envelope has hot or cold spots from thermal bridges, occupants are more likely to feel uncomfortable and respond by over-conditioning the air in the space, creating another source of energy loss.

The common practices of leaving concrete slab floor edges un-insulated and extending structural slabs through the thermal envelope to create balconies are particularly problematic and significant thermal bridges. This proposal addresses this significant issue by requiring that the thermal bridges created by concrete floor slabs that penetrate the building thermal envelope be addressed either by providing them with thermal breaks or by encapsulating them in continuous insulation. There are products available on the market that can be used to provide a thermal break within a continuously poured slab that extends to create a balcony. Alternately, balconies can utilize alternate structural configurations that do not require turning the building into a huge radiator.

Cost Impact: The code change proposal will increase the cost of construction
This will increase the cost of construction. Cost impact will vary depending on the approach taken.

CE81-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Proponent requested disapproval to work with opponent and bring back a public comment (Vote: 15-0).

Assembly Action: **None**

CE81-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C402.2.8 (New)

Proponents:
Eric Makela, representing New Buildings Institute (ericm@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C402.2.8 Peripheral edges of intermediate ~~Concrete slab~~ floors and balconies. ~~Concrete~~ Peripheral edges of intermediate floor s ~~slabs~~ and extensions of floors that penetrate the building thermal envelope , including balconies, shall be provided with either continuous insulation having a minimum thermal resistance of R-3 or a minimum R-3 thermal break located where the concrete slab penetrates the building thermal envelope. Continuous applications of Fire safing shall be deemed to comply.

When compliance is in accordance with Section C402.1.5 on component performance alternative, the peripheral edges of intermediate floors and extensions of floors that penetrate the building envelope shall be considered above grade walls.

Exceptions:

1. Buildings located in Climate Zones 1 through 3.
2. Existing buildings or alterations to existing buildings.
3. Uninsulated walls.

Commenter's Reason: The requirements for overall assembly insulation have been well-addressed in the code. However, the existing requirements do not adequately address significant thermal bridging issues.
Thermal bridges are created when a relatively high thermally conductive material “bridges” through the insulating materials in the thermal envelope.
Disapproval was requested for CE81 during the IECC Code Development Hearings to modify and clarify the proposal to specifically address peripheral edges of intermediate floors and balconies, assemblies that are areas of significant thermal bridging.

This Public Comment provides some practical exceptions to bring this proposal in line with ASHRAE with the understanding that the R-3 insulation can be traded-off by using the component performance alternative if there are overriding structural issues that will make is difficult to comply with the R-3 requirement.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This will increase the cost of construction. Cost impact will vary depending on the approach taken. Note that the Component Performance Alternative can be used to trade-off the continuous insulation through increases in efficiencies in other parts of the building envelope that may result in lower construction costs.

Public Comment# 2083

Public Comment 2:

IECC®: C402.2.8 (New)

Proponents:
Martha VanGeem, representing Masonry Alliance for Codes and Standards; Tien Peng, NRMCA, representing NRMCA (tpeng@nrmca.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C402.2.8 Peripheral edges of intermediate ~~Concrete slab~~ floors and balconies. Peripheral edges of intermediate ~~Concrete floor slabs~~ floors and extensions of floors that penetrate the building thermal envelope , including balconies, shall be provided with either continuous insulation having a minimum thermal resistance of R-3 or a minimum R-3 thermal break located where the floor ~~concrete slab~~ penetrates the building thermal envelope. The insulation and thermal break material are allowed to be interrupted by structural connections and framing. Approved perimeter fire containment systems in accordance with the International Building Code shall be deemed to comply.

When compliance is in accordance with Section C402.1.5 on component performance alternative, the peripheral edges of intermediate floors and extensions of floors that penetrate the building envelope shall be considered walls.

Exceptions:

1. Buildings located in Climate Zone 1 through 3.
2. Existing buildings or alterations to existing buildings.
3. Uninsulated walls.
4. Buildings with not more than 20 percent of the gross above-grade wall area as vertical fenestration.
5. Extensions of floors that penetrate the building envelope that provide weather protection at grade, pedestrian, or street level and are at the first story above that level.
6. Extensions of floors and balconies where their total linear length as a percentage of the perimeter of the building on that story are limited to 35% in Climate Zone 4, 30% in Climate Zone 5, 20% in Climate Zone 6, 10% in Climate Zone 7, and 0% in Climate Zone 8.

Commenter's Reason: This modification clears up the vagueness of the original proposal in many ways.
1.) The heading and part of the body of the text in the original proposal refer to “concrete slabs floors” or “concrete floor slabs” (they are inconsistent). This is confusing because a “slab” is often thought of as a slab-on-grade floor in the IECC. This proposal does not pertain to “slab-on-grade floors” or “floors above outdoor air or unconditioned space”, another type of floor in the IECC. It applies to the edges of intermediate floor slabs, extensions of floor slabs, and balconies.
2.) Insulation cannot be used in place of structural connections. Wording was added that insulation can be interrupted by structural connections and framing. Structural engineers need to design balconies for wind and seismic loads. Proprietary balcony thermal break systems, used in Europe and specified by engineers in the U.S. who are interested in reducing thermal bridges, include structural connections to support cantilevered balconies.
3.) The joint between the cladding and intermediate floor slab is often filled with fire safing, a kind of insulation that provides enhanced fire protection. This is allowed to be used.
4.) Since Section 402.1.5 refers the U-factor, F-factor, and C-factor Table C402.1.4, and peripheral edges of slabs are not included in that table, it needs to be clarified that these edges and the balconies are part of the wall when using this compliance method.
5.) Exception 1 for climate zones 1 through 3 is similar to that in ASHRAE 90.1 addendum av on thermal bridges. Thermal bridges are responsible for more heat loss when the change in temperature (delta T) between the inside and outside of the building is greater. So their heat loss is greater in the winter in cold climates, where the delta T can be 60F or more, than in the summer in warm climates, where the delta T is more frequently 20F or less.
6.) Exception 2 for existing buildings is similar to that in the latest draft for ASHRAE 90.1 addendum av on thermal bridges. It can be very expensive to retrofit existing buildings to meet this requirement. It could be nearly impossible to retrofit cantilevered concrete balconies without destroying them.
7.) Exception 3 for uninsulated walls is similar to that in the ASHRAE 90.1 addendum av on thermal bridges. If a wall is uninsulated, then the intermediate floor is a similar thermal bridge as the wall itself. The intermediate floor edge is small compared to the area of the wall.
8.) Exception 4 is added because the glass windows in a building are actually the biggest thermal bridge in the building. A linear foot of glass has about the same heat loss as an intermediate floor. This recognizes that buildings with more opaque walls have more insulation and will often save more energy. The optimal amount of glazing for daylighting is often in the range of 20% of the above grade wall area. ASHRAE 90.1-2016 appendix G, Table G3.1.1-1, sets the baseline percentage of fenestration in the range of 6% for warehouses to 40% for large office buildings. Those individual percentages based on building type could be used here but it would complicate this proposal.
9.) Exceptions 5 is similar to that in ASHRAE 90.1 addendum av on thermal bridges. This recognizes the benefit of a covering overhead at building entrances and along sidewalks so that pedestrians can walk without getting wet (or as wet) during rain and snow events.

10.) Exception 6 is similar to that in ASHRAE 90.1 addendum av on thermal bridges. The emphasis here is to allow a small percentage of traditional balconies when this requirement is first introduced to the code for designers, contractors, and code officials to get used to the requirement, and to not ban traditional cantilevered balconies. The buildings that are showcased as the worst offenders have more balconies or overhangs in colder climates than in this exception. Balconies are an amenity in residential construction so that residences have access to the outdoors.
One argument for not having any exceptions might be that the requirements can be traded off using COMCheck (that the edge and balconies can be constructed without insulation if COMcheck is used). The fallacy of that is that the prescriptive requirements should be reasonable, practical, and cost effective. Some building owners and contractors just want to know what to do to comply and therefore need reasonable prescriptive requirements. Code officials need to know what compliance looks like.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This public comment only clarifies the original proposal with additional details necessary to contend with the practicalities of insulating peripheral areas in various buildings and construction arrangements. The public comment does not require additional material or labor than what the original proposal intends to require. The original proposal requires insulating of the peripheral areas (which does require added material and labor) and that why the net effect of the public comment and the proposal is an increase in the cost of construction.

Public Comment# 1811

CE87-19

IECC®: TABLE C402.4

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

TABLE C402.4
BUILDING ENVELOPE FENESTRATION MAXIMUM *U*-FACTOR AND SHGC REQUIREMENTS

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
Vertical fenestration																
U-factor																
Fixed fenestration	0.50		0.50		0.46		0.38		0.38		0.36		0.29		0.29	
Operable fenestration	0.65		0.65		0.60		0.45		0.45		0.43		0.37		0.37	
Entrance doors	1.10		0.83		0.77		0.77		0.77		0.77		0.77		0.77	
SHGC																
Orientation[a]	~~SEW~~ Fixed	~~N~~ Operable	~~SEW~~ Fixed	~~N~~ Operable	~~SEW~~ Fixed	~~N~~ Operable	~~SEW~~ Fixed	~~N~~ Operable	~~SEW~~ Fixed	~~N~~ Operable	~~SEW~~ Fixed	~~N~~ Operable	~~SEW~~ Fixed	~~N~~ Operable	~~SEW~~ Fixed	~~N~~ Operable
PF < 0.2	~~0.25~~ 0.23	~~0.33~~ 0.21	0.25	~~0.33~~ 0.23	0.25	~~0.33~~ 0.23	0.36	~~0.48~~ 0.33	0.38	~~0.51~~ 0.33	~~0.40~~ 0.38	~~0.53~~ 0.34	~~0.45~~ 0.40	~~NR~~ 0.36	~~0.45~~ 0.40	~~NR~~ 0.36
0.2 ≤ PF < 0.5	~~0.30~~ 0.28	~~0.37~~ 0.25	0.30	~~0.37~~ 0.28	0.30	~~0.37~~ 0.28	0.43	~~0.53~~ 0.40	0.46	~~0.56~~ 0.40	~~0.48~~ 0.46	~~0.58~~ 0.41	~~NR~~ 0.48	~~NR~~ 0.43	~~NR~~ 0.48	~~NR~~ 0.43
PF ≥ 0.5	~~0.40~~ 0.37	~~0.40~~ 0.34	0.40	~~0.40~~ 0.37	0.40	~~0.40~~ 0.37	0.58	~~0.58~~ 0.53	0.61	~~0.61~~ 0.53	~~0.64~~ 0.61	~~0.64~~ 0.54	~~NR~~ 0.64	~~NR~~ 0.58	~~NR~~ 0.64	~~NR~~ 0.58
Skylights																
U-factor	0.75		0.65		0.55		0.50		0.50		0.50		0.50		0.50	
SHGC	0.35		0.35		0.35		0.40		0.40		0.40		NR		NR	

NR = No Requirement, PF = Projection Factor.

~~a. "N" indicates vertical fenestration oriented within 45 degrees of true north. "SEW" indicates orientations other than "N." For buildings in the southern hemisphere, reverse south and north. Buildings located at less than 23.5 degrees latitude shall use SEW for all orientations.~~

Reason: The purpose of this code change proposal is to save energy, reduce energy costs and peak demand, and enhance occupant comfort by improving commercial fenestration SHGCs and making the IECC's treatment reasonably consistent with Addendum *aw* to ASHRAE Standard 90.1-2016, which will be part of the published Standard 90.1-2019. The proposal also greatly simplifies compliance with the prescriptive fenestration SHGC requirements in the IECC by adopting ASHRAE's "fixed" and "operable" approach to setting SHGC requirements, in lieu of requiring the user to determine the orientation of each fenestration product in the building in order to apply the IECC's current orientation-specific SHGCs. This proposal also maintains projection factor adjustments that are consistent with the current IECC approach but adjusts them according to the new "fixed" and "operable" distinction. These changes will result in energy savings and peak demand savings in every climate zone, and in many cases may reduce the size of cooling equipment. The proposal will also bring greater consistency between IECC and ASHRAE SHGC requirements while reducing unnecessary confusion.

The commercial IECC's prescriptive approach of incorporating orientation into its SHGC requirement has been unnecessarily complicated in recent years, and it has not provided any real efficiency or compliance benefits. The residential IECC prescriptive path has always applied a single SHGC to fenestration in each climate zone, irrespective of orientation, leaving more sophisticated design choices to the performance path, where it is more appropriate. By contrast, recent editions of the IECC have established orientation-specific SHGCs in the commercial prescriptive path by increasing the SHGC (and reducing efficiency) for northern orientations. The current SHGC division between South/East/West on one hand, and North-facing fenestration on the other, is unnecessary, less efficient, and too complicated for a prescriptive path that is most often used for simple commercial and multifamily buildings. To the extent that design professionals want to incorporate a more sophisticated solar design into a building, a performance compliance approach is a far more appropriate compliance path for such a design. The current orientation-specific SHGCs promote the idea that a design professional should incorporate a higher SHGC on the north-facing walls – an approach that is not only unlikely in practice, but potentially risky, since the wrong windows may be installed on the wrong side of the building. (Note that higher SHGCs on the north side are also less efficient; while a low SHGC is more beneficial on the other orientations, lower SHGCs provide benefits on north orientations as well.)

A better approach has been charted by ASHRAE in Addendum *aw*. ASHRAE sets SHGC requirements based on whether the fenestration is fixed or operable, since operable fenestration typically has larger frames and lower unit SHGCs as a result. ASHRAE does not differentiate the prescriptive SHGC requirements by orientation and has not set an artificially high and unrealistic SHGC for north-facing fenestration, recognizing that the lower SHGC is cost-effective on any side of the building. This approach has the added benefit of improving north-oriented fenestration SHGCs; these lower SHGCs were found by ASHRAE to be cost-effective (there is likely no additional cost associated with the improved SHGCs given the U-factor requirements).

While we would prefer even lower SHGCs in some climate zones, this proposal improves the SHGCs in every climate zone to varying degrees and is a step in the right direction. Low-SHGC fenestration is critically important in commercial buildings because of high daytime occupancy rates and higher internal thermal loads. Reducing solar heat gain will improve occupant comfort and may allow for the installation of smaller cooling equipment, which will not only save building owners money at construction, but again every time the equipment is replaced. Widespread use of low-SHGC fenestration (and the accompanying peak reduction) will also help reduce the need for utilities to build peaking plants or purchase peak electric power, which will ultimately benefit all utility ratepayers.

Cost Impact: The code change proposal will increase the cost of construction

While we believe that many windows currently being installed will already meet or exceed these SHGC requirements, in some cases, the lower SHGCs will require the selection of a more efficient window or the incorporation of other energy efficient measures in the IECC's performance-based compliance options, either of which may increase costs. However, since the SHGC is largely just the result of the choice of low-e coating, there may be no additional cost in most cases. Moreover, any increased glass costs may be more than offset by reduced cooling equipment costs in many cases. In any event, these SHGC values have all been thoroughly considered in ASHRAE's energy and cost-effectiveness analyses. To the extent that the lower SHGCs increase construction costs, based on ASHRAE's work, we expect that these improvements are cost-effective over the useful life of the building.

CE87-19

Public Hearing Results

Errata: This proposal includes published errata

Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Submitted**

Committee Reason: This proposal is consistent with others the committee has heard - bringing consistency with ASHRAE tables, and the increases in stringency are cost justified (Vote: 15-0).

Assembly Action: **None**

CE87-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE C402.4

Proponents:
Jeff Inks, representing Window and Door Manufacturers Association (jinks@wdma.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE C402.4
BUILDING ENVELOPE FENESTRATION MAXIMUM *U*-FACTOR AND SHGC REQUIREMENTS

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
Vertical fenestration																
U-factor																
Fixed fenestration	0.50		0.50		0.46		0.38		0.38		0.36		0.29		0.29	
Operable fenestration	0.65		0.65		0.60		0.45		0.45		0.43		0.37		0.37	
Entrance doors	1.10		0.83		0.77		0.77		0.77		0.77		0.77		0.77	
SHGC																
Orientation[a]	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable
PF < 0.2	0.23	~~0.21~~ 0.23	0.25	0.23	0.25	0.23	0.36	0.33	0.38	0.33	0.38	0.34	0.40	0.36	0.40	0.36
0.2 ≤ PF < 0.5	0.28	0.25	0.30	0.28	0.30	0.28	0.43	0.40	0.46	0.40	0.46	0.41	0.48	0.43	0.48	0.43
PF ≥ 0.5	0.37	0.34	0.40	0.37	0.40	0.37	0.58	0.53	0.61	0.53	0.61	0.54	0.64	0.58	0.64	0.58
Skylights																
U-factor	0.75		0.65		0.55		0.50		0.50		0.50		0.50		0.50	
SHGC	0.35		0.35		0.35		0.40		0.40		0.40		NR		NR	

NR = No Requirement, PF = Projection Factor.

Commenter's Reason: While we are supportive of the proposal as whole, we are submitting this public comment for consideration of a single modification to set the SHGC for operable products with a PF < 0.20 in Climate Zone 1, to 0.23 as it is for fixed products in Climate Zone 1. As noted by the proponents in the reason statement, an SHGC of 0.21 may not be problematic for many commercial building applications, however, it can be for sliding glass doors and for hung and sliding windows with narrow frame/sash profiles used in multifamily residential construction as well as other more residential style commercial buildings. While a combination of low-e and tinted glass can be used to achieve 0.21 SHGC, tinted glass is typically not well accepted in any type of residential application. Given operable products are more common for residential applications and the energy savings between products with an SHGC of 0.21 and 0.23 is limited, this modification is reasonable.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
While this proposal may not increase or decrease the cost of construction, it will allow the use of more desirable fenestration products, in particular for residential and residential style construction without a significant compromise in energy efficiency or overall efficiency gains achieved by the 2021 IECC.

Public Comment# 2076

CE93-19 Part I

IECC: Part I: C402.4.3, Chapter 6CE (New)\

IECC: Part II: R402.5(N1102.5), Chapter 6RE (IRC Chapter 44) (New)

Proposed Change as Submitted

Proponents: Marc Levitan, representing the ICC 500 Storm Shelter Development Committee; Benchmark Harris representing the National Storm Shelter Association (NSSA) (bharris@huckabee-inc.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C402.4.3 Maximum *U*-factor and SHGC. The maximum *U*-factor and solar heat gain coefficient (SHGC) for fenestration shall be as specified in Table C402.4.

The window projection factor shall be determined in accordance with Equation 4-5.

$PF = A/B$
(Equation 4-5)
where:

PF = Projection factor (decimal).

A = Distance measured horizontally from the farthest continuous extremity of any overhang, eave or permanently attached shading device to the vertical surface of the glazing.

B = Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave or permanently attached shading device. Where different windows or glass doors have different *PF* values, they shall each be evaluated separately.

Exception: The maximum U-factor and solar heat gain coefficient (SHGC) for fenestration shall not be required in storm shelters complying with ICC 500.

Add new standard(s) as follows:

ICC

International Code Council, Inc.
500 New Jersey Avenue NW 6th Floor
Washington DC 20001

ICC 500: ICC/NSSA Standard for the Design and Construction of Storm Shelters

Reason: This proposal is submitted by the National Storm Shelter Association (NSSA) and the ICC 500 Storm Shelter Standard Development committee.
The ICC 500 Standards Development committee is responsible for the development of the ICC/NSSA Standard for the Design and Construction of Storm Shelters. The committee is currently working on the development of the 2020 edition. In 2017 the ICC 500 committee held 7 open conference calls. In addition, there were numerous Working Group meetings and conference calls, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: https://www.iccsafe.org/codes-tech-support/codes/code-development-process/standards-development/is-stm.

NSSA was responsible for the development of the original standard for storm shelters in 2001, which ICC 500 replaced through an agreement between ICC and NSSA. Representing General, User and Producer interest categories, NSSA is a technical organization that is committed to promoting consistent quality in both residential and community storm shelters.

Storm windows have a limited availability with the U values required in Section C402.4.3 and C402.5. There is an elevated life-safety concern associated with storm shelters and any window must meet strict missile impact testing and pressure requirements or be protected upon activation of the shelter with shutters.

Cost Impact: The code change proposal will decrease the cost of construction
This modification will increase design options.

Analysis: The referenced standard, ICC 500-2014, is currently referenced in other 2018 I-codes.

CE93-19 Part I

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There is insufficient reason to entirely eliminate these requirements. We cannot abridge health requirements, and there are assemblies that can be constructed to comply with the current language (Vote: 15-0).

Assembly Action: **None**

CE93-19 Part I

Individual Consideration Agenda

Public Comment 1:

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Submitted

Commenter's Reason: This proposal specifies a specific type of building where more precedent requirements should be utilized. These types of structure are designed to place the occupants in a more safe situation which requires for impact resistant glazing. The U-factor and SHGC requirements and impact resistant requirements may not always be possible.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
Current compliance with the U-factor and SHGC requirements for impact-resistant windows (required for a storm shelter) can be very costly. Providing relief on storm shelter windows can substantially reduce costs of the windows and thus, the cost of construction for storm shelters.

Public Comment# 1789

NOTE: CE93-19 PART II DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

CE93-19 Part II

IECC: R402.5 (IRC N1102.5), ICC Chapter 06

Proposed Change as Submitted

Proponents: Benchmark Harris, representing National Storm Shelter Association (bharris@huckabee-inc.com)

2018 International Energy Conservation Code

Revise as follows:

R402.5 (IRC N1102.5) Maximum fenestration *U*-factor and SHGC (Mandatory). The area-weighted average maximum fenestration *U*-factor permitted using tradeoffs from Section R402.1.5 or R405 shall be 0.48 in *Climate Zones* 4 and 5 and 0.40 in *Climate Zones* 6 through 8 for vertical fenestration, and 0.75 in *Climate Zones* 4 through 8 for skylights. The area-weighted average maximum fenestration SHGC permitted using tradeoffs from Section R405 in *Climate Zones* 1 through 3 shall be 0.50.

> **Exception:** The maximum U-factor and solar heat gain coefficient (SHGC) for fenestration shall not be required in storm shelters complying with ICC 500.

Add new standard(s) as follows:

ICC

International Code Council, Inc.
500 New Jersey Avenue NW 6th Floor
Washington DC 20001

ICC 500: ICC/NSSA Standard for the Design and Construction of Storm Shelters

Reason: This proposal is submitted by the National Storm Shelter Association (NSSA) and the ICC 500 Storm Shelter Standard Development committee.
The ICC 500 Standards Development committee is responsible for the development of the ICC/NSSA Standard for the Design and Construction of Storm Shelters. The committee is currently working on the development of the 2020 edition. In 2017 the ICC 500 committee held 7 open conference calls. In addition, there were numerous Working Group meetings and conference calls, which included members of the committee as well as any interested party to discuss and debate the proposed changes. Related documentation and reports are posted on the BCAC website at: https://www.iccsafe.org/codes-tech-support/codes/code-development-process/standards-development/is-stm.

NSSA was responsible for the development of the original standard for storm shelters in 2001, which ICC 500 replaced through an agreement between ICC and NSSA. Representing General, User and Producer interest categories, NSSA is a technical organization that is committed to promoting consistent quality in both residential and community storm shelters.

Storm windows have a limited availability with the U values required in Section C402.4.3 and C402.5. There is an elevated life-safety concern associated with storm shelters and any window must meet strict missile impact testing and pressure requirements or be protected upon activation of the shelter with shutters.

Cost Impact: The code change proposal will decrease the cost of construction
This modification will increase design options.

Analysis: The referenced standard, ICC 500-2014, is currently referenced in other 2018 I-codes.

CE93-19 Part II

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: These are specific building uses and a reasonable relaxation of window requirements (Vote: 10-1).

Assembly Action: **None**

CE96-19

IECC: C202 (New), C402.5, C402.5.1, C402.5.1.2, C402.5.1.2.3 (New)

Proposed Change as Submitted

Proponents: Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gayathri@swinter.com); Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

SECTION C202
GENERAL DEFINITIONS

Add new definition as follows:

TESTING UNIT ENCLOSURE AREA. The area sum of all the boundary surfaces that define the *dwelling unit*, *sleeping unit*, or occupiable *conditioned space* including top/ceiling, bottom/floor, and all side walls. This does not include interior partition walls within the *dwelling unit*, *sleeping unit*, or occupiable *conditioned space*. Wall height shall be measured from the finished floor of the *conditioned space* to the finished floor or roof/ceiling air barrier above.

Revise as follows:

C402.5 Air leakage—thermal envelope (Mandatory). The building thermal envelope ~~of buildings~~ shall comply with Sections C402.5.1 through C402.5.8, or the building thermal envelope shall be tested in accordance with ASTM E 779 at a pressure differential of 0.3 inch water gauge (75 Pa) or an equivalent method approved by the code official and deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope is not greater than 0.40 cfm/ft^2 (2.0 L/s • m^2). Where compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6 and C402.5.7.

C402.5.1 Air barriers. A continuous air barrier shall be provided throughout the building thermal envelope. The continuous air barriers shall be ~~permitted to be~~ located on the inside or outside of the building thermal envelope, located within the assemblies composing the building thermal envelope, or any combination thereof. The air barrier shall comply with Sections C402.5.1.1 and C402.5.1.2.

Exception: Air barriers are not required in buildings located in Climate Zone 2B.

C402.5.1.1 Air barrier construction. The continuous air barrier shall be constructed to comply with the following:

1. The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.
2. Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.
3. Penetrations of the air barrier shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Sealing shall allow for expansion, contraction and mechanical vibration. Joints and seams associated with penetrations shall be sealed in the same manner or taped. Sealing materials shall be securely installed around the penetration so as not to dislodge, loosen or otherwise impair the penetrations' ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation. Sealing of concealed fire sprinklers, where required, shall be in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.
4. Recessed lighting fixtures shall comply with Section C402.5.8. Where similar objects are installed that penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.

C402.5.1.2 Air barrier compliance ~~options~~. A continuous air barrier for the opaque building envelope shall comply with the following:

1.Buildings or portions of buildings including Group R and Group I occupancy shall meet the provisions of Section C402.5.1.2.3.

Exception: Buildings in Climate Zones 2B, 3C, and 5C.

2.Buildings or portions of buildings including Group R and Group I occupancy in Climate Zones 3C and 5C shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.

3.Buildings or portions of buildings other than Group R and Group I occupancy shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.

C402.5.1.2.1 Materials. Materials with an air permeability not greater than 0.004 cfm/ft^2 (0.02 L/s • m^2) under a pressure differential of 0.3 inch water gauge (75 Pa) when tested in accordance with ASTM E2178 shall comply with this section. Materials in Items 1 through 16 shall be deemed to comply with this section, provided that joints are sealed and materials are installed as air barriers in accordance with the manufacturer's instructions.

1. Plywood with a thickness of not less than $^3/_8$ inch (10 mm).
2. Oriented strand board having a thickness of not less than $^3/_8$ inch (10 mm).
3. Extruded polystyrene insulation board having a thickness of not less than $^1/_2$ inch (12.7 mm).
4. Foil-back polyisocyanurate insulation board having a thickness of not less than $^1/_2$ inch (12.7 mm).
5. Closed-cell spray foam having a minimum density of 1.5 pcf (2.4 kg/m^3) and having a thickness of not less than $1^1/_2$ inches (38 mm).
6. Open-cell spray foam with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m^3) and having a thickness of not less than 4.5 inches (113 mm).
7. Exterior or interior gypsum board having a thickness of not less than $^1/_2$ inch (12.7 mm).
8. Cement board having a thickness of not less than $^1/_2$ inch (12.7 mm).
9. Built-up roofing membrane.
10. Modified bituminous roof membrane.
11. Fully adhered single-ply roof membrane.
12. A Portland cement/sand parge, or gypsum plaster having a thickness of not less than $^5/_8$ inch (15.9 mm).
13. Cast-in-place and precast concrete.
14. Fully grouted concrete block masonry.
15. Sheet steel or aluminum.
16. Solid or hollow masonry constructed of clay or shale masonry units.

C402.5.1.2.2 Assemblies. Assemblies of materials and components with an average air leakage not greater than 0.04 cfm/ft^2 (0.2 L/s • m^2) under a pressure differential of 0.3 inch of water gauge (w.g.)(75 Pa) when tested in accordance with ASTM E2357, ASTM E1677 or ASTM E283 shall comply with this section. Assemblies listed in Items 1 through 3 shall be deemed to comply, provided that joints are sealed and the requirements of Section C402.5.1.1 are met.

1. Concrete masonry walls coated with either one application of block filler or two applications of a paint or sealer coating.
2. Masonry walls constructed of clay or shale masonry units with a nominal width of 4 inches (102 mm) or more.
3. A Portland cement/sand parge, stucco or plaster not less than $^1/_2$ inch (12.7 mm) in thickness.

Add new text as follows:

C402.5.1.2.3 Dwelling and sleeping unit enclosure testing The building thermal envelope shall be tested in accordance with ASTM E 779, ANSI/RESNET/ICC 380, ASTM E1827 or an equivalent method approved by the code official. The measured air leakage shall not exceed 0.30 cfm/ft^2 (1.5 L/s m^2) of the testing unit enclosure area at a pressure differential of 0.2 inch water gauge (50 Pa). Where multiple dwelling units or sleeping units or other occupiable conditioned spaces are contained within one building thermal envelope, each unit shall be considered an individual testing unit and the building air leakage shall be the weighted average of all testing unit results, weighted by each testing unit's testing unit enclosure area. Units shall be tested separately with an unguarded blower door test as follows:

1. Where buildings have fewer than eight testing units, each testing unit shall be tested.
2. For buildings with eight or more testing units the greater of seven units or 20 percent of the testing units in the building shall be tested including a top floor unit, a ground floor unit, and a unit with the largest testing unit enclosure area. Where any tested unit exceeds the maximum air leakage rate, an additional 20 percent of units shall be tested, including a mixture of testing unit types and locations.

Reason: Air leakage can be a significant source of energy waste in buildings, contributing to higher heating and cooling costs for building owners and occupants, and increasing risk related to comfort and durability. Air tightness testing can result in more attention to air barrier sealing and significantly reduced building leakage. Currently, the residential energy code requires air tightness testing for residential buildings three stories and less in height to ensure proper tightness and a controlled indoor environment. However, in the commercial energy code there is no testing requirement for residential buildings four stories or more in height (e.g., apartments, dormitories, hotel guest rooms). Industry standards affecting these buildings have historically relied upon visual verification, as well as material and assembly requirements. Providing adequate control over air leakage can also allow many benefits, including reduced HVAC equipment sizing, better building pressurization, and energy savings due to reduced heating and cooling of infiltrated outside air. In moist climates, ensuring lower leakage through testing can also result in better humidity control and reduced risk of durability issues.
Air barrier testing saves energy by reducing infiltration of outside air into and out of the building. Most of the time, outside air is hotter or colder than the comfort temperature being maintained in the residence by the heating and cooling systems. Therefore, reducing the infiltration will reduce energy use for heating and cooling. This proposal would require that blower door testing be applied to a sample of units or occupiable spaces in a multiple unit residential construction project. The equipment and staff required are the same as are needed in current air leakage testing required under the residential energy code.

Why is building leakage testing superior to other approaches?

While it is important that the materials and assemblies have limited leakage, specification by individual materials and assemblies does not necessarily equate to an air-tight building. Recent research (Wiss 2014) shows that 40% of buildings constructed without an envelope consultant have air leakage exceeding the current optional test standard of 0.40 cfm/ft^2 at 75 Pa, while buildings with envelope consultants had leakage below 0.25 cfm/ft^2 at 75 Pa. Requiring testing will ensure that the goal of this section of the code—limiting unintended air infiltration in buildings—is achieved.

What strategies are considered to minimize compliance burdens in the field?

To manage testing cost, a testing approach is proposed that requires only 20% of the units (with a seven-unit minimum) to be tested in the building. The testing method is also an unguarded test of individual units that reduces cost significantly compared to whole building testing or guarded unit testing. To motivate high-quality air sealing, additional testing of an additional 20% of the units would be required if any unit exceeds the leakage limit. Then the weighted average of tested units is used for comparison to the required leakage limit. While the testing requirement is slightly less stringent than the residential code, it matches current optional commercial requirements and is an improvement over the current condition of no testing requirements in the commercial code. It also provides a more reasonable target than air changes per hour for these units, which are typically smaller and have less total leakage than detached residences.

Are there existing codes and standards that require similar testing measures?

This proposal is similar to the residential air leakage provisions in the 2018 IECC in that it also requires the use of ASTM E 779. The proposal is similar to air leakage testing that is required by the State of Washington and City of Seattle commercial building energy codes as well as procedures followed by the U.S. Department of Defense for testing of commercial buildings. The City of Seattle requirements have been in place since 2009 and hundreds of commercial buildings have been tested under that code, including many large buildings. Additionally, thousands of dwelling units have successfully been tested and achieved this metric through the USGBC's LEED for Homes Multifamily Mid-Rise program and the EPA's ENERGY STAR Multifamily High Rise program. It will also be a required test in ASHRAE 62.2-2019.

Bibliography: Hart R and B Liu. 2015. *Methodology for Evaluating Cost-effectiveness of Commercial Energy Code Changes.* Pacific Northwest National Laboratory for U.S. Department of Energy; Energy Efficiency & Renewable Energy. PNNL-23923, Rev. 1. https://www.energycodes.gov/development/commercial/methodology
Hart R and M Tyler. 2018. *Envelope Air Tightness for Sleeping and Dwelling Units.* Pacific Northwest National Laboratory for U.S. Department of Energy. PNNL-28337. http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-28337.pdf

Wiss J. 2014. *ASHRAE 1478-RP Measuring Airtightness of Mid- and High-Rise Non-Residential Buildings*. Elstner Associates, Inc. for ASHRAE. https://web.ornl.gov/sci/buildings/conf-archive/2013%20B12%20papers/186-Brennan.pdf

Cost Impact: The code change proposal will increase the cost of construction
PNNL performed a cost-effectiveness analysis to identify the net impacts associated with the proposal using the established DOE methodology (Hart and Liu 2015). Results of the cost-effectiveness analysis indicate that the average savings-to-investment ratio (SIR) and simple payback (SPP) for unguarded dwelling unit testing with a limit of 0.30 cfm/ft^2 (1.5 L/s · m^2) at a pressure differential of 0.2 inch water gauge (50 Pa) in mid-rise apartment buildings were:

· SIR: 7.8; cost-effective if greater than 1.0

· SPP: 5.3 years; cost-effective if less than 40 year life

A measure is cost-effective when the SIR is greater than 1.0, indicating that the present value of savings is greater than the incremental cost. The cost for individual unguarded unit testing is expected to be significantly lower than the cost for whole building testing, especially with the sampling protocol provided. Results of the cost-effectiveness analysis were taken into account when developing this proposal (i.e., the recommended language only targets building types and climate zones where the testing requirement was determined to be cost-effective).

For buildings already conducting whole-building testing as their compliance option, this may decrease the cost of construction. For buildings not conducting testing, this is an increase in costs to perform the tests. This proposal however does not require more than what is currently required in the residential IECC for similar types of commercial buildings 3 stories and lower.

CE96-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:

C402.5.1.2.3 Dwelling and sleeping unit enclosure testing. The building thermal envelope shall be tested in accordance with ASTM E 779, ANSI/RESNET/ICC 380, ASTM E1827 or an equivalent method approved by the code official. The measured air leakage shall not exceed 0.30 cfm/ft^2(1.5 L/s · m^2) of the testing unit enclosure area at a pressure differential of 0.2 inch water gauge (50 Pa). Where multiple dwelling units or sleeping units or other occupiable conditioned spaces are contained within one building thermal envelope, each unit shall be considered an individual testing unit and the building air leakage shall be the weighted average of all testing unit results, weighted by each testing unit's testing unit enclosure area. Units shall be tested separately with an unguarded blower door test as follows:

1. Where buildings have fewer than eight testing units, each testing unit shall be tested.

2. For buildings with eight or more testing units the greater of seven units or 20 percent of the testing units in the building shall be tested including a top floor unit, a ground floor unit, and a unit with the largest testing unit enclosure area. For each ~~Where any~~ tested unit that exceeds the maximum air leakage rate, an additional 2~~0 percent of~~ units shall be tested, including a mixture of testing unit types and locations.

Committee Reason: This is a successful cost effective methodology which will decrease the stack effect in medium and high rise multi-family. There is no reason to limit testing to an arbitrary 3 stories or less. The modification provides clarification and a more reasonable threshold (Vote 14-1).

Assembly Action: **None**

CE96-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C402.5.1.2

Proponents:
Martha VanGeem, self, representing Masonry Alliance for Codes and Standards

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C402.5.1.2 Air barrier compliance . A continuous air barrier for the opaque building envelope shall comply with the following:

1. Buildings or portions of buildings including Group R and Group I occupancy shall meet the provisions of Section C402.5.1.2.3.
   Exception: Buildings in Climate Zones 2B, 3C, and 5C.

2. Buildings or portions of buildings that do not comply with C402.5.1.2.3 ~~including Group R and Group I occupancy in Climate Zones 3C and 5C~~ shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.
3. ~~Buildings or portions of buildings other than Group R and Group I occupancy shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.~~

Commenter's Reason: There are two paths of compliance in C402.5 -- detailed continuous air barrier requirements in Sections C402.5.1 through C402.5.8 OR testing and C402.5.5 through C402.5.7. In the original proposal, the testing requirements have been inserted into Section C402.5.1 (as section C402.5.1.2.3) which is the air barrier requirements for when testing is not required. The original proposal should have changed the charging language in C402.5 to clarify when testing is required and not put the testing requirements within path where no testing is required (C402.5.1 and C402.5.1.2).

Here is the text from C402.5:
The building thermal envelope of buildings shall comply with Sections C402.5.1 through C402.5.8, OR the building thermal envelope shall be tested… … Where compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6 and C402.5.7.

This public comment includes the original intent of the section – that if testing is performed (C402.5.1.2.3), then the materials and assembly requirements C402.5.1.2.1 and C402.5.1.2.2 do not need to be demonstrated. Requiring buildings to comply with C402.5.1.2.3 as well as C402.5.1.2.1 and C402.5.1.2.2 would increase costs unnecessarily and conflict with the charging paragraph of C402.5.

Bullets (2.) and (3.) can be combined to be applied to all buildings. The use of the word "including" is not clear in bullet (2.). It can mean including Group R and I and other buildings as well.

To clean up the text, clarify the text, and make it consistent with the language in C402.5, the new item (2.) applies to all buildings. The exception under C402.5.1 already provides an exemption for Climate Zone 2B.

Hopefully it is still clear from the charging paragraph of Section C402.5 that compliance with sections C402.5.2, C402.5.3, C402.5.4, and C402.5.8 is not required when testing according to C401.5.1.2.3 is used for compliance.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The public comment is only a clarification that does not add (or subtract) materials or labor costs. Because the original proposal increases the cost of construction, the net effect of both is an increase in the cost of construction.

Public Comment# 1887

Public Comment 2:

Proponents:
Duane Jonlin, representing Seattle Department of Construction and Inspections (duane.jonlin@seattle.gov)

requests Disapprove

Commenter's Reason: Please <u>disapprove</u> CE96 for dwelling unit compartmentalization testing.
Pressure testing of individual apartment units does <u>not</u> relate to envelope air leakage or it's associated energy loss. More air typically leaks through apartment's interior partitions, floor, and ceiling than through the exterior wall.

Air movement between apartments is a matter for a green code or building code, but is not in the scope of the IECC.

The only condition where compartmentalization testing is warranted is for apartments that are accessed via balconies directly from the exterior, so that whole-building testing is not warranted. Therefore, if the membership prefers to keep this change to accommodate that specific circumstance, the third sentence in C402.5.1.2.3 should be modified to read:

"Where multiple dwelling units or sleeping units or other occupiable conditioned spaces are contained within one building thermal envelope, <u>and the individual dwelling or sleeping units are accessed directly from the building exterior</u>, each unit shall be considered an individual testing unit and the building air leakage shall be the weighted average of all testing unit results, weighted by each testing unit's testing unit enclosure area."

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Because this public comment would result in no code change there is no impact to cost.

Public Comment# 2022

Public Comment 3:

Proponents:
Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests Disapprove

Commenter's Reason: Disapproval in support of CE97-19 which is more in line with the current code provisions and supported by the testing used as the basis of both CE96-19 and CE97-19. Testing and cost data for both proposals, which is based on testing of commercial buildings, did not include testing of R and I occupancies has no bases. The proposed change CE96-19 which includes testing of R and I occupancies should be disapproved.

The requirements for testing of dwelling units in CE96-19 is also in error. The testing procedure does not include a requirement that the air testing shall be to determine the air leakage to the building exterior (which is what the concern is) vs. testing the air leakage of the individual unit, which if not done properly, could include leakage to adjoining units to the side, below, above and to the interior of the building.

CE96-19 and CE97-19 also include supporting information stating that 40% of the buildings constructed without an envelope consultant have air leakage exceeding the current optional test standard of 0.40 cfm/ft^2 at 75 PA. In other words, 60% of the buildings with an envelope consultant pass the test. Clearly, the simple solution, other than testing, is to use an envelope consultant to ensure that the building envelope meets the requirements of Section C402.5.1.2.1 Materials or C402.5.1.2.2 Assemblies as required by current code and CE97-19.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1194

CE97-19

IECC®: C402.5, C402.5.1, C402.5.1.2, C402.5.1.2.3 (New)

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing Northwest Energy Codes Group (ericM@newbuildings.org)

2018 International Energy Conservation Code

Revise as follows:

C402.5 Air leakage—thermal envelope (Mandatory). The building thermal envelope ~~of buildings~~ shall comply with Sections C402.5.1 through C402.5.8, or the building thermal envelope shall be tested in accordance with ~~ASTM E 779 at a pressure differential of 0.3 inch water gauge (75 Pa) or an equivalent method approved by the code official and deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope is not greater than 0.40 cfm/ft^2 (2.0 L/s • m^2).~~ Section C402.5.1.2.3. Where compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6 and C402.5.7.

C402.5.1 Air barriers. A continuous air barrier shall be provided throughout the building thermal envelope. The air barriers shall be ~~permitted to be~~ located on the inside or outside of the building thermal envelope, located within the assemblies composing the building thermal envelope, or any combination thereof. The air barrier shall comply with Sections C402.5.1.1 and C402.5.1.2.

Exception: Air barriers are not required in buildings located in Climate Zone 2B.

C402.5.1.2 Air barrier ~~compliance options.~~ compliance. A continuous air barrier for the opaque building envelope shall comply with the following:

1. Buildings or portions of buildings including group R and group I occupancy shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.
2. Buildings or portions of buildings of other than group R and group I occupancy shall meet the provisions of Section C402.5.1.2.3.

   Exceptions:

   1. Buildings in Climate Zones 2B, 3B, 3C, and 5C.
   2. Buildings larger than 5000 square feet floor area in Climate Zones 0B, 1, 2A, 4B, and 4C.
   3. Buildings between 5000 and 50,000 square feet floor area in Climate Zones 0A, 3A and 5B.

3. Buildings or portions of buildings other than group R and group 1 occupancy that do not complete air barrier testing shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.

Add new text as follows:

C402.5.1.2.3 Non-residential building thermal envelope testing The building thermal envelope shall be tested in accordance with ASTM E 779 or an equivalent method approved by the code official. The measured air leakage shall not exceed 0.40 cfm/ft^2 (2.0 L/s · m^2) of the building thermal envelope area at a pressure differential of 0.3 inch water gauge (75 Pa). Alternatively, portions of the building shall be tested and the measured air leakages shall be area-weighted by the surface areas of the building envelope in each portion. The weighted average test results shall not exceed the whole building leakage limit. In the alternative approach, the following portions of the building shall be tested:

1. The entire envelope area of all stories that have any spaces directly under a roof,
2. The entire envelope area of all stories that have a building entrance, exposed floor, or loading dock, or are below grade, and
3. Representative above-grade sections of the building totaling at least 25 percent of the wall area enclosing the remaining conditioned space.

Exception: Where the measured air leakage rate exceeds 0.40 cfm/ft^2 (2.0 L/s•m^2) but does not exceed 0.60 cfm/ft^2 (3.0 L/s•m2), a diagnostic evaluation using smoke tracer or infra-red imaging shall be conducted while the building is pressurized along with a visual inspection of the air barrier. Any leaks noted shall be sealed where such sealing can be made without destruction of existing building components. An additional report identifying the corrective actions taken to seal leaks shall be submitted to the code official and the building owner, and shall be deemed to comply with satisfy the requirements of this section.

Reason: Air leakage can be a significant source of energy waste in buildings, contributing to higher heating and cooling costs for building owners and occupants, and increasing risk related to comfort and durability. Air tightness testing can result in more attention to envelope assembly air barrier sealing and significantly reduced building leakage. Currently Section C402.5 Air Leakage – thermal envelope, allows air tightness testing as an alternative to meeting material or assembly selection and installation method requirements to ensure proper tightness and a controlled indoor environment. Adequate control over air leakage can provide many benefits, including reduced HVAC equipment sizing, better building pressurization, and energy savings due to reduced heating and cooling of infiltrated outside air. In moist climates, ensuring lower air leakage through whole-building testing can also result in better humidity control and reduced risk of durability issues.

While it is important that the materials and assemblies have limited leakage, that alone does not guarantee a low leakage building. Recent research (Wiss 2014) shows that 40% of buildings constructed *without* an envelope consultant have air leakage exceeding the currently optional test standard requirements, while buildings with envelope consultants all had leakage below 0.25 cfm/ft^2. Testing is the most reliable means of ensuring that the intent of this code section—limiting unintended energy waste in buildings due to air infiltration—will be achieved.

The measure retains the current IECC optional compliance path test limit of 0.40 cfm/ft^2 at 75 Pa. Since mandatory—rather than optional— testing would be a new requirement, it is appropriate to retain the current and higher limit of 0.4 cfm/ft^2 for improved building industry acceptance. Durston and Heron's review (2012) of the more stringent requirements by the U.S. Department of Defense (DOD) shows that without testing, the range of building leakage can exceed the requirement by more than double (0.9 cfm/ft^2). However, with testing included as part of the construction process, the average leakage of buildings was determined to be well below the 0.4 cfm/ft^2 limit. Therefore, based on the DOD findings, the test limit of 0.40 cfm/ft^2 is considered a realistic and achievable goal. In addition, the target is well established in the IECC, and aligns with similar optional requirements contained in Standard 90.1.

Intent of the Code Change Proposal

This code change proposal will require

· The leakage testing thresholds are the same as current optional testing thresholds.

· Proposed requirements for testing vary by climate zone and building size and are based on industry-accepted cost-effectiveness analysis methods.

· As outlined in the optional compliance path, portions of buildings could be tested on a sampling basis.

· Commercial buildings under 5000 square feet can be tested using residential methods, technicians, and equipment with the maximum leakage rate set at 0.30 cfm/ft^2 (1.5 L/s · m^2) at 0.2 in. w.g. (50 Pa). This testing pressure differential is common for residential testing, and is equivalent to a leakage rate of 0.40 cfm/ft^2 (1.5 L/s · m^2) at 0.3 in. w.g. (75 Pa), the current alternative commercial test limit. Yet, implementing the residential procedure can dramatically reduce testing costs for these smaller buildings.

· Since this would be a new requirement, a backup exception is provided so that if a building fails the 0.40 cfm/ft^2 test, the building can still pass the requirement as long as the tested value is below 0.60 cfm/ft^2 and additional diagnostics are performed.

Climate Zones 0A and 0B are included in the code change proposal assuming that a code change proposal submitted by SEHPCAC to update the climate zones is submitted and approved. These climate zone designations can be removed from the proposal with no impact if the climate zones are not updated.

What strategies are considered to minimize compliance burdens in the field?

Three specific strategies are applied to minimize the impact of testing on building project costs:

· Testing is only required for certain building types and climate zones where analysis indicates it is cost-effective and the savings justifies the cost. Based on that analysis, size thresholds by climate zone are provided for non-residential buildings.

· It is also prudent to provide some flexibility in the test standard to allow for building industry acceptance and a transition to meeting a fixed testing requirement. Specifically, when the building envelope is complete and testing occurs, access to the air barrier for repairs is difficult. Thus, an exception is included that allows the tested leakage rate to be no more than 0.6 cfm/ft^2 as long as specific remediation efforts are made. This exception is meant to provide a modest relaxation of the requirement, but only if significant corrective actions are taken that may reduce the air leakage.

· As an additional strategy, the measure allows representative portions or a sample of spaces in the building to be tested instead of the whole building. This alternative supports more economical testing of large buildings, which can help reduce the compliance burden and is consistent with similar requirements in ASHRAE 90.1-2016.

Existing Codes and Standards that Require Similar Testing Measures

The measure is consistent with air leakage testing requirements and thresholds required by the State of Washington and City of Seattle commercial building energy codes (SDCI Community Engagement 2012), as well as procedures followed by the DOD for testing of commercial buildings referenced above. The City of Seattle requirements have been in place since 2009, and hundreds of commercial buildings have been tested under that code, including many large buildings. The proposed measure is less stringent than the current DOD requirements (0.25 cfm/ft^2), and case studies (Durston and Heron 2012) have shown that much lower leakage levels—in the range of 0.15 cfm/ft^2—can be achieved.

Energy Savings

An analysis of energy impact shows that annual energy savings from air barrier improvement resulting from testing due to the measure ranges from $5.07 to $71.88 per thousand square feet of floor area in offices in climate zones where testing is recommended. More details are found in the cost-effectiveness analysis referenced in the Appendix.

Cost-effectiveness: Pacific Northwest National Laboratory performed a cost-effectiveness analysis using the established DOE methodology (Hart and Liu 2015). Results of the analysis indicate that the average savings-to-investment ratio (SIR) and simple payback period (SPP) for commercial building testing with a limit of 0.40 cfm/ft^2 (1.5 L/s · m^2) at a pressure differential of 0.3 inch w.g. (50 Pa) in office buildings vary by size, as shown in the table below.

Building size range, floor area square feet	**<5000**	**5000 to 50,000**	**>50,000**
Average SIR	7.3	2.2	3.2
Average SPP (years)	7.1	13.1	10.2

A measure is cost-effective when the SIR is greater than 1.0, indicating that the present value of savings is greater than the incremental cost. Under ASHRAE 90.1 criteria, cost-effectiveness is proven when the simple payback is shorter than the scalar threshold of 22.2 years. Based on the cost-effectiveness analysis results, air barrier testing is specified for buildings that have both an SIR greater than 1 and a simple payback that is less than the 90.1 scalar threshold based on climate zone and building size.

As a result of breaks in cost assumptions, most climate zones qualify for testing for buildings below 5000 square feet, with fewer climate zones requiring testing for buildings larger than 50,000 square feet, and the fewest climate zones requiring testing for buildings between 5000 and 50,000 square feet.

Bibliography: TechBrief-ComBldgAirLeakageTesting_PNNL-28367
https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-28367.pdf

Wiss J. 2014. *ASHRAE 1478-RP Measuring Airtightness of Mid- and High-Rise Non-Residential Buildings*. Elstner Associates, Inc. for ASHRAE. https://www.ashrae.org/resources--publications/periodicals/enewsletters/esociety/2014-12-10-articles/completed-research-december-2014.

Durston JL and M Heron. 2012. *Summary and Analysis of Large Building Air Leakage Testing for the U.S. Department of Defense*. Atlanta, GA. http://c.ymcdn.com/sites/www.nibs.org/resource/resmgr/BEST/best3_durston.2.9.pdf.

Hart R and B Liu. 2015. *Methodology for Evaluating Cost-effectiveness of Commercial Energy Code Changes*. Pacific Northwest National Laboratory for U.S. Department of Energy; Energy Efficiency & Renewable Energy. PNNL-23923, Rev. 1. https://www.energycodes.gov/development/commercial/methodology.

SDCI Community Engagement. 2012. "Air Barriers and Pressure Testing." *Building Connections*, March 12, 2012. http://buildingconnections.seattle.gov/2012/03/01/air-barriers-and-pressure-testing/.

Background References

NEEC. 2011. *Air Barrier Management Fact Sheet*. https://neec.net/wp-content/uploads/2009/04/NREC-Air-Barrier-07-2011.pdf.

Air Barrier Association of America. 2018. *ABAA Energy Savings Calculator*. http://www.airbarrier.org/technical-information/energy-savings-calculator/.

Cost Impact: The code change proposal will increase the cost of construction
This measure will increase the cost of construction of new commercial buildings as whole building air leakage testing will be required except for primarily residential buildings (Group R and I building occupancies). Based on a survey of professional commercial building air barrier testing companies, it was determined that the cost of air leakage testing fell into three ranges:

· $350 or $0.12 to $0.07 per square foot for buildings up to 5000 square feet

· $0.50 to $0.15 per square foot for buildings between 5000 and 50,000 square feet

· $0.15 to $0.09 per square foot for buildings between 50,000 and 100,000 square feet, with decreasing costs for larger buildings.

As demand for air leakage testing in commercial buildings increases, more companies will enter the market to provide these services. Therefore, a gradual decrease in cost is expected as more companies are available to do the testing.

CE97-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
C402.5.1.2 Air barrier compliance. A continuous air barrier for the opaque building envelope shall comply with the following:

1. Buildings or portions of buildings including group R and group I occupancy shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.
2. Buildings or portions of buildings of other than group R and group I occupancy shall meet the provisions of Section C402.5.1.2.3.

   Exceptions:

   Buildings in Climate Zones 2B, 3B, 3C, and 5C.
   Buildings larger than 5000 square feet floor area in Climate Zones 0B, 1, 2A, 4B, and 4C.
   Buildings between 5000 and 50,000 square feet floor area in Climate Zones 0A, 3A and 5B.
   3. Buildings or portions of buildings other than group R and group I ~~1~~ occupancy that do not complete air barrier testing shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.

C402.5.1.2.3 ~~Non-residential b~~ Building thermal envelope testing . The building thermal envelope shall be tested in accordance with ASTM E 779 , ANSI/RESNET/ICC 380, or ASTM E1827 or an equivalent method approved by the code official. The measured air leakage shall not exceed 0.40 cfm/ft^2 (2.0 L/s · m^2) of the building thermal envelope area at a pressure differential of 0.3 inch water gauge (75 Pa). Alternatively, portions of the building shall be tested and the measured air leakages shall be area-weighted by the surface areas of the building envelope in each portion. The weighted average test results shall not exceed the whole building leakage limit. In the alternative approach, the following portions of the building shall be tested:

1. The entire envelope area of all stories that have any spaces directly under a roof,
2. The entire envelope area of all stories that have a building entrance, exposed floor, or loading dock, or are below grade, and
3. Representative above-grade sections of the building totaling at least 25 percent of the wall area enclosing the remaining conditioned space.

Exception: Where the measured air leakage rate exceeds 0.40 cfm/ft^2 (2.0 L/s•m^2) but does not exceed 0.60 cfm/ft^2(3.0 L/s•m2), a diagnostic evaluation using smoke tracer or infra-red imaging shall be conducted while the building is pressurized along with a visual inspection of the air barrier. Any leaks noted shall be sealed where such sealing can be made without destruction of existing building components. An additional report identifying the corrective actions taken to seal leaks shall be submitted to the code official and the building owner, and shall be deemed to comply with satisfy the requirements of this section.

Committee Reason: This is a conservative step that that has already been shown to be cost effective, it provides an alternative for very large buildings in testing a portion. The modifications correct the occupancy type and clarify building type that can use the method and additional testing standard (Vote: 12-3).

Assembly Action: **None**

Staff Analysis: Standard ASTM E1827 is already a referenced standard in this code. Standard ANSI/RESNET/ICC 380 is already referenced in another I-Code, specifically the IECC-Residential provisions.

CE97-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C402.5.1.2

Proponents:
Martha VanGeem, self, representing Masonry Alliance for Codes and Standards

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C402.5.1.2 Air barrier compliance. A continuous air barrier for the opaque building envelope shall comply with the following:

1. ~~Buildings or portions of buildings including group R and group I occupancy shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.~~

~~2.~~ 1. Buildings or portions of buildings of other than group R and group I occupancy shall meet the provisions of Section C402.5.1.2.3.

Exceptions:

1. Buildings in Climate Zones 2B, 3B, 3C, and 5C.
2. Buildings larger than 5000 square feet floor area in Climate Zones 0B, 1, 2A, 4B, and 4C.
3. Buildings between 5000 and 50,000 square feet floor area in Climate Zones 0A, 3A and 5B.

~~3.~~ 2. Buildings or portions of buildings ~~other than group R and group I occupancy~~ that do not complete air barrier testing shall meet the provisions of Section C402.5.1.2.1 or C402.5.1.2.2.

Commenter's Reason:
There are two paths of compliance in C402.5 -- detailed continuous air barrier requirements in Sections C402.5.1 through C402.5.8 OR testing and C402.5.5 through C402.5.7. In the original proposal, the testing requirements have been inserted into Section C402.5.1 (as section C402.5.1.2.3) which is the air barrier requirements for when testing is not required. The original proposal should have changed the charging language in C402.5 to clarify when testing is required and not put the testing requirements within path where no testing is required (C402.5.1 and C402.5.1.2).

Here is the text from C402.5:
The building thermal envelope of buildings shall comply with Sections C402.5.1 through C402.5.8, OR the building thermal envelope shall be tested… … Where compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6 and C402.5.7.

This public comment includes the original intent of the section – that if testing is performed (C402.5.1.2.3), then the materials and assembly requirements C402.5.1.2.1 and C402.5.1.2.2 do not need to be demonstrated. Requiring buildings to comply with C402.5.1.2.3 as well as C402.5.1.2.1 or C402.5.1.2.2 would increase costs unnecessarily and conflict with the charging paragraph of C402.5.

The original bullet item (1.) conflicted with the original bullet item (3.) because the original item (1.) could be read to include all "buildings or portions of buildings". "Including" is a subset of all buildings but doesn't disallow all buildings. It's meaning and use is confusing here.

To clean up the text, clarify the text, and make it consistent with the charging language in C402.5, the new item (2.) applies to all buildings and allows either testing OR compliance with C405.1.2.1 or C405.1.2.2.

Hopefully it is still clear from the charging paragraph of Section C402.5 that compliance with sections C402.5.2, C402.5.3, C402.5.4, and C402.5.8 is not required when testing according to C401.5.1.2.3 is used for compliance.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The public comment is only a clarification that does not add (or subtract) materials or labor costs. Because the original proposal increases the cost of construction, the net effect of both is an increase in the cost of construction.

Public Comment# 1896

Public Comment 2:

Proponents:
Duane Jonlin, representing Seattle Department of Construction and Inspections (duane.jonlin@seattle.gov)

requests As Modified by Committee

Commenter's Reason: Please <u>support</u> the Committee decision to require testing of air barriers.
The current code does little to control air leakage, because the problem is *not* air leaking right through the materials and assemblies themselves, but rather through the joints between these elements and penetrations through them. These leaks cannot be located or measured by visual inspection - the only way to know how much air is leaking through your building, and to start reducing that leakage, is to actually test it.

Air barrier tightness improves dramatically as soon as the trades involved know that the test will take place, simply because everyone is paying closer attention. Our experience here in Washington state is that buildings can pass easily, and we are now in the process of tightening up the test standard even further.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is a supportive comment, not involving a change in cost.

Public Comment 3:

Proponents:
Barry Greive, Target Corp, representing Target Corp (barry.greive@target.com)

requests Disapprove

Commenter's Reason: There is no real justification for this proposal. The envelope in larger buildings will be designed by licensed architects, usually with tested designs. The envelope is also inspected by the jurisdiction to ensure it is done per the design, code, and to ensure it is properly sealed. The proponents mention that there are not that many testers currently available, but if this is passed then there will be more, that is a reason not to allow this to move forward, the resources are not available at this time.
There are many buildings where this is just not feasible. Think about a large warehouse with multiple dock doors, some with close to 100 dock doors. Aircraft hangers and other manufacturing facilities. This proposal gives no exceptions for buildings with lower energy usage, or for high performing buildings.

A typical large distribution warehouse would cost (using the cost provided) over $270,000 for this test. This is another cost that is not needed, especially on small buildings which are using typical construction methods that don't meet the exceptions. Speaking of exceptions, if envelope testing is so beneficial there should be no exceptions. This is a huge hardship for small business, especially in smaller more out of the way jurisdictions that do not have the contractors readily available, if they have to travel far, the cost will surely increase beyond what is in the reason statement.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1320

CE99-19

IECC®: C103.2, C402.5.1, C402.5.1.3 (New)

<u>Proposed Change as Submitted</u>

Proponents: Eric Makela, New Buildings Institute, representing Northwest Energy Codes Group (ericM@newbuildings.org)

2018 International Energy Conservation Code

Revise as follows:

C103.2 Information on construction documents. Construction documents shall be drawn to scale on suitable material. Electronic media documents are permitted to be submitted where *approved* by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, systems and equipment as herein governed. Details shall include, but are not limited to, the following as applicable:

1. Insulation materials and their *R*-values.
2. Fenestration *U*-factors and solar heat gain coefficients (SHGCs).
3. Area-weighted *U*-factor and solar heat gain coefficient (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water heating systems and equipment types, sizes and efficiencies.
6. Economizer description.
7. Equipment and system controls.
8. Fan motor horsepower (hp) and controls.
9. Duct sealing, duct and pipe insulation and location.
10. Lighting fixture schedule with wattage and control narrative.
11. Location of *daylight* zones on floor plans.
12. Air ~~sealing details.~~ <u>barrier and air sealing details, including the location of the air barrier.</u>

C402.5.1 Air barriers. A continuous air barrier shall be provided throughout the building thermal envelope. The air barriers shall be permitted to be located on the inside or outside of the building envelope, located within the assemblies composing the envelope, or any combination thereof. The air barrier shall comply with Sections C402.5.1.1<u>, C402.5.1.2</u> and ~~C402.5.1.2.~~ <u>C402.5.1.3.</u>

Exception: Air barriers are not required in buildings located in *Climate Zone* 2B.

Add new text as follows:

<u>**C402.5.1.3 Building envelope performance verification.** The installation of the continuous air barrier shall be verified by a registered design professional or approved agency in accordance with the following:</u>

1. <u>A review of the construction documents and other supporting data shall be conducted to assess compliance with the requirements in Sections C402.5.1.</u>
2. <u>Inspection of continuous air barrier components and assemblies shall be conducted during construction while the air barrier is still accessible for inspection and repair to verify compliance with the requirements of Sections C402.5.1.1 and C402.5.1.</u>
3. <u>A final commissioning report shall be completed by the registered design professional or approved agency and provided to the building owner or owner's authorized agent and the code official. The report shall identify deficiencies found during the review of the construction documents and inspection and details of corrective measures used.</u>

Reason: The testing path for infiltration in the IECC requires a leakage rate of 0.40 CFM/sf @ 75PA. However, according to "Achieving the 30% Goal: Energy and Cost Savings Analysis of ASHRAE Standard 90.1-2010" prepared by the Pacific Northwest National Lab, the prescriptive air barrier requirements currently used in the IECC only achieve 1.0 CFM/sf @ 75Pa. The prescriptive path is therefore not achieving the level of performance achieved by the testing path. The code requires that air barrier materials meet 0.40 CFM/sf @ 75Pa, so the issue must be with installation and not the materials themselves. This proposal narrows that gap by requiring verification of the air barrier during construction and reporting back to the owner and code official in a manner similar to existing acceptance testing requirements, thereby ensuring better air barrier installation without actually requiring testing.
The proposal includes a sequence of requirements to ensure both effectiveness, ease of implementation and ease of enforcement. Key among these is a requirement that the inspection occur while remediation of errors can still be remedied. Submission of the report to the code official and the owner will ensure that the process has been followed.

The proposal also modifies the charging language in C402.5 and the construction documentation requirements in C103 to enable the new requirements.

According to Evan Mills, PhD, a researcher at Lawrence Berkeley National Laboratory, savings associated with using BECx from both maintenance and energy savings average about 16% for existing buildings and 13% for new construction (“Calculating the ROI of building enclosure commissioning.” *Building Design + Construction*. June 28, 2013.)

Cost Impact: The code change proposal will increase the cost of construction
Evan Mills, PhD, a researcher at Lawrence Berkeley National Laboratory studied the benefits of BECx, noting that commissioning only costs about $1.16/sf for new construction and $0.30/sf for existing buildings on average, with a payback period of as little as 14 months.

CE99-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
C402.5.1.3 Building envelope performance verification. The installation of the continuous air barrier shall be verified by the code official, a registered design professional or approved agency in accordance with the following:

1. A review of the construction documents and other supporting data shall be conducted to assess compliance with the requirements in Section C402.5.1.

2. Inspection of continuous air barrier components and assemblies shall be conducted while the air barrier is still accessible for inspection and repair to verify compliance with the requirements of Sections C402.5.1.1 and C402.5.1.

3. A final commissioning report shall be provided for inspections completed by the registered design professional or approved agency. ~~and~~ The commissioning report shall be provided to the building owner or owner's authorized agent and the code official. The report shall identify deficiencies found during the review of the construction documents and inspection and details of corrective measures ~~used~~ taken.

Committee Reason: This proposal fills an important gap, and provides an exemption for those buildings that were tested - it fills gap in prior approvals. The modification provides an important addition, allowing building official to provide verification (Vote: 14-1).

Assembly Action: **None**

CE99-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C402.5.1.3 (New)

Proponents:
David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C402.5.1.3 Building envelope performance verification. The installation of the continuous air barrier shall be verified by the code official, a registered design professional or approved agency in accordance with the following:

1. ~~A review of the construction documents and other supporting data shall be conducted to assess compliance with the requirements in Sections C402.5.1.~~
2. Inspection of continuous air barrier components and assemblies shall be conducted during construction while the air barrier is still accessible for inspection and repair to verify compliance with the requirements of Sections C402.5.1.1 and C402.5.1.
3. I~~A final commissioning report shall be provided f~~ For inspections completed by the registered design professional or approved agency a final

commissioning report shall be provided. The ~~and the~~ commissioning report shall be provided to the building owner or owner's authorized agent and the code official. The report shall identify deficiencies found during the review of the construction documents and inspection and details of corrective measures taken.

Commenter's Reason: Requiring a review of the construction documents is not necessary as all construction documents are required to be reviewed to determine compliance with the ICC Codes.
The changes proposed make it clear that when the inspections are performed by the registered design professional or approved agency would require a commissioning report and that it is provided to the owner and code official. With this change, and the changes by the committee it will be clear that the owner can rely on the building inspector to provide the necessary verification.

Bibliography: None

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The modification will simply clarify how the verification is to be performed and will have no cost impact.

Public Comment# 2005

Public Comment 2:

IECC®: C103.2, C408.4 (New)

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C103.2 Information on construction documents. Construction documents shall be drawn to scale on suitable material. Electronic media documents are permitted to be submitted where *approved* by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, systems and equipment as herein governed. Details shall include, but are not limited to, the following as applicable:

1. Insulation materials and their *R*-values.
2. Fenestration *U*-factors and solar heat gain coefficients (SHGCs).
3. Area-weighted *U*-factor and solar heat gain coefficient (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water heating systems and equipment types, sizes and efficiencies.
6. Economizer description.
7. Equipment and system controls.
8. Fan motor horsepower (hp) and controls.
9. Duct sealing, duct and pipe insulation and location.
10. Lighting fixture schedule with wattage and control narrative.
11. Location of *daylight* zones on floor plans.
12. Air barrier and air sealing details, including the location of the air barrier.

~~C402.5.1.3~~ C408.4 Building envelope performance verification. The installation of the continuous air barrier shall be verified by a registered design the code official, a registered design professional or approved agency in accordance with the following:

1. A review of the construction documents and other supporting data shall be conducted to assess compliance with the requirements in Sections C402.5.1.
2. Inspection of continuous air barrier components and assemblies shall be conducted during construction while there is still ready access to the air barrier ~~is still accessible~~ for inspection and repair to verify compliance with the requirements of Sections C402.5.1.1 and C402.5.1.
3. A final commissioning report shall be provided for inspections completed by the registered design professional or approved agency. The commissioning report shall be provided to the building owner or owner's authorized agent and the code official. The report shall identify deficiencies found during the review of the construction documents and inspection and details of corrective measures taken..

Commenter's Reason: This proposal has great merit, but it was originally located in the wrong section. This new section should be located in the commissioning section.
The change from 'accessible' to 'ready access' is for editorial consistency with CE29-19 Part II which was approved.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

Relocation of sections in the code are nearly editorial and as such, have no cost impact. Although the proposal indicated a cost increase, that may not be necessarily accurate for all projects because normally, the required inspections and report generation are already occurring.

Public Comment# 1793

Public Comment 3:

IECC®: C402.5.1.3 (New)

Proponents:
Martha VanGeem, self, representing Masonry Alliance for Codes and Standards; Margo Thompson, representing National Multifamily Housing Council (mthompson@newportventures.net); Emily Lorenz, representing PCI (emilyblorenz@gmail.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C402.5.1.3 Building envelope performance verification. The design and installation of the continuous air barrier shall be verified by a registered design professional or approved agency in accordance with the following:

1. A review of the construction documents and other supporting data shall be conducted to assess compliance with the requirements in Sections C402.5.1.
2. Inspection of continuous air barrier components and assemblies shall be conducted during construction while the air barrier is still accessible for inspection and repair to verify compliance with the requirements of Sections C402.5.1.1 and C402.5.1.
3. A final commissioning report shall be completed by the registered design professional or approved agency and provided to the building owner or owner's authorized agent and the code official. The report shall identify deficiencies found during the review of the construction documents and inspection and details of corrective measures used.

    Exception: Where the building thermal envelope meets the air leakage testing requirements of Section C402.5 and the testing report is provided to the building owner or owner's authorized agent and the code official, inspection of the continuous air barrier during construction by a registered design professional is not required.

Commenter's Reason: There are two paths of compliance in C402.5 -- detailed continuous air barrier requirements in Sections C402.5.1 through C402.5.8 OR testing and C402.5.5 through C402.5.7.
Inspection of continuous air barrier components and assemblies during construction by a registered design professional should not be required when testing meets the requirements of Section C402.5. This is an added cost in addition to the cost of testing.
- So, this public comment adds an exception that inspection during construction by a registered design professional is not required when the testing meets the requirements.
When testing is used for compliance, the report needs to be provided.

It is confusing whether this entire section C402.5.1.3 is required when testing is the path for compliance. Section C402.5.1 was not originally for the testing path (see the charging language for C402.5 and above description). Yet, the testing requirements have been put into Section C402.5.1 for some of the proposals (CE96 and CE97). Therefore, this text clarifies what is required.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The public comment is only a clarification that does not add (or subtract) materials or labor costs. Because the original proposal increases the cost of construction, the net effect of both is an increase in the cost of construction.

Public Comment# 1544

Public Comment 4:

Proponents:

Barry Greive, Target Corp, representing Target Corp (barry.greive@target.com)

requests Disapprove

Commenter's Reason: Air barrier third party verification is not necessary. This is another burdensome item on the contractor and owner. This would cost an owner of a large warehouse an additional 2+ million dollars to comply. The code already requires sealing, and the professional designer will ensure their design meets code. The jurisdiction should be inspecting this already too. In the reason statement it says there is a 14 month payback, will an owner really see a 2+ million dollar payback in 14 months?
Building envelope performance verification should be a trade-off or option, this should not be mandated. What benefit is there to requiring the code official to receive this report. I can see issues with the final report, will a jurisdiction now require verification of any deficiencies noted, to ensure they were corrected and will they trust the person to verify compliance?

This also gives no exception to buildings build with traditional and proven methods of construction. I can think of a prototypical chain food restaurant, they know their buildings, and have built thousands of them, what benefit is there to require someone on site to do another inspection. This can also cause a delay in construction because of the availability of qualified people to conduct this verification. What makes a person qualified? Allowing the code official is a good step, that provision was approved as modified. However, on large projects, the code official will not have enough time to do this while it is being constructed. As such, it will still require hiring a third party inspector or paying the architect to perform the verification.

This should not be mandatory, it should be a trade-off or an option.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1321

CE104-19

IECC®: C402.5.3

Proposed Change as Submitted

Proponents: donald sivigny, State of MN, representing State of MN and Association of Minnesota Building Officials (don.sivigny@state.mn.us)

2018 International Energy Conservation Code

Delete without substitution:

~~**C402.5.3 Rooms containing fuel-burning appliances.** In *Climate Zones* 3 through 8, where combustion air is supplied through openings in an exterior wall to a room or space containing a space-conditioning fuel-burning appliance, one of the following shall apply:~~

~~1.The room or space containing the appliance shall be located outside of the *building thermal envelope.*~~
~~2.The room or space containing the appliance shall be enclosed and isolated from conditioned spaces in-side the building thermal envelope. Such rooms shall comply with all of the following:~~
~~2.1.The walls, floors and ceilings that separate the enclosed room or space from conditioned spaces shall be insulated to be not less than equivalent to the insulation requirement of below-grade walls as specified in Table C402.1.3 or C402.1.4.~~
~~2.2.The walls, floors and ceilings that separate the enclosed room or space from conditioned spaces shall be sealed in accordance with Section C402.5.1.1.~~
~~2.3.The doors into the enclosed room or space shall be shall be fully gasketed.~~
~~2.4.Water lines and ducts in the enclosed room or space shall be insulated in accordance with Section C403.~~
~~2.5.Where an air duct supplying combustion air to the enclosed room or space passes through conditioned space, the duct shall be insulated to an *R*-value of not less than R-8.~~

~~**Exception:** Fireplaces and stoves complying with Sections 901 through 905 of the International Mechanical Code, and Section 2111.14 of the International Building Code.~~

Reason: The language in the IECC R402.5.3 is deleted in its entirety with no replacement language. Many of the appliances installed today due to Federal Energy Efficiency requirements and customer demands, are direct vent appliances with both intake and exhaust pipes continuous to the outside as listed in exception #1. The concern of this original code change is that the colder air that is installed as combustion air needs to be tempered or conditioned to the temperature of the rest of the building. The thought is that this will save money by not having to warm this colder air once it enters the building. There are advantages to having this open combustion air duct, in the area of the mechanicals in case any of the mechanical combustion appliances need additional air for proper combustion, this opening will supply it. This is a simple safety issue to make combustion air available. Remember, the code is not allowed to create a life safety issue. However the fallacy is in the thought process that this open duct is constantly bringing in cooler or warmer air into the building (depending on the season of the year and your climate zone,).This does not happen. There are some very simple and successful ways to prevent air from entering the building when it's not needed for combustion. With a 90 degree bend in the duct (the most common way) or placing the end of the duct in a pail or container etc. This can be done without the added costs of building walls around the mechanical room that meet the same requirements of the exterior walls of the home including air leakage, and R-values and U factors of the wall system. The average cost of framing a 10 foot wall is between $150 and $360 for labor and material, depending on location of the country you are building in. Add to that cost an additional $50 to $75 for insulation and another $100 to $150 for air sealing and the costs add up very fast. These costs don't even include the average exterior type of door that is required to be gasketed and sealed. Add another $250 to $300 not including Labor. And an additional $50 to $75 for the hardware, frame and door knobs. So where are the savings for meeting this code change? The fact is that the additional costs to do this are between $500.00 on the very low end, and $900 or more, on the higher end. This makes no sense. This code section is trying to solve a problem that does not exist. Especially if the building meets the air tightness requirements of the code already. Also the temperature on both sides of this very expensive wall system is basically the same temperature, why the need for insulation then? Building Physics will dictate that air needs a pressure differential, and a hole, to move air through these walls. Without both a pressure differential and a hole, air will not move. There will not be walls that are separating outside unconditioned air form interior conditioned air, and there will be essentially very little, or no pressure difference from one side of these walls to the other side because there is not going to be a Delta T (Temperature difference). Both sides will be conditioned space. With the cost of housing growing so fast in our country today let's not keep code changes in the code that cost a lot of money, for no return on the investment (ROI)

Cost Impact: The code change proposal will decrease the cost of construction
The cost factor of doing all this work to isolate theism room if and when a passive combustion air is brought into the space costs so much more than the language of the code will ever save in the first place.

CE104-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Encouraged the proponent to bring it back and clarify application for closed combustion appliances (Vote: 15-0).

Assembly Action: **None**

CE104-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Ted Williams, representing American Gas Association (twilliams@aga.org)

requests As Submitted

Commenter's Reason: The proponent's reasons for deleting the current language is correct and sufficient, especially since the current language is justified based upon life safety, not energy, issues. Life safety of equipment should be taken up in the appropriate ICC codes (e.g., the IFGC for gas-fired equipment).

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
The proponent's justification for decreased cost of construction is correct.

Public Comment# 2154

CE106-19

IECC: C402.5.9(New), C402.5.9.1(New), C403.1.3(New)

Proposed Change as Submitted

Proponents: Hope Medina, representing Self (hmedina@coloradocode.net)

2018 International Energy Conservation Code

Add new text as follows:

C402.5.9 Operable openings interlocking. (Mandatory) Occupancies that utilize an operable opening larger than 40 square feet shall have the openings interlocked with the heating and cooling system to raise the cooling setpoint to 80 degrees or heating to 70 degrees when the operable opening is open in the exterior wall of the building.

Exceptions:

1. Food cooking and prep areas that contain equipment that contributes to the mechanical load calculations of a restaurant type occupancy that are zoned separately.
2. Warehouses that utilize overhead doors for the function of the occupancy, where approved by the code official.
3. The first entrance doors where located in the exterior wall and are part of a vestibule system.

C402.5.9.1 Operable controls (Mandatory) Controls shall comply with Section C403.13.

C403.13 Operable opening interlocking controls. (Mandatory) The heating and cooling systems shall have controls that will interlock these mechanical systems to the set temperatures of 80 degrees for cooling and 70 degrees for heating when the conditions of Section C402.5.9 exist. The controls shall configure to shut off the systems entirely when the outdoor temperatures are below 80 degrees or above 70 degrees.

Reason: It has become a frequent practice for large operable windows, roll up doors, and/or sliding or folding doors to be installed and open to take advantage of cross ventilation or wind to assist with cooling and ventilation of a space. The problem has become that the cooling and heating systems for these spaces are still running, which does not assist with the energy efficiency of a building or space. The intent of this proposal is to address this common practice with a practical approach that utilizes similar concepts in other standards and other jurisdictional amendments without “banning” this practice.
The exceptions are needed to address very specific situations this requirement would hinder the function of the space. When preparing food often the equipment utilized is going to increase the need for mechanical cooling, and it is not the intent to cause any discomfort. The exceptions allow for the food prep areas to still utilize the mechanical cooling system. The second exception acknowledges that many warehouses will utilize natural ventilation, and these doors are often opened for this reason. The third exception is to address when the entrance door is opened for people who are coming and going of the space.

The controls for these systems would not need to be on when the outdoor temperatures have reached the set temperatures.

Cost Impact: The code change proposal will increase the cost of construction
While this requirement will have an increase of cost on the front end it should decrease the operation cost post construction.

CE106-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Based on proponent's request for disapproval to work on corrections (Vote: 15-0).

Assembly Action: **None**

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as ‘mandatory’ will instead have their respective section numbers added to the new non-tradeable requirement tables.

CE106-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C402.5.9 (New), C402.5.9.1 (New), C403.13 (New)

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C402.5.9 Operable openings interlocking. (Mandatory) Where occupancies ~~that~~ utilize ~~an~~ operable openings to the outdoors that are larger than 40 square feet in area ~~shall have the~~ such openings shall be interlocked with the heating and cooling system so as to raise the cooling set point to 90 ~~80~~ degrees ~~or~~ and lower the heating set point to 55 ~~70~~ degrees whenever the operable opening is open ~~in the exterior wall~~ The change in heating and cooling setpoints shall occur within 10 minute of opening the operable opening.

Exceptions:

1 Separately zoned areas associated with the preparation of food that ~~Food cooking and prep areas that~~ contain~~s~~ appliances ~~equipment~~ that contribute~~s~~ to the HVAC ~~mechanical~~ loads ~~calculations~~ of a restaurant ~~type~~ or similar type of ~~occupancy that are zoned separately~~.
2. Warehouses that utilize overhead doors for the function of the occupancy, where approved by the code official.
3. The first entrance doors where located in the exterior wall and are part of a vestibule system.

C402.5.9.1 Operable controls (Mandatory) Controls shall comply with Section C403.13.

C403.13 Operable opening interlocking controls. (Mandatory) The heating and cooling systems shall have controls that will interlock these mechanical systems to the set temperatures of 90 ~~80~~ degrees for cooling and 55 ~~70~~ degrees for heating when the conditions of Section C402.5.9 exist. The controls shall configure to shut off the systems entirely when the outdoor temperatures are below 90~~80~~ degrees or above 55 ~~70~~ degrees.

Commenter's Reason: The intent of this public comment is to address and correct some values that were entered incorrectly with the original proposal. It also incorporates suggestions from the committee to add a time frame associated for when this would be activated.
It has become common practice for restaurants and bars to have large operable openings, such as windows, or sliding /folding doors, or roll up/ overhead doors that are left over for a significant amount of time for either ambiance or to utilize cross ventilation. With the use of these openings the mechanical heating and cooling systems are still functioning as if these openings are not open, and not how they had been designed for. So much time and effort has been made to ensure that these commercial buildings to be energy efficient by having a good thermal envelope with efficient mechanical equipment sized to the building heating and cooling loads, that by leaving these windows and doors open it negates these efforts.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This public comment only adjusts control thresholds and adds an elapsed-time-to-disable-mechanical-system function, both of which is a matter of purchasing the appropriate control. The appropriate control shouldn't cost any more. The original proposal's cost increase is for adding the controls, sensors and wiring to facilitate the control methodology.

Public Comment# 1416

CE108-19

IECC: C202, C202(New), C403.1, C403.1.2 (New), TABLE C403.1.2(1) (New), TABLE C403.1.2(2)(New), TABLE C403.3.2(9), C405.1, TABLE C405.3.2(2), Chapter 6CE (New)

Proposed Change as Submitted

Proponents: Nicholas O'Neil, Energy 350, representing Energy 350 (noneil@energy350.com)

2018 International Energy Conservation Code

SECTION C202
GENERAL DEFINITIONS

Revise as follows:

COMPUTER ROOM. A room whose primary function is to house equipment for the processing and storage of electronic data ~~and that~~ which has a design ~~electronic data~~ total ITE equipment power density ~~of~~ less than or equal to 20 watts per square foot (20 watts per 0.092 m^2) of conditioned ~~floor~~ area or a ~~connected~~ design ~~electronic data~~ total ITE equipment load ~~of~~ less than or equal to 10 kW.

Add new definition as follows:

DATA CENTER. A room, or series of rooms that share data center systems, whose primary function is to house equipment for the processing and storage of electronic data and which has a design total ITE equipment power density exceeding 20 watts per square foot of conditioned area and a total design ITE equipment load greater than 10 kW.

DATA CENTER SYSTEMS. HVAC systems and equipment, or portions thereof used to provide cooling or ventilation in a data center.

INFORMATION TECHNOLOGY EQUIPMENT (ITE) ITE includes computers, data storage devices, servers, and network/communication equipment.

Revise as follows:

C403.1 General. Mechanical systems and equipment serving the building heating, cooling, ventilating or refrigerating needs shall comply with this section.

Exception: Data center systems are exempt from the requirements of Sections C403.4 and C403.5.

Add new text as follows:

C403.1.2 Data Centers Data center systems shall comply with Sections 6 and 8 of ASHRAE 90.4 with the following changes:

1. Replace design MLC values in the ASHRAE 90.4 specified in Table 6.2.1.1 with the values in Table C403.1.2(1) as applicable in each climate zone.
2. Replace annualized MLC values in the ASHREA 90.4 specified in Table 6.2.1.2 with the values in Table C403.1.2(2) as applicable in each climate zone.

C403.1.2(1)
Maximum Design Mechanical Load Component (Design MLC)

Climate Zones as Listed in ASHRAE Standard 169	Design MLC at 100% and at 50% ITE Load
0A	0.24
0B	0.26
IA	0.23
2A	0.24
3A	0.23
4A	0.23
5A	0.22
6A	0.22
1B	0.28
2B	0.27
3B	0.26
4B	0.23
5B	0.23
6B	0.21
3C	0.19
4C	0.21
5C	0.19
7	0.20
8	0.19

C403.1.2(2)
Maximum Annualized Mechanical Load Component (Annualized MLC)

Climate Zones as Listed in ASHRAE Standard 169	HVAC Maximum Annualized MLC at 100% and at 50% ITE Load
0A	0.19
0B	0.20
IA	0.18
2A	0.19
3A	0.18
4A	0.17
5A	0.17
6A	0.17
1B	0.16
2B	0.18
3B	0.18
4B	0.18
5B	0.16
6B	0.17
3C	0.16
4C	0.16
5C	0.16
7	0.16
8	0.16

Revise as follows:

TABLE C403.3.2(9)
MINIMUM EFFICIENCY AIR CONDITIONERS AND CONDENSING UNITS SERVING COMPUTER ROOMS AND DATA CENTERS

EQUIPMENT TYPE	NET SENSIBLE COOLING CAPACITY[a]	MINIMUM SCOP-127[b] EFFICIENCY DOWNFLOW UNITS / UPFLOW UNITS	TEST PROCEDURE
Air conditioners, air cooled	< 65,000 Btu/h	2.20 / 2.09	ANSI/ASHRAE 127
	≥ 65,000 Btu/h and < 240,000 Btu/h	2.10 / 1.99	
	≥ 240,000 Btu/h	1.90 / 1.79	
Air conditioners, water cooled	< 65,000 Btu/h	2.60 / 2.49	
	≥ 65,000 Btu/h and < 240,000 Btu/h	2.50 / 2.39	
	≥ 240,000 Btu/h	2.40 / 2.29	
Air conditioners, water cooled with fluid economizer	< 65,000 Btu/h	2.55 / 2.44	
	≥ 65,000 Btu/h and < 240,000 Btu/h	2.45 / 2.34	
	≥ 240,000 Btu/h	2.35 / 2.24	
Air conditioners, glycol cooled (rated at 40% propylene glycol)	< 65,000 Btu/h	2.50 / 2.39	
	≥ 65,000 Btu/h and < 240,000 Btu/h	2.15 / 2.04	
	≥ 240,000 Btu/h	2.10 / 1.99	
Air conditioners, glycol cooled (rated at 40% propylene glycol) with fluid economizer	< 65,000 Btu/h	2.45 / 2.34	
	≥ 65,000 Btu/h and < 240,000 Btu/h	2.10 / 1.99	
	≥ 240,000 Btu/h	2.05 / 1.94	

For SI: 1 British thermal unit per hour = 0.2931 W.

a. Net sensible cooling capacity: the total gross cooling capacity less the latent cooling less the energy to the air movement system. (Total Gross – latent – Fan Power).

b. Sensible coefficient of performance (SCOP-127): a ratio calculated by dividing the net sensible cooling capacity in watts by the total power input in watts (excluding reheaters and humidifiers) at conditions defined in ASHRAE Standard 127. The net sensible cooling capacity is the gross sensible capacity minus the energy dissipated into the cooled space by the fan system.

C405.1 General (Mandatory). This section covers lighting system controls, the maximum lighting power for interior and exterior applications and electrical energy consumption.

Dwelling units within multifamily buildings shall comply with Section R404.1. All other dwelling units shall comply with Section R404.1, or with Sections C405.2.4 and C405.3. Sleeping units shall comply with Section C405.2.4, and with Section R404.1 or C405.3. Lighting installed in walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with the lighting requirements of Section C403.10.1 or C403.10.2. Transformers, uninterruptable power supplies, motors and electrical power processing equipment in data center systems shall comply with Section 8 of ASHRAE 90.4 in addition to this code.

TABLE C405.3.2(2)
INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD

COMMON SPACE TYPES[a]	LPD (watts/sq.ft)
Atrium	
Less than 40 feet in height	0.03 per foot in total height
Greater than 40 feet in height	0.40 + 0.02 per foot in total height
Audience seating area	
In an auditorium	0.63
In a convention center	0.82
In a gymnasium	0.65
In a motion picture theater	1.14
In a penitentiary	0.28
In a performing arts theater	2.03
In a religious building	1.53
In a sports arena	0.43
Otherwise	0.43
Banking activity area	0.86
Breakroom (See Lounge/breakroom)	
Classroom/lecture hall/training room	
In a penitentiary	1.34
Otherwise	0.96
Computer room, <u>Data Center</u>	1.33
Conference/meeting/multipurpose room	1.07
Copy/print room	0.56
Corridor	
In a facility for the visually impaired (and not used primarily by the staff)[b]	0.92
In a hospital	0.92
In a manufacturing facility	0.29
Otherwise	0.66
Courtroom	1.39
Dining area	
In bar/lounge or leisure dining	0.93
In cafeteria or fast food dining	0.63
In a facility for the visually impaired (and not used primarily by the staff)[b]	2.00
In family dining	0.71
In a penitentiary	0.96
Otherwise	0.63
Electrical/mechanical room	0.43
Emergency vehicle garage	0.41
Food preparation area	1.06
Guestroom[c, d]	0.77
Laboratory	
In or as a classroom	1.20
Otherwise	1.45
Laundry/washing area	0.43
Loading dock, interior	0.58
Lobby	

For an elevator	0.68
In a facility for the visually impaired (and not used primarily by the staff)[b]	2.03
In a hotel	1.06
In a motion picture theater	0.45
In a performing arts theater	1.70
Otherwise	1.0
Locker room	0.48
Lounge/breakroom	
In a healthcare facility	0.78
Otherwise	0.62
Office	
Enclosed	0.93
Open plan	0.81
Parking area, interior	0.14
Pharmacy area	1.34
Restroom	
In a facility for the visually impaired (and not used primarily by the staff[b]	0.96
Otherwise	0.85
Sales area	1.22
Seating area, general	0.42
Stairway (see Space containing stairway)	
Stairwell	0.58
Storage room	0.46
Vehicular maintenance area	0.56
Workshop	1.14
BUILDING TYPE SPECIFIC SPACE TYPES[a]	LPD (watts/sq.ft)
Automotive (see Vehicular maintenance area)	
Convention Center—exhibit space	0.88
Dormitory—living quarters[c, d]	0.54
Facility for the visually impaired[b]	
In a chapel (and not used primarily by the staff)	1.06
In a recreation room (and not used primarily by the staff)	1.80
Fire Station—sleeping quarters[c]	0.20
Gymnasium/fitness center	
In an exercise area	0.50
In a playing area	0.82
Healthcare facility	
In an exam/treatment room	1.68
In an imaging room	1.06
In a medical supply room	0.54
In a nursery	1.00
In a nurse's station	0.81
In an operating room	2.17
In a patient room[c]	0.62
In a physical therapy room	0.84
In a recovery room	1.03
Library	

In a reading area	0.82
In the stacks	1.20
Manufacturing facility	
In a detailed manufacturing area	0.93
In an equipment room	0.65
In an extra-high-bay area (greater than 50′ floor-to-ceiling height)	1.05
In a high-bay area (25-50’ floor-to-ceiling height)	0.75
In a low-bay area (less than 25’ floor-to-ceiling height)	0.96
Museum	
In a general exhibition area	1.05
In a restoration room	0.85
Performing arts theater—dressing room	0.36
Post office—sorting area	0.68
Religious buildings	
In a fellowship hall	0.55
In a worship/pulpit/choir area	1.53
Retail facilities	
In a dressing/fitting room	0.50
In a mall concourse	0.90
Sports arena—playing area	
For a Class I facility[e]	2.47
For a Class II facility[f]	1.96
For a Class III facility[g]	1.70
For a Class IV facility[h]	1.13
Transportation facility	
In a baggage/carousel area	0.45
In an airport concourse	0.31
At a terminal ticket counter	0.62
Warehouse—storage area	
For medium to bulky, palletized items	0.35
For smaller, hand-carried items	0.69

a. In cases where both a common space type and a building area specific space type are listed, the building area specific space type shall apply

b. A ‘Facility for the Visually Impaired’ is a facility that is licensed or will be licensed by local or state authorities for senior long-term care, adult daycare, senior support or people with special visual needs.

c. Where sleeping units are excluded from lighting power calculations by application of Section R405.1, neither the area of the sleeping units nor the wattage of lighting in the sleeping units is counted.

d. Where dwelling units are excluded from lighting power calculations by application of Section R405.1, neither the area of the dwelling units nor the wattage of lighting in the dwelling units is counted.

e. Class I facilities consist of professional facilities; and semiprofessional, collegiate, or club facilities with seating for 5,000 or more spectators.

f. Class II facilities consist of collegiate and semiprofessional facilities with seating for fewer than 5,000 spectators; club facilities with seating for between 2,000 and 5,000 spectators; and amateur league and high-school facilities with seating for more than 2,000 spectators.

g. Class III facilities consist of club, amateur league and high-school facilities with seating for 2,000 or fewer spectators.

h. Class IV facilities consist of elementary school and recreational facilities; and amateur league and high-school facilities without provision for spectators.

Add new standard(s) as follows:

ASHRAE

ASHRAE
1791 Tullie Circle NE
Atlanta GA 30329

90.4-2016: Energy Standard for Data Centers

Reason: Data centers have long had difficulty meeting all prescriptive code requirements and are additionally discouraged from pursuing more efficient alternatives with useful waste heat. Instead of current prescriptive code language (emphasizing component performance ratings and cooler-weather economization) this proposal seeks to require large sophisticated data center projects to meet a performance-based ASHRAE Standard allowing attractive system-wide tradeoffs for efficiency and explicit credit for useful heat recovery. While data centers pursuing this path may experience energy savings, this proposal seeks to instill a performance-based approach to encourage more efficient design overall using a methodology that better suits this unique building type.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
We do not anticipate any significant financial impacts to be incurred due to this change.

Staff Analysis: A review of the standard proposed for inclusion in the code, ASHRAE 90.4-2016, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

Analysis: A review of the standard proposed for inclusion in the code, ASHRAE 90.4-2016, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

CE108-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
TABLE C403.1.2(1)

Maximum Design Mechanical Load Component (Design MLC)

Climate Zone~~s as Listed in ASHRAE Standard 169~~	Design MLC at 100% and at 50% ITE Load
0A	0.24
0B	0.26
IA	0.23
2A	0.24
3A	0.23
4A	0.23
5A	0.22
6A	0.22
1B	0.28
2B	0.27
3B	0.26
4B	0.23
5B	0.23
6B	0.21
3C	0.19
4C	0.21
5C	0.19
7	0.20
8	0.19

C403.1.2(2)

Maximum Annualized Mechanical Load Component (Annualized MLC)

Climate Zone~~s as Listed in ASHRAE Standard 169~~	HVAC Maximum AnnualizedMLC at 100% and at 50%ITE Load
0A	0.19
0B	0.20
IA	0.18
2A	0.19
3A	0.18
4A	0.17
5A	0.17
6A	0.17
1B	0.16
2B	0.18
3B	0.18
4B	0.18
5B	0.16
6B	0.17
3C	0.16
4C	0.16
5C	0.16
7	0.16
8	0.16

Committee Reason: The proposal provides clear requirements for managing energy use in Data Centers. It needs a public comment to align the definition with ASHRAE 90.4 Testimony indicated their intent was mandatory as applicable. The modification removed a reference standard that is not in the IECC (Vote: 12-3).

Assembly Action: **None**

CE108-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests Disapprove

Commenter's Reason: There are many technical problems with the proposal as submitted:
-It refers to an older version of 90.4. The 2019 version is scheduled to be published by October, 2019.

-The proposed definition of *data center systems* is significantly different from the definition in the 2016 version of 90.4.

-It takes only a portion of a Standard (90.4), but not other key portions of the Standard.

-It refers to using Chapters 6 and 8 of the Standard, but there are numerous technical terms in both chapters that are not defined in this proposal.

-The efficiency values shown for lighting power density and computer room air conditioners are not consistent with the latest version of ASHRAE

90.1 (where the values are updated).

-The MLC and ELC values shown in the proposal will be less stringent than the values shown in the 2019 version of ASHRAE Standard 90.4.

-There is a better solution available. CE-43 allows the use of the whole standard 90.4, using the most recent version.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval will not change the current code.

Public Comment# 1290

CE111-19

IECC: C202, (New), C403.2, C403.2.3(New)

Proposed Change as Submitted

Proponents: Marilyn Williams, representing National Electrical Manufacturers Association (mar_williams@nema.org)

2018 International Energy Conservation Code

SECTION C202
GENERAL DEFINITIONS

Add new text as follows:

FAULT DETECTION AND DIAGNOSTICS (FDD) SYSTEM A software platform that utilizes building analytic algorithms to convert data provided by sensors and devices to automatically identify faults in building systems and provide a prioritized list of actionable resolutions to those faults based on cost or energy avoidance,comfort and maintenance impact.

Revise as follows:

C403.2 System design (Mandatory). Mechanical systems shall be designed to comply with Sections C403.2.1 ~~and C403.2.2.~~ through C403.2.3. Where elements of a building's mechanical systems are addressed in Sections C403.3 through C403.12, such elements shall comply with the applicable provisions of those sections.

Add new text as follows:

C403.2.3 Fault Detection and Diagnostics (Mandatory) New buildings with a gross conditioned floor area of 100,000 square feet (9290 square meters) or larger shall include a fault detection and diagnostics (FDD) system to monitor the HVAC system's performance and automatically identify faults. The FDD system shall:

1. Include permanently installed sensors and devices to monitor the HVAC system's performance;
2. Sample the HVAC system's performance at least once per 15 minutes;
3. Automatically identify and report HVAC system faults;
4. Automatically notify authorized personnel of identified HVAC system faults;
5. Automatically provide prioritized recommendations for repair of identified faults based on analysis of data collected from the sampling of HVAC system performance; and
6. Be capable of transmitting the prioritized fault repair recommendations to remotely located authorized personnel.

Reason: Energy efficiency of a new building's HVAC system will degrade over time caused by poorly maintained, failing and improperly controlled equipment. The proposed FDD requirement will reduce that degradation by detecting HVAC system faults and notifying building operators so that actions may be taken to reduce energy consumption of the building. Additionally, FDD systems are being utilized to drive operational efficiency, make better use of maintenance personnel, and resolve comfort issues.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change proposal "will" increase the cost of construction because it will require additional hardware, software and labor during installation. Providing specific cost would violate antitrust laws, however a published example of cost and savings is provided from the following link https://ecobuilding.schneider-electric.com/documents/10807/217223/Lab+Project+Building+Analytics+Case+Study/a6d8b9b6-7fdd-4e87-a90b-c98ece595a25: Setup/install cost - $23,190, Annual maintenance cost - $35,407, and Annual savings - $286,000.

CE111-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
C403.2.3 Fault Detection and Diagnostics (Mandatory). New buildings with ~~a~~ an HVAC system serving a gross conditioned floor area of 100,000 square feet (9290 square meters) or larger shall include a fault detection and diagnostics (FDD) system to monitor the HVAC system's performance and automatically identify faults. The FDD system shall:

1. Include permanently installed sensors and devices to monitor the HVAC system's performance;
2. Sample the HVAC system's performance at least once per 15 minutes;
3. Automatically identify and report HVAC system faults;

4. Automatically notify authorized personnel of identified HVAC system faults;
5. Automatically provide prioritized recommendations for repair of identified faults based on analysis of data collected from the sampling of HVAC system performance; and
6. Be capable of transmitting the prioritized fault repair recommendations to remotely located authorized personnel.

Exception: R1 and R-2 occupancies.

Committee Reason: This is on-going commissioning, a good means of cost effective energy savings. Inspecting for it is similar to metering systems. Security issues are addressed if it can be operated not in the cloud. The modification corrects the pointer from building size to HVAC size and opponent's comments (Vote: 15-0).

Assembly Action: None

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

CE111-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Barry Greive, Target Corp, representing Target Corp (barry.greive@target.com)

requests Disapprove

Commenter's Reason: While this proposal sounds like a good idea, it has huge cost and security implications. This proposal also has no enforcement arm to fix anything the system finds is not performing as the software says it should be.
There are many sophisticated owners who already have similar systems in place that monitor system performance, they may not monitor to the level the proponent is requesting, or make a recommendation, but the owner is still aware of how their systems are functioning. Requiring an additional system which can be breached is a security concern, this would have to be a stand alone system in many buildings. Who decides what the fix will be if a fault occurs, and does it even need to be corrected?

The cost is greater than what is in the cost impact study, someone needs to say what needs to be fixed, establish a cost, establish a priority and decide which exact items will be monitored. The annual maintenance cost of $35k is extremely high and the savings of $265k is not even fathomable. This sounds like a proprietary system that provides no benefit other than giving some information that can easily be ignored.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1565

CE112-19

IECC®: TABLE C403.3.2(5)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Revise as follows:

TABLE C403.3.2(5)
MINIMUM EFFICIENCY REQUIREMENTS: GAS- AND OIL-FIRED BOILERS

Portions of table not shown remain unchanged.

EQUIPMENT TYPE[a]	SUBCATEGORY OR RATING CONDITION	SIZE CATEGORY (INPUT)	MINIMUM EFFICIENCY[d, e]	TEST PROCEDURE
Boilers, steam	Gas-fired	< 300,000 Btu/h[f]	80% AFUE	10 CFR Part 430
	Gas-fired- all, except natural draft	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h[b]	79% E_t	10 CFR Part 431
		> 2,500,000 Btu/h[a]	79% E_t	
	Gas-fired-natural draft	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h[b]	77% E_t 79% E_t as of March 2,2020	
		> 2,500,000 Btu/h[a]	77% E_t 79% E_t as of Mach 2,2020	
	Oil-fired[c]	< 300,000 Btu/h	82% AFUE	10 CFR Part 430
		≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h[b]	81% E_t	10 CFR Part 431
		> 2,500,000 Btu/h[a]	81% E_t	

For SI: 1 British thermal unit per hour = 0.2931 W.

a. These requirements apply to boilers with rated input of 8,000,000 Btu/h or less that are not packaged boilers and to all packaged boilers. Minimum efficiency requirements for boilers cover all capacities of packaged boilers.
b. Maximum capacity – minimum and maximum ratings as provided for and allowed by the unit's controls.
c. Includes oil-fired (residual).
d. E_c = Combustion efficiency (100 percent less flue losses).
e. E_t = Thermal efficiency. See referenced standard for detailed information.
f. Boilers shall not be equipped with a constant-burning ignition pilot.
g. A boiler not equipped with a tankless domestic water heating coil shall be equipped with an automatic means for adjusting the temperature of the water such that an incremental change in inferred heat load produces a corresponding incremental change in the temperature of the water supplied.

Reason: This will align the IECC with the required minimum efficiency values shown in ASHRAE 90.1-2016 (and 2013, 2010, and 2007) Table 6.8.1-6, "Gas and Oil Fired *Boilers* - Minimum *Efficiency* Requirements".
These values were agreed to on a consensus basis by the ASHRAE Mechanical SubCommittee, the ASHRAE 90.1 Full Committee, and then went out for public review before being published.

Cost Impact: The code change proposal will increase the cost of construction
There will be an increase in cost to install higher efficiency equipment.

CE112-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Based on proponent's request for disapproval and prior action on CE113 (Vote: 14-1).

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

Proponents:
Ted Williams, representing American Gas Association (twilliams@aga.org)

requests As Submitted

Commenter's Reason: The proponent is correct that the IECC needs to reflect the minimum efficiencies promulgated by ASHRAE 90.1 on equipment since failing to do so, the IECC efficiencies would be preempted under federal law.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The proponent's comment on cost of construction is sufficient.

Public Comment# 2150

CE113-19

IECC®: C403.3.2, TABLE C403.3.2(1), TABLE C403.3.2(2), TABLE C403.3.2(3), TABLE C403.3.2(4), TABLE C403.3.2(5), TABLE C403.3.2(6), TABLE C403.3.2(7), TABLE C403.3.2(8), TABLE C403.3.2(9), TABLE C403.3.2(10), C403.3.2.1, C403.3.2.2, C403.5.5, C403.9, C406.2, TABLE C407.5.1(1), C408.2.3.1

Proposed Change as Submitted

Proponents: Connor Barbaree, representing ASHRAE (cbarbaree@ashrae.org)

2018 International Energy Conservation Code

Revise as follows:

C403.3.2 HVAC equipment performance requirements (Mandatory). Equipment shall meet the minimum efficiency requirements of Tables ~~C403.3.2(1) through C403.3.2(9)~~ 6.8.1-1 through 6.8.1-19 of ASHRAE Standard 90.1 when tested and rated in accordance with the applicable test procedure. Plate-type liquid-to-liquid heat exchangers shall meet the minimum requirements of Table ~~C403.3.2(10).~~ 6.8.1-8 of ASHRAE Standard 90.1. The efficiency shall be verified through certification under an approved certification program or, where a certification program does not exist, the equipment efficiency ratings shall be supported by data furnished by the manufacturer. Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements. Where components, such as indoor or outdoor coils, from different manufacturers are used, calculations and supporting data shall be furnished by the designer that demonstrates that the combined efficiency of the specified components meets the requirements herein.

Table 6.8.1-1 Electrically Operated Unitary Air Conditioners and Condensing Units - Minimum Efficiency Requirements

Table 6.8.1-2 Electrically Operated Air Cooled Unitary and Heat Pumps - Minimum Efficiency Requirements

Table 6.8.1-3 Water Chilling Packages - Minimum Efficiency Requirements

Table 6.8.1-4 Electrically Operated Packaged Terminal Air Conditioners, Packaged Terminal Heat Pumps, Single-Package Vertical Air Conditioners, Single-Package Vertical Heat Pumps, Room Air Conditioners, and Room Air Conditioner Heat Pumps—Minimum Efficiency Requirements

Table 6.8.1-5 Warm-Air Furnaces and Combination Warm-Air Furnaces/Air-Conditioning Units, Warm-Air Duct Furnaces, and Unit Heaters—Minimum Efficiency Requirements

Table 6.8.1-6 Gas- and Oil-Fired Boilers—Minimum Efficiency Requirements

Table 6.8.1-7 Performance Requirements for Heat Rejection Equipment—Minimum Efficiency Requirements

Table 6.8.1-8 Heat Transfer Equipment—Minimum Efficiency Requirements

Table 6.8.1-9 Electrically Operated Variable-Refrigerant-Flow Air Conditioners—Minimum Efficiency Requirements

Table 6.8.1-10 Electrically Operated Variable-Refrigerant-Flow and Applied Heat Pumps— Minimum Efficiency Requirements[if supportFields]> FILENAME

Table 6.8.1-11 Floor Mounted Air Conditioners and Condensing Units Serving Computer Rooms—Minimum Efficiency Requirements

Table 6.8.1-13 Commercial Refrigerators, Freezers and Refrigeration—Minimum Efficiency Requirements

Table 6.8.1-14 Vapor Compression Based Indoor Pool Dehumidifiers—Minimum Efficiency Requirements

Table 6.8.1-15 Electrically Operated DX-DOAS Units, Single-Package and Remote Condenser, without Energy Recovery—Minimum Efficiency Requirements

Table 6.8.1-16 Electrically Operated DX-DOAS Units, Single-Package and Remote Condenser, with Energy Recovery—Minimum Efficiency Requirements

Table 6.8.1-17 Electrically Operated Water Source Heat Pumps—Minimum Efficiency Requirements

Table 6.8.1-18 Heat Pump and Heat Reclaim Chiller Packages – Minimum Efficiency Requirements

Table 6.8.1-19 Ceiling Mounted Computer Room Air Conditioners—Minimum Efficiency Requirements

Delete without substitution:

~~TABLE C403.3.2(1)~~

~~MINIMUM EFFICIENCY REQUIREMENTS: ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING UNITS~~

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY~~	~~HEATING SECTION TYPE~~	~~SUBCATEGORY OR RATING CONDITION~~	~~MINIMUM EFFICIENCY~~	~~TEST PROCEDURE[a]~~
~~Air conditioners, air cooled~~	~~< 65,000 Btu/h[b]~~	~~All~~	~~Split System~~	~~13.0 SEER~~	~~AHRI 210/240~~
			~~Single Package~~	~~14.0 SEER~~	
~~Through-the-wall (air cooled)~~	~~≤ 30,000 Btu/h[b]~~	~~All~~	~~Split system~~	~~12.0 SEER~~	
			~~Single Package~~	~~12.0 SEER~~	
~~Small-duct high-velocity (air cooled)~~	~~< 65,000 Btu/h[b]~~	~~All~~	~~Split System~~	~~11.0 SEER~~	
~~Air conditioners, air cooled~~	~~≥ 65,000 Btu/h and < 135,000 Btu/h~~	~~Electric Resistance (or None)~~	~~Split System and Single Package~~	~~11.2 EER12.8 IEER~~	~~AHRI 340/360~~
		~~All other~~	~~Split System and Single Package~~	~~11.0 EER12.6 IEER~~	
	~~≥ 135,000 Btu/h and < 240,000 Btu/h~~	~~Electric Resistance (or None)~~	~~Split System and Single Package~~	~~11.0 EER12.4 IEER~~	
		~~All other~~	~~Split System and Single Package~~	~~10.8 EER12.2 IEER~~	
	~~≥ 240,000 Btu/h and < 760,000 Btu/h~~	~~Electric Resistance (or None)~~	~~Split System and Single Package~~	~~10.0 EER11.6 IEER~~	
		~~All other~~	~~Split System and Single Package~~	~~9.8 EER11.4 IEER~~	
	~~≥ 760,000 Btu/h~~	~~Electric Resistance (or None)~~	~~Split System and Single Package~~	~~9.7 EER11.2 IEER~~	
		~~All other~~	~~Split System and Single Package~~	~~9.5 EER11.0 IEER~~	
~~Air conditioners, water cooled~~	~~< 65,000 Btu/h[b]~~	~~All~~	~~Split System and Single Package~~	~~12.1 EER12.3 IEER~~	~~AHRI 210/240~~
	~~≥ 65,000 Btu/h and < 135,000 Btu/h~~	~~Electric Resistance (or None)~~	~~Split System and Single Package~~	~~12.1 EER13.9 IEER~~	~~AHRI 340/360~~
		~~All other~~	~~Split System and Single Package~~	~~11.9 EER13.7 IEER~~	
	~~≥ 135,000 Btu/h and < 240,000 Btu/h~~	~~Electric Resistance (or None)~~	~~Split System and Single Package~~	~~12.5 EER13.9 IEER~~	
		~~All other~~	~~Split System and Single Package~~	~~12.3 EER13.7 IEER~~	
	~~≥ 240,000 Btu/h and < 760,000 Btu/h~~	~~Electric Resistance (or None)~~	~~Split System and Single Package~~	~~12.4 EER13.6 IEER~~	
		~~All other~~	~~Split System and Single Package~~	~~12.2 EER13.4 IEER~~	
	~~≥ 760,000 Btu/h~~	~~Electric Resistance (or None)~~	~~Split System and Single Package~~	~~12.2 EER13.5 IEER~~	
		~~All other~~	~~Split System and Single Package~~	~~12.0 EER13.3 IEER~~	
	~~< 65,000 Btu/h[b]~~	~~All~~	~~Split System and Single Package~~	~~12.1 EER12.3 IEER~~	~~AHRI 210/240~~
	~~≥ 65,000 Btu/h and < 135,000 Btu/h~~	~~Electric Resistance (or None)~~	~~Split System and Single Package~~	~~12.1 EER12.3 IEER~~	
		~~All other~~	~~Split System and Single Package~~	~~11.9 EER12.1 IEER~~	
		~~Electric Resistance (or None)~~	~~Split System and Single Package~~	~~12.0 EER12.2 IEER~~	

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY~~	~~HEATING SECTION TYPE~~	~~SUBCATEGORY OR RATING CONDITION~~	~~MINIMUM EFFICIENCY~~	~~TEST PROCEDURE~~
~~Air conditioners, evaporatively cooled~~	~~≥ 135,000 Btu/h and < 240,000 Btu/h~~	~~All other~~	~~Split System and Single Package~~	~~11.8 EER12.0 IEER~~	~~AHRI 340/360~~
	~~≥ 240,000 Btu/h and < 760,000 Btu/h~~	~~Electric Resistance (or None)~~	~~Split System and Single Package~~	~~11.9 EER12.1 IEER~~	
		~~All other~~	~~Split System and Single Package~~	~~11.7 EER11.9 IEER~~	
	~~≥ 760,000 Btu/h~~	~~Electric Resistance (or None)~~	~~Split System and Single Package~~	~~11.7 EER11.9 IEER~~	
		~~All other~~	~~Split System and Single Package~~	~~11.5 EER11.7 IEER~~	
~~Condensing units, air cooled~~	~~≥ 135,000 Btu/h~~	~~—~~	~~—~~	~~10.5 EER11.8 IEER~~	~~AHRI 365~~
~~Condensing units, water cooled~~	~~≥ 135,000 Btu/h~~	~~—~~	~~—~~	~~13.5 EER14.0 IEER~~	
~~Condensing units, evaporatively cooled~~	~~≥ 135,000 Btu/h~~	~~—~~	~~—~~	~~13.5 EER14.0 IEER~~	

~~For SI: 1 British thermal unit per hour = 0.2931 W.~~

~~a. Chapter 6 contains a complete specification of the referenced test procedure, including the reference year version of the test procedure.~~
~~b.Single-phase, air-cooled air conditioners less than 65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.~~

~~TABLE C403.3.2(2)~~

~~MINIMUM EFFICIENCY REQUIREMENTS: ELECTRICALLY OPERATED UNITARY AND APPLIED HEAT PUMPS~~

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY~~	~~HEATING SECTION TYPE~~	~~SUBCATEGORY OR RATING CONDITION~~	~~MINIMUM EFFICIENCY~~	~~TEST PROCEDURE[a]~~
~~Air cooled (cooling mode)~~	~~< 65,000 Btu/h[b]~~	~~All~~	~~Split System~~	~~14.0 SEER~~	~~AHRI 210/240~~
			~~Single Package~~	~~14.0 SEER~~	
~~Through-the-wall, air cooled~~	~~≤ 30,000 Btu/h[b]~~	~~All~~	~~Split System~~	~~12.0 SEER~~	
			~~Single Package~~	~~12.0 SEER~~	
~~Single-duct high-velocity air cooled~~	~~< 65,000 Btu/h[b]~~	~~All~~	~~Split System~~	~~11.0 SEER~~	
~~Air cooled (cooling mode)~~	~~≥ 65,000 Btu/h and < 135,000 Btu/h~~	~~Electric Resistance (or None)~~	~~Split System and Single Package~~	~~11.0 EER 12.0 IEER~~	~~AHRI 340/360~~
		~~All other~~	~~Split System and Single Package~~	~~10.8 EER 11.8 IEER~~	
	~~≥ 135,000 Btu/h and < 240,000 Btu/h~~	~~Electric Resistance (or None)~~	~~Split System and Single Package~~	~~10.6 EER 11.6 IEER~~	
		~~All other~~	~~Split System and Single Package~~	~~10.4 EER 11.4 IEER~~	
	~~≥ 240,000 Btu/h~~	~~Electric Resistance (or None)~~	~~Split System and Single Package~~	~~9.5 EER 10.6 IEER~~	
		~~All other~~	~~Split System and Single Package~~	~~9.3 EER 9.4 IEER~~	
~~Water to Air: Water Loop (cooling mode)~~	~~< 17,000 Btu/h~~	~~All~~	~~86°F entering water~~	~~12.2 EER~~	~~ISO 13256-1~~
	~~≥ 17,000 Btu/h and < 65,000 Btu/h~~	~~All~~	~~86°F entering water~~	~~13.0 EER~~	
	~~≥ 65,000 Btu/h and < 135,000 Btu/h~~	~~All~~	~~86°F entering water~~	~~13.0 EER~~	
~~Water to Air: Ground Water (cooling mode)~~	~~< 135,000 Btu/h~~	~~All~~	~~59°F entering water~~	~~18.0 EER~~	~~ISO 13256-1~~
~~Brine to Air: Ground Loop (cooling mode)~~	~~< 135,000 Btu/h~~	~~All~~	~~77°F entering water~~	~~14.1 EER~~	~~ISO 13256-1~~
~~Water to Water: Water Loop (cooling mode)~~	~~< 135,000 Btu/h~~	~~All~~	~~86°F entering water~~	~~10.6 EER~~	~~ISO 13256-2~~
~~Water to Water: Ground Water (cooling mode)~~	~~< 135,000 Btu/h~~	~~All~~	~~59°F entering water~~	~~16.3 EER~~	
~~Brine to Water: Ground Loop (cooling mode)~~	~~< 135,000 Btu/h~~	~~All~~	~~77°F entering fluid~~	~~12.1 EER~~	
~~Air cooled (heating mode)~~	~~< 65,000 Btu/h[b]~~	—	~~Split System~~	~~8.2 HSPF~~	~~AHRI 210/240~~
		—	~~Single Package~~	~~8.0 HSPF~~	
~~Through-the-wall, (air cooled, heating mode)~~	~~≤ 30,000 Btu/h[b] (cooling capacity)~~	—	~~Split System~~	~~7.4 HSPF~~	
		—	~~Single Package~~	~~7.4 HSPF~~	
~~Small-duct high velocity (air cooled, heating mode)~~	~~< 65,000 Btu/h[b]~~	—	~~Split System~~	~~6.8 HSPF~~	
~~Air cooled (heating mode)~~	~~≥ 65,000 Btu/h and < 135,000 Btu/h (cooling capacity)~~	—	~~47°F db/43°F wb outdoor air~~	~~3.3 COP~~	~~AHRI 340/360~~
			~~17°Fdb/15°F wb outdoor air~~	~~2.25 COP~~	
			~~47°F db/43°F wb outdoor air~~	~~3.2 COP~~	

~~EQUIPMENT TYPE~~	~~≥ 135,000 Btu/h (cooling capacity)~~ ~~SIZE CATEGORY~~	~~HEATING SECTION TYPE~~	~~SUBCATEGORY OR RATING CONDITION~~	~~MINIMUM EFFICIENCY~~	~~TEST PROCEDURE~~
			~~17°Fdb/15°F wb outdoor air~~	~~2.05 COP~~	
~~Water to Air: Water Loop (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~68°F entering water~~	~~4.3 COP~~	~~ISO 13256-1~~
~~Water to Air: Ground Water (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~50°F entering water~~	~~3.7 COP~~	
~~Brine to Air: Ground Loop (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~32°F entering fluid~~	~~3.2 COP~~	
~~Water to Water: Water Loop (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~68°F entering water~~	~~3.7 COP~~	~~ISO 13256-2~~
~~Water to Water: Ground Water (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~50°F entering water~~	~~3.1 COP~~	
~~Brine to Water: Ground Loop (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~32°F entering fluid~~	~~2.5 COP~~	

~~For SI: 1 British thermal unit per hour = 0.2931 W, °C = [(°F) - 32]/1.8.~~

~~a. Chapter 6 contains a complete specification of the referenced test procedure, including the reference year version of the test procedure.~~
~~b.Single-phase, air-cooled heat pumps less than 65,000 Btu/h are regulated by NAECA. SEER and HSPF values are those set by NAECA.~~

~~TABLE C403.3.2(3)~~

~~MINIMUM EFFICIENCY REQUIREMENTS: ELECTRICALLY OPERATED PACKAGED TERMINAL AIR CONDITIONERS, PACKAGED TERMINAL HEAT PUMPS, SINGLE-PACKAGE VERTICAL AIR CONDITIONERS, SINGLE VERTICAL HEAT PUMPS, ROOM AIR CONDITIONERS AND ROOM AIR-CONDITIONER HEAT PUMPS~~

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY (INPUT)~~	~~SUBCATEGORY OR RATING CONDITION~~	~~MINIMUM EFFICIENCY~~	~~TEST PROCEDURE~~[a]
~~PTAC (cooling mode) new construction~~	~~All Capacities~~	~~95°F db outdoor air~~	~~14.0 - (0.300 × Cap/1000) EER~~	~~AHRI 310/380~~
~~PTAC (cooling mode) replacements~~[b]	~~All Capacities~~	~~95°F db outdoor air~~	~~10.9 - (0.213 × Cap/1000) EER~~	
~~PTHP (cooling mode) new construction~~	~~All Capacities~~	~~95°F db outdoor air~~	~~14.0 - (0.300 × Cap/1000) EER~~	
~~PTHP (cooling mode) replacements~~[b]	~~All Capacities~~	~~95°F db outdoor air~~	~~10.8 - (0.213 × Cap/1000) EER~~	
~~PTHP (heating mode) new construction~~	~~All Capacities~~	—	~~3.2 - (0.026 × Cap/1000) COP~~	
~~PTHP (heating mode) replacements~~[b]	~~All Capacities~~	—	~~2.9 - (0.026 × Cap/1000) COP~~	
~~SPVAC (cooling mode)~~	~~< 65,000 Btu/h~~	~~95°F db/ 75°F wb outdoor air~~	~~9.0 EER~~	~~AHRI 390~~
	~~≥ 65,000 Btu/h and < 135,000 Btu/h~~	~~95°F db/ 75°F wb outdoor air~~	~~8.9 EER~~	
	~~≥ 135,000 Btu/h and < 240,000 Btu/h~~	~~95°F db/ 75°F wb outdoor air~~	~~8.6 EER~~	
~~SPVHP (cooling mode)~~	~~< 65,000 Btu/h~~	~~95°F db/ 75°F wb outdoor air~~	~~9.0 EER~~	
	~~≥ 65,000 Btu/h and < 135,000 Btu/h~~	~~95°F db/ 75°F wb outdoor air~~	~~8.9 EER~~	
	~~≥ 135,000 Btu/h and < 240,000 Btu/h~~	~~95°F db/ 75°F wb outdoor air~~	~~8.6 EER~~	
~~SPVHP (heating mode)~~	~~< 65,000 Btu/h~~	~~47°F db/ 43°F wb outdoor air~~	~~3.0 COP~~	~~AHRI 390~~
	~~≥ 65,000 Btu/h and < 135,000 Btu/h~~	~~47°F db/ 43°F wb outdoor air~~	~~3.0 COP~~	
	~~≥ 135,000 Btu/h and < 240,000 Btu/h~~	~~47°F db/ 75°F wb outdoor air~~	~~2.9 COP~~	
~~Room air conditioners, with louvered sides~~	~~< 6,000 Btu/h~~	—	~~11.0 CEER~~	~~ANSI/AHAM RAC-1~~
	~~≥ 6,000 Btu/h and < 8,000 Btu/h~~	—	~~11.0 CEER~~	
	~~≥ 8,000 Btu/h and < 14,000 Btu/h~~	—	~~10.9 CEER~~	
	~~≥ 14,000 Btu/h and < 20,000 Btu/h~~	—	~~10.7 CEER~~	
	~~≥ 20,000 Btu/h and ≤ 25,000 Btu/h~~	—	~~9.4 CEER~~	
	~~> 25,000 Btu/h~~	—	~~9.0 CEER~~	
~~Room air conditioners, without louvered sides~~	~~< 6,000 Btu/h~~	—	~~10.0 CEER~~	
	~~≥ 6,000 Btu/h and < 8,000 Btu/h~~	—	~~10.0 CEER~~	
	~~≥ 8,000 Btu/h and < 11,000 Btu/h~~	—	~~9.6 CEER~~	
	~~≥ 11,000 Btu/h and < 14,000 Btu/h~~	—	~~9.5 CEER~~	
	~~≥ 14,000 Btu/h and < 20,000 Btu/h~~	—	~~9.3 CEER~~	

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY (INPUT)~~	~~SUBCATEGORY OR RATING CONDITION~~	~~MINIMUM EFFICIENCY~~	~~TEST PROCEDURE~~
	~~≥ 20,000 Btu/h~~	—	~~9.4 CEER~~	
~~Room air-conditioner heat pumps with louvered sides~~	~~< 20,000 Btu/h~~	—	~~9.8 CEER~~	
	~~≥ 20,000 Btu/h~~	—	~~9.3 CEER~~	
~~Room air-conditioner heat pumps without louvered sides~~	~~< 14,000 Btu/h~~	—	~~9.3 CEER~~	
	~~≥ 14,000 Btu/h~~	—	~~8.7 CEER~~	
~~Room air conditioner casement only~~	~~All capacities~~	—	~~9.5 CEER~~	~~ANSI/AHAM RAC-1~~
~~Room air conditioner casement-slider~~	~~All capacities~~	—	~~10.4 CEER~~	

~~For SI: 1 British thermal unit per hour = 0.2931 W, °C = [(°F) - 32]/1.8, wb = wet bulb, db = dry bulb.~~

~~"Cap" = The rated cooling capacity of the project in Btu/h. Where the unit's capacity is less than 7000 Btu/h, use 7000 Btu/h in the calculation. Where the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculations.~~

~~a. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.~~
~~b.Replacement unit shall be factory labeled as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY: NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS." Replacement efficiencies apply only to units with existing sleeves less than 16 inches (406 mm) in height and less than 42 inches (1067 mm) in width.~~

~~TABLE C403.3.2(4)~~

~~WARM-AIR FURNACES AND COMBINATION WARM-AIR FURNACES/AIR-CONDITIONING UNITS, WARM-AIR DUCT FURNACES AND UNIT HEATERS, MINIMUM EFFICIENCY REQUIREMENTS~~

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY (INPUT)~~	~~SUBCATEGORY OR RATING CONDITION~~	~~MINIMUM EFFICIENCY~~[d, e]	~~TEST PROCEDURE~~[a]
~~Warm-air furnaces, gas fired~~	~~< 225,000 Btu/h~~	—	~~80% AFUE or 80%E_t~~[c]	~~DOE 10 CFR Part 430 or ANSI Z21.47~~
	~~≥ 225,000 Btu/h~~	~~Maximum capacity~~[c]	~~80%E_t~~[f]	~~ANSI Z21.47~~
~~Warm-air furnaces, oil fired~~	~~< 225,000 Btu/h~~	—	~~83% AFUE or 80%E_t~~[c]	~~DOE 10 CFR Part 430 or UL 727~~
	~~≥ 225,000 Btu/h~~	~~Maximum capacity~~[b]	~~81%E_t~~[g]	~~UL 727~~
~~Warm-air duct furnaces, gas fired~~	~~All capacities~~	~~Maximum capacity~~[b]	~~80%E_c~~	~~ANSI Z83.8~~
~~Warm-air unit heaters, gas fired~~	~~All capacities~~	~~Maximum capacity~~[b]	~~80%E_c~~	~~ANSI Z83.8~~
~~Warm-air unit heaters, oil fired~~	~~All capacities~~	~~Maximum capacity~~[b]	~~80%E_c~~	~~UL 731~~

~~For SI: 1 British thermal unit per hour = 0.2931 W.~~

~~a. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.~~
~~b.Minimum and maximum ratings as provided for and allowed by the unit's controls.~~
~~c.Combination units not covered by the National Appliance Energy Conservation Act of 1987 (NAECA) (3-phase power or cooling capacity greater than or equal to 65,000 Btu/h [19 kW]) shall comply with either rating.~~
~~d. E_t = Thermal efficiency. See test procedure for detailed discussion.~~
~~e. E_c = Combustion efficiency (100% less flue losses). See test procedure for detailed discussion.~~
~~f. E_c = Combustion efficiency. Units shall also include an IID, have jackets not exceeding 0.75 percent of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.~~
~~g. E_t = Thermal efficiency. Units shall also include an IID, have jacket losses not exceeding 0.75 percent of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.~~

~~TABLE C403.3.2(5)~~

~~MINIMUM EFFICIENCY REQUIREMENTS: GAS- AND OIL-FIRED BOILERS~~

~~EQUIPMENT TYPE[a]~~	~~SUBCATEGORY OR RATING CONDITION~~	~~SIZE CATEGORY (INPUT)~~	~~MINIMUM EFFICIENCY[d, e]~~	~~TEST PROCEDURE~~
~~Boilers, hot water~~	~~Gas-fired~~	~~< 300,000 Btu/h[f, g]~~	~~82% AFUE~~	~~10 CFR Part 430~~
		~~≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h[b]~~	~~80% E_t~~	~~10 CFR Part 431~~
		~~> 2,500,000 Btu/h[a]~~	~~82% E_e~~	
	~~Oil-fired[c]~~	~~< 300,000 Btu/h[g]~~	~~84% AFUE~~	~~10 CFR Part 430~~
		~~≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h[b]~~	~~82% E_t~~	~~10 CFR Part 431~~
		~~> 2,500,000 Btu/h[a]~~	~~84% E_e~~	
~~Boilers, steam~~	~~Gas-fired~~	~~< 300,000 Btu/h[f]~~	~~80% AFUE~~	~~10 CFR Part 430~~
	~~Gas-fired- all, except natural draft~~	~~≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h[b]~~	~~79% E_t~~	~~10 CFR Part 431~~
		~~> 2,500,000 Btu/h[a]~~	~~79% E_t~~	
	~~Gas-fired-natural draft~~	~~≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h[b]~~	~~77% E_t~~	
		~~> 2,500,000 Btu/h[a]~~	~~77% E_t~~	
	~~Oil-fired[c]~~	~~< 300,000 Btu/h~~	~~82% AFUE~~	~~10 CFR Part 430~~
		~~≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h[b]~~	~~81% E_t~~	~~10 CFR Part 431~~
		~~> 2,500,000 Btu/h[a]~~	~~81% E_t~~	

~~For SI: 1 British thermal unit per hour = 0.2931 W.~~

~~a.These requirements apply to boilers with rated input of 8,000,000 Btu/h or less that are not packaged boilers and to all packaged boilers. Minimum efficiency requirements for boilers cover all capacities of packaged boilers.~~

~~b.Maximum capacity – minimum and maximum ratings as provided for and allowed by the unit's controls.~~

~~c.Includes oil-fired (residual).~~

~~d. E_c = Combustion efficiency (100 percent less flue losses).~~

~~e. E_t = Thermal efficiency. See referenced standard for detailed information.~~

~~f.Boilers shall not be equipped with a constant-burning ignition pilot.~~

~~g.A boiler not equipped with a tankless domestic water heating coil shall be equipped with an automatic means for adjusting the temperature of the water such that an incremental change in inferred heat load produces a corresponding incremental change in the temperature of the water supplied.~~

~~TABLE C403.3.2(6)~~

~~MINIMUM EFFICIENCY REQUIREMENTS: CONDENSING UNITS, ELECTRICALLY OPERATED~~

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY~~	~~MINIMUM EFFICIENCY[b]~~	~~TEST PROCEDURE[a]~~
~~Condensing units, air cooled~~	~~≥ 135,000 Btu/h~~	~~10.1 EER11.2 IPLV~~	~~AHRI 365~~
~~Condensing units, water or evaporatively cooled~~	~~≥ 135,000 Btu/h~~	~~13.1 EER13.1 IPLV~~	

~~For SI: 1 British thermal unit per hour = 0.2931 W.~~

~~a. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.~~
~~b.IPLVs are only applicable to equipment with capacity modulation.~~

~~**TABLE C403.3.2(7)**~~

~~**WATER CHILLING PACKAGES — EFFICIENCY REQUIREMENTS[a, b, d]**~~

~~**EQUIPMENT TYPE**~~	~~**SIZE CATEGORY**~~	~~**UNITS**~~	~~**BEFORE 1/1/2015**~~		~~**AS OF 1/1/2015**~~		~~**TEST PROCEDURE[c]**~~
			~~**Path A**~~	~~**Path B**~~	~~**Path A**~~	~~**Path B**~~	
~~Air-cooled chillers~~	~~< 150 Tons~~	~~EER (Btu/W)~~	~~≥ 9.562 FL~~	~~NA[c]~~	~~≥ 10.100 FL~~	~~≥ 9.700 FL~~	~~AHRI 550/590~~
			~~≥ 12.500 IPLV~~		~~≥ 13.700 IPLV~~	~~≥ 15,800 IPLV~~	
	~~≥ 150 Tons~~		~~≥ 9.562 FL~~	~~NA[c]~~	~~≥ 10.100 FL~~	~~≥ 9.700 FL~~	
			~~≥ 12.500 IPLV~~		~~≥ 14.000 IPLV~~	~~≥ 16.100 IPLV~~	
~~Air cooled without condenser, electrically operated~~	~~All capacities~~	~~EER(Btu/W)~~	~~Air-cooled chillers without condenser shall be rated with matching condensers and complying with air-cooled chiller efficiency requirements.~~				
~~Water cooled, electrically operated positive displacement~~	~~< 75 Tons~~	~~kW/ton~~	~~≤ 0.780 FL~~	~~≤ 0.800 FL~~	~~≤ 0.750 FL~~	~~≤ 0.780 FL~~	
			~~≤ 0.630 IPLV~~	~~≤ 0.600 IPLV~~	~~≤ 0.600 IPLV~~	~~≤ 0.500 IPLV~~	
	~~≥ 75 tons and < 150 tons~~		~~≤ 0.775 FL~~	~~≤ 0.790 FL~~	~~≤ 0.720 FL~~	~~≤ 0.750 FL~~	
			~~≤ 0.615 IPLV~~	~~≤ 0.586 IPLV~~	~~≤ 0.560 IPLV~~	~~≤ 0.490 IPLV~~	
	~~≥ 150 tons and < 300 tons~~		~~≥ 0.680 FL~~	~~≥ 0.718 FL~~	~~≥ 0.660 FL~~	~~≥ 0.680 FL~~	
			~~≥ 0.580 IPLV~~	~~≥ 0.540 IPLV~~	~~≥ 0.540 IPLV~~	~~≥ 0.440 IPLV~~	
	~~≥ 300 tons and < 600 tons~~		~~≤ 0.620 FL~~	~~≤ 0.639 FL~~	~~≤ 0.610 FL~~	~~≤ 0.625 FL~~	
			~~≤ 0.540 IPLV~~	~~≤ 0.490 IPLV~~	~~≤ 0.520 IPLV~~	~~≤ 0.410 IPLV~~	
	~~≥ 600 tons~~		~~≤ 0.620 FL~~	~~≤ 0.639 FL~~	~~≤ 0.560 FL~~	~~≤ 0.585 FL~~	
			~~≤ 0.540 IPLV~~	~~≤ 0.490 IPLV~~	~~≤ 0.500 IPLV~~	~~≤ 0.380 IPLV~~	
~~Water cooled, electrically operated centrifugal~~	~~< 150 Tons~~	~~kW/ton~~	~~≤ 0.634 FL~~	~~≤ 0.639 FL~~	~~≤ 0.610 FL~~	~~≤ 0.695 FL~~	
			~~≤ 0.596 IPLV~~	~~≤ 0.450 IPLV~~	~~≤ 0.550 IPLV~~	~~≤ 0.440 IPLV~~	
	~~≥ 150 tons and < 300 tons~~		~~≤ 0.634 FL~~	~~≤ 0.639 FL~~	~~≤ 0.610 FL~~	~~≤ 0.635 FL~~	
			~~≤ 0.596 IPLV~~	~~≤ 0.450 IPLV~~	~~≤ 0.550 IPLV~~	~~≤ 0.400 IPLV~~	
	~~≥ 300 tons and < 400 tons~~		~~≤ 0.576 FL~~	~~≤ 0.600 FL~~	~~≤ 0.560 FL~~	~~≤ 0.595 FL~~	
			~~≤ 0.549 IPLV~~	~~≤ 0.400 IPLV~~	~~≤ 0.520 IPLV~~	~~≤ 0.390 IPLV~~	
	~~≥ 400 tons and < 600 tons~~		~~≤ 0.576 FL~~	~~≤ 0.600 FL~~	~~≤ 0.560 FL~~	~~≤ 0.585 FL~~	
			~~≤ 0.549 IPLV~~	~~≤ 0.400 IPLV~~	~~≤ 0.500 IPLV~~	~~≤ 0.380 IPLV~~	
	~~≥ 600 Tons~~		~~≤ 0.570 FL~~	~~≤ 0.590 FL~~	~~≤ 0.560 FL~~	~~≤ 0.585 FL~~	
			~~≤ 0.539 IPLV~~	~~≤ 0.400 IPLV~~	~~≤ 0.500 IPLV~~	~~≤ 0.380 IPLV~~	
~~Air cooled, absorption, single effect~~	~~All capacities~~	~~COP~~	~~≥ 0.600 FL~~	~~NA[c]~~	~~≥ 0.600 FL~~	~~NA[c]~~	~~AHRI 560~~
~~Water cooled absorption, single effect~~	~~All capacities~~	~~COP~~	~~≥ 0.700 FL~~	~~NA[c]~~	~~≥ 0.700 FL~~	~~NA[c]~~	
~~Absorption, double effect, indirect fired~~	~~All capacities~~	~~COP~~	~~≥ 1.000 FL~~	~~NA[c]~~	~~≥ 1.000 FL~~	~~NA[c]~~	
			~~≥ 1.050 IPLV~~		~~≥ 1.050 IPLV~~		
~~Absorption double effect direct fired~~	~~All capacities~~	~~COP~~	~~≥ 1.000 FL~~	~~NA[c]~~	~~≥ 1.000 FL~~	~~NA[c]~~	
			~~≥ 1.000 IPLV~~		~~≥ 1.050 IPLV~~		

~~a.The requirements for centrifugal chiller shall be adjusted for nonstandard rating conditions in accordance with Section C403.3.2.1 and are only applicable for the range of conditions listed in Section C403.3.2.1. The requirements for air-cooled, water-cooled positive displacement and absorption chillers are at standard rating conditions defined in the reference test procedure.~~

~~b.Both the full-load and IPLV requirements shall be met or exceeded to comply with this standard. Where there is a Path B, compliance can be with either Path A or Path B for any application.~~

~~c.NA means the requirements are not applicable for Path B and only Path A can be used for compliance.~~

~~d.FL represents the full-load performance requirements and IPLV the part-load performance requirements.~~

~~TABLE C403.3.2(8)~~
~~MINIMUM EFFICIENCY REQUIREMENTS: HEAT REJECTION EQUIPMENT~~

~~EQUIPMENT TYPE[a]~~	~~TOTAL SYSTEM HEAT REJECTION CAPACITY AT RATED CONDITIONS~~	~~SUBCATEGORY OR RATING CONDITION[i]~~	~~PERFORMANCE REQUIRED[b, c, d, g, h]~~	~~TEST PROCEDURE[e, f]~~
~~Propeller or axial fan open-circuit cooling towers~~	~~All~~	~~95°F entering water 85°F leaving water 75°F entering wb~~	~~≥ 40.2 gpm/hp~~	~~CTI ATC-105 and CTI STD-201 RS~~
~~Centrifugal fan open-circuit cooling towers~~	~~All~~	~~95°F entering water 85°F leaving water 75°F entering wb~~	~~≥ 20.0 gpm/hp~~	~~CTI ATC-105 and CTI STD-201 RS~~
~~Propeller or axial fan closed-circuit cooling towers~~	~~All~~	~~102°F entering water 90°F leaving water 75°F entering wb~~	~~≥ 16.1 gpm/hp~~	~~CTI ATC-105S and CTI STD-201 RS~~
~~Centrifugal fan closed-circuit cooling towers~~	~~All~~	~~102°F entering water 90°F leaving water 75°F entering wb~~	~~≥ 7.0 gpm/hp~~	~~CTI ATC-105S and CTI STD-201 RS~~
~~Propeller or axial fan evaporative condensers~~	~~All~~	~~Ammonia Test Fluid 140°F entering gas temperature 96.3°F condensing temperature75°F entering wb~~	~~≥ 134,000 Btu/h × hp~~	~~CTI ATC-106~~
~~Centrifugal fan evaporative condensers~~	~~All~~	~~Ammonia Test Fluid 140°F entering gas temperature 96.3°F condensing temperature 75°F entering wb~~	~~≥ 110,000 Btu/h × hp~~	~~CTI ATC-106~~
~~Propeller or axial fan evaporative condensers~~	~~All~~	~~R-507A Test Fluid 165°F entering gas temperature 105°F condensing temperature 75°F entering wb~~	~~≥ 157,000 Btu/h × hp~~	~~CTI ATC-106~~
~~Centrifugal fan evaporative condensers~~	~~All~~	~~R-507A Test Fluid 165°F entering gas temperature 105°F condensing temperature 75°F entering wb~~	~~≥ 135,000 Btu/h × hp~~	~~CTI ATC-106~~
~~Air-cooled condensers~~	~~All~~	~~125°F Condensing Temperature 190°F Entering Gas Temperature 15°F subcooling 95°F entering db~~	~~≥ 176,000 Btu/h × hp~~	~~AHRI 460~~

~~For SI: °C = [(°F)-32]/1.8, L/s • kW = (gpm/hp)/(11.83), COP = (Btu/h · hp)/(2550.7),~~

~~db = dry bulb temperature, °F, wb = wet bulb temperature, °F.~~

~~a.The efficiencies and test procedures for both open- and closed-circuit cooling towers are not applicable to hybrid cooling towers that contain a combination of wet and dry heat exchange sections.~~
~~b. For purposes of this table, open circuit cooling tower performance is defined as the water flow rating of the tower at the thermal rating condition, divided by the fan nameplate-rated motor power.~~
~~c. For purposes of this table, closed-circuit cooling tower performance is defined as the water flow rating of the tower at the thermal rating condition, divided by the sum of the fan nameplate-rated motor power and the spray pump nameplate-rated motor power.~~
~~d.For purposes of this table, air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the fan nameplate-rated motor power.~~
~~e. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure. The certification requirements do not apply to field-erected cooling towers.~~
~~f.Where a certification program exists for a covered product and it includes provisions for verification and challenge of equipment efficiency ratings, then the product shall be listed in the certification program; or, where a certification program exists for a covered product, and it includes provisions for verification and challenge of equipment efficiency ratings, but the product is not listed in the existing certification program, the ratings shall be verified by an independent laboratory test report.~~
~~g.Cooling towers shall comply with the minimum efficiency listed in the table for that specific type of tower with the capacity effect of any project-specific accessories or options included in the capacity of the cooling tower~~
~~h.For purposes of this table, evaporative condenser performance is defined as the heat rejected at the specified rating condition in the table divided by the sum of the fan motor nameplate power and the integral spray pump nameplate power~~
~~i.Requirements for evaporative condensers are listed with ammonia (R-717) and R-507A as test fluids in the table. Evaporative condensers intended for use with halocarbon refrigerants other than R-507A shall meet the minimum efficiency requirements listed in this table with R-507A as the test fluid.~~

~~TABLE C403.3.2(9)~~
~~MINIMUM EFFICIENCY AIR CONDITIONERS AND CONDENSING UNITS SERVING COMPUTER ROOMS~~

~~EQUIPMENT TYPE~~	~~NET SENSIBLE COOLING CAPACITY[a]~~	~~MINIMUM SCOP-127[b] EFFICIENCY DOWNFLOW UNITS / UPFLOW UNITS~~	~~TEST PROCEDURE~~
~~Air conditioners, air cooled~~	~~< 65,000 Btu/h~~	~~2.20 / 2.09~~	~~ANSI/ASHRAE 127~~
	~~≥ 65,000 Btu/h and < 240,000 Btu/h~~	~~2.10 / 1.99~~	
	~~≥ 240,000 Btu/h~~	~~1.90 / 1.79~~	
~~Air conditioners, water cooled~~	~~< 65,000 Btu/h~~	~~2.60 / 2.49~~	
	~~≥ 65,000 Btu/h and < 240,000 Btu/h~~	~~2.50 / 2.39~~	
	~~≥ 240,000 Btu/h~~	~~2.40 / 2.29~~	
~~Air conditioners, water cooled with fluid economizer~~	~~< 65,000 Btu/h~~	~~2.55 / 2.44~~	
	~~≥ 65,000 Btu/h and < 240,000 Btu/h~~	~~2.45 / 2.34~~	
	~~≥ 240,000 Btu/h~~	~~2.35 / 2.24~~	
~~Air conditioners, glycol cooled (rated at 40% propylene glycol)~~	~~< 65,000 Btu/h~~	~~2.50 / 2.39~~	
	~~≥ 65,000 Btu/h and < 240,000 Btu/h~~	~~2.15 / 2.04~~	
	~~≥ 240,000 Btu/h~~	~~2.10 / 1.99~~	
~~Air conditioners, glycol cooled (rated at 40% propylene glycol) with fluid economizer~~	~~< 65,000 Btu/h~~	~~2.45 / 2.34~~	
	~~≥ 65,000 Btu/h and < 240,000 Btu/h~~	~~2.10 / 1.99~~	
	~~≥ 240,000 Btu/h~~	~~2.05 / 1.94~~	

~~For SI: 1 British thermal unit per hour = 0.2931 W.~~

~~a.Net sensible cooling capacity: the total gross cooling capacity less the latent cooling less the energy to the air movement system. (Total Gross – latent – Fan Power).~~
~~b.Sensible coefficient of performance (SCOP-127): a ratio calculated by dividing the net sensible cooling capacity in watts by the total power input in watts (excluding reheaters and humidifiers) at conditions defined in ASHRAE Standard 127. The net sensible cooling capacity is the gross sensible capacity minus the energy dissipated into the cooled space by the fan system.~~

~~TABLE C403.3.2(10)~~
~~HEAT TRANSFER EQUIPMENT~~

~~EQUIPMENT TYPE~~	~~SUBCATEGORY~~	~~MINIMUM EFFICIENCY~~	~~TEST PROCEDURE[a]~~
~~Liquid-to-liquid heat exchangers~~	~~Plate type~~	~~NR~~	~~AHRI 400~~

~~NR = No Requirement.~~

~~a. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.~~

C403.3.2.1 Water-cooled centrifugal chilling packages (Mandatory). Equipment not designed for operation at AHRI Standard 550/590 test conditions of 44°F (7°C) leaving chilled-water temperature and 2.4 gpm/ton evaporator fluid flow and 85°F (29°C) entering condenser water temperature with 3 gpm/ton (0.054 l/s • kW) condenser water flow shall have maximum full-load kW/ton (FL) and part-load ratings requirements adjusted using Equations 4-6 and ~~4~~-7.

$FL_{adj} = FL/K_{adj}$
(Equation 4-6)
$PLV_{adj} = IPLV/K_{adj}$
(Equation 4-7)
where:

K_{adj} = A x B

FL = Full-load kW/ton value as specified in ~~Table C403.3.2(7)~~ the tables in Section C403.3.2.

FL_{adj} = Maximum full-load kW/ton rating, adjusted for nonstandard conditions.

IPLV = Value as specified in ~~Table C403.3.2(7)~~ the tables in Section C403.3.2.
PLV_{adj} = Maximum *NPLV* rating, adjusted for nonstandard conditions.

$A = 0.00000014592 \times (LIFT)^4\ 0.0000346496 \times (LIFT)^3 + 0.00314196 \times (LIFT)^2 - 0.147199 \times (LIFT) + 3.9302$

$B = 0.0015 \times L_{vg}E_{vap} + 0.934$

$LIFT = L_{vg}Cond - L_{vg}E_{vap}$

$L_{vg}Cond$ = Full-load condenser leaving fluid temperature (°F).

$L_{vg}Evap$ = Full-load evaporator leaving temperature (°F).
The FL_{adj} and PLV_{adj} values are only applicable for centrifugal chillers meeting all of the following full-load design ranges:

1. Minimum evaporator leaving temperature: 36°F.
2. Maximum condenser leaving temperature: 115°F.
3. 20°F ≤ LIFT ≤ 80°F.

C403.3.2.2 Positive displacement (air- and water-cooled) chilling packages. Equipment with a leaving fluid temperature higher than 32°F (0°C) and water-cooled positive displacement chilling packages with a condenser leaving fluid temperature below 115°F (46°C) shall meet the requirements of ~~Table C403.3.2(7)~~ the tables in Section C403.3.2. when tested or certified with water at standard rating conditions, in accordance with the referenced test procedure.

C403.5.5 Economizer fault detection and diagnostics (Mandatory). Air-cooled unitary direct-expansion units listed in ~~Tables C403.3.2(1) through C403.3.2(3)~~ the tables in Section C403.3.2. and variable refrigerant flow (VRF) units that are equipped with an economizer in accordance with Sections C403.5 through C403.5.4 shall include a fault detection and diagnostics system complying with the following:

1. The following temperature sensors shall be permanently installed to monitor system operation:
1.1. Outside air.
1.2. Supply air.
1.3. Return air.
2. Temperature sensors shall have an accuracy of ±2°F (1.1°C) over the range of 40°F to 80°F (4°C to 26.7°C).
3. Refrigerant pressure sensors, where used, shall have an accuracy of ±3 percent of full scale.
4. The unit controller shall be configured to provide system status by indicating the following:
4.1. Free cooling available.

4.2. Economizer enabled.
4.3. Compressor enabled.
4.4. Heating enabled.
4.5. Mixed air low limit cycle active.
4.6. The current value of each sensor.
5. The unit controller shall be capable of manually initiating each operating mode so that the operation of compressors, economizers, fans and the heating system can be independently tested and verified.
6. The unit shall be configured to report faults to a fault management application available for *access* by day-to-day operating or service personnel, or annunciated locally on zone thermostats.
7. The fault detection and diagnostics system shall be configured to detect the following faults:
7.1. Air temperature sensor failure/fault.
7.2. Not economizing when the unit should be economizing.
7.3. Economizing when the unit should not be economizing.
7.4. Damper not modulating.
7.5. Excess outdoor air.

C403.9 Heat rejection equipment. Heat rejection equipment, including air-cooled condensers, dry coolers, open-circuit cooling towers, closed-circuit cooling towers and evaporative condensers, shall comply with this section.

Exception: Heat rejection devices where energy usage is included in the equipment efficiency ratings listed in ~~Tables C403.3.2(6) and C403.3.2(7)~~ the tables in Section C403.3.2.

C406.2 More efficient HVAC equipment performance. Equipment shall exceed the minimum efficiency requirements listed in ~~Tables C403.3.2(1) through C403.3.2(7)~~ the tables in Section C403.3.2 by 10 percent, in addition to the requirements of Section C403. Where multiple performance requirements are provided, the equipment shall exceed all requirements by 10 percent. *Variable refrigerant flow systems* shall exceed the energy efficiency provisions of ANSI/ASHRAE/IESNA 90.1 by 10 percent. Equipment not listed in Tables C403.3.2(1) through C403.3.2(7) shall be limited to 10 percent of the total building system capacity.

TABLE C407.5.1(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Space use classification	Same as proposed	The space use classification shall be chosen in accordance with Table C405.5.2 for all areas of the building covered by this permit. Where the space use classification for a building is not known, the building shall be categorized as an office building.
Roofs	Type: Insulation entirely above deck	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table C402.1.4	As proposed
	Solar absorptance: 0.75	As proposed
	Emittance: 0.90	As proposed
Walls, above-grade	Type: Mass wall where proposed wall is mass; otherwise steel-framedwall	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table C402.1.4	As proposed
	Solar absorptance: 0.75	As proposed
	Emittance: 0.90	As proposed
Walls, below-grade	Type: Mass wall	As proposed
	Gross area: same as proposed	As proposed
	U-Factor: as specified in Table C402.1.4 with insulation layer on interiorside of walls	As proposed
Floors, above-grade	Type: joist/framed floor	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table C402.1.4	As proposed
Floors, slab-on-grade	Type: Unheated	As proposed
	F-factor: as specified in Table C402.1.4	As proposed
Opaque doors	Type: Swinging	As proposed
	Area: Same as proposed	As proposed
	U-factor: as specified in Table C402.1.4	As proposed
Vertical fenestration other than opaque doors	Area 1.The proposed vertical fenestration area; where the proposed vertical fenestration area is less than 40 percent of above-grade wall area. 2.40 percent of above-grade wall area; where the proposed vertical fenestration area is 40 percent or more of the above-grade wall area.	As proposed
	U-factor: as specified in Table C402.4	As proposed
	SHGC: as specified in Table C402.4 except that for climates with no requirement (NR) SHGC = 0.40 shall be used	As proposed
	External shading and PF: None	As proposed
Skylights	Area 1.The proposed skylight area; where the proposed skylight area is less than that permitted by Section C402.1. 2.The area permitted by Section C402.1; where the proposed skylight area exceeds that permitted by Section C402.1.	As proposed

	permitted by Section C402.1	
	U-factor: as specified in Table C402.4	As proposed
	SHGC: as specified in Table C402.4 except that for climates with no requirement (NR) SHGC = 0.40 shall be used.	As proposed
Lighting, interior	The interior lighting power shall be determined in accordance with Section C405.3.2. Where the occupancy of the building is not known, the lighting power density shall be 1.0 Watt per square foot (10.7 W/m^2) based on the categorization of buildings with unknown space classification as offices.	As proposed
Lighting, exterior	The lighting power shall be determined in accordance with Table C405.4.2(2) and C405.4.2(3). Areas and dimensions of surfaces shall be the same as proposed.	As proposed
Internal gains	Same as proposed	Receptacle, motor and process loads shall be modeled and estimated based on the space use classification. End-use load components within and associated with the building shall be modeled to include, but not be limited to, the following: exhaust fans, parking garage ventilation fans, exterior building lighting, swimming pool heaters and pumps, elevators, escalators, refrigeration equipment and cooking equipment.
Schedules	Same as proposed **Exception:** Thermostat settings and schedules for HVAC systems that utilize radiant heating, radiant cooling and elevated air speed, provided that equivalent levels of occupant thermal comfort are demonstrated by means of equal Standard Effective Temperature as calculated in Normative Appendix B of ASHRAE Standard 55.	Operating schedules shall include hourly profiles for daily operation and shall account for variations between weekdays, weekends, holidays and any seasonal operation. Schedules shall model thetime-dependent variations in occupancy, illumination, receptacle loads, thermostat settings, mechanical ventilation, HVAC equipment availability, service hot water usage and any process loads. The schedules shall be typical of the proposed building type as determined by the designer and approved by the jurisdiction.
Mechanical ventilation	Same as proposed	As proposed, in accordance with Section C403.2.2.
Heating systems	Fuel type: same as proposed design	As proposed
	Equipment type[a]: as specified in Tables C407.5.1(2) and C407.5.1(3)	As proposed
	Efficiency: as specified in ~~Tables C403.3.2(4) and C403.3.2(5)~~ the tables in Section C403.3.2.	As proposed
	Capacity[b]: sized proportionally to the capacities in the proposed design based on sizing runs, and shall be established such that no smaller number of unmet heating load hours and no larger heating capacity safety factors are provided than in the proposed design.	As proposed
Cooling systems	Fuel type: same as proposed design	As proposed
	Equipment type[c]: as specified in Tables C407.5.1(2) and C407.5.1(3)	As proposed
	Efficiency: as specified in ~~Tables C403.3.2(1), C403.3.2(2) and C403.3.2(3)~~ the tables in Section C403.3.2	As proposed
	Capacity[b]: sized proportionally to the capacities in the proposed design based on sizing runs, and shall be established such that no smaller number of unmet cooling load hours and no larger cooling capacity safety factors are provided than in the proposed design.	As proposed
	Economizer[d]: same as proposed, in accordance with Section C403.5.	As proposed

Service water heating[e]	Fuel type: same as proposed	As proposed
	Efficiency: as specified in Table C404.2	For *Group R*, as proposed multiplied by SWHF. For other than *Group R*, as proposed multiplied by efficiency as provided by the manufacturer of the DWHR unit.
	Capacity: same as proposed	As proposed
	Where no service water hot water system exists or is specified in the proposed design, no service hot water heating shall be modeled.	

SWHF = Service water heat recovery factor, DWHR = Drain water heat recovery.

a. Where no heating system exists or has been specified, the heating system shall be modeled as fossil fuel. The system characteristics shall be identical in both the standard reference design and proposed design.
b. The ratio between the capacities used in the annual simulations and the capacities determined by sizing runs shall be the same for both the standard reference design and proposed design.
c. Where no cooling system exists or no cooling system has been specified, the cooling system shall be modeled as an air-cooled single-zone system, one unit per thermal zone. The system characteristics shall be identical in both the standard reference design and proposed design.
d. If an economizer is required in accordance with Table C403.5(1) and where no economizer exists or is specified in the proposed design, then a supply-air economizer shall be provided in the standard reference design in accordance with Section C403.5.
e. The SWHF shall be applied as follows:
1. Where potable water from the DWHR unit supplies not less than one shower and not greater than two showers, of which the drain water from the same showers flows through the DWHR unit then SWHF = [1 – (DWHR unit efficiency • 0.36)].
2. Where potable water from the DWHR unit supplies not less than three showers and not greater than four showers, of which the drain water from the same showers flows through the DWHR unit then SWHF = [1 – (DWHR unit efficiency • 0.33)].
3. Where potable water from the DWHR unit supplies not less than five showers and not greater than six showers, of which the drain water from the same showers flows through the DWHR unit, then SWHF = [1 – (DWHR unit efficiency • 0.26)].
4. Where Items 1 through 3 are not met, SWHF = 1.0.

C408.2.3.1 Equipment. Equipment functional performance testing shall demonstrate the installation and operation of components, systems, and system-to-system interfacing relationships in accordance with approved plans and specifications such that operation, function, and maintenance serviceability for each of the commissioned systems is confirmed. Testing shall include all modes and *sequence of operation*, including under full-load, part-load and the following emergency conditions:

1. All modes as described in the *sequence* of *operation*.
2. Redundant or *automatic* back-up mode.
3. Performance of alarms.
4. Mode of operation upon a loss of power and restoration of power.

Exception: Unitary or packaged HVAC equipment listed in ~~Tables C403.3.2(1) through C403.3.2(3)~~ the tables in Section C403.3.2 that do not require supply air economizers.

Reason: *These tables have historically come from ASHRAE Standard 90.1. They all represent industry consensus, and are rarely, if ever, intended to be different than 90.1.*
During the last few code cycles, we have noticed that due to the processes, the tables tend to diverge. The reason for this is that public comments to the IECC are due before the final tables are developed and generated for 90.1. Typically, we find errata in the 90.1 tables when we are developing the print version of the standard. Due to timing, those corrections in 90.1 never make it into the IECC. By referencing these tables in 90.1, we ensure that the requirements are aligned. ASHRAE also recognizes that code officials want to have the tables in the book. If this proposal is accepted, ASHRAE has contacted ICC staff about the possibility of reprinting the necessary tables in the IECC as printed in 90.1.

This proposal intends to modify the code by extracting and reprinting the following Tables from ASHRAE Standard 90.1-2019:

Table 6.8.1-1 Electrically Operated Unitary Air Conditioners and *Condensing Units*—Minimum *Efficiency* Requirements

Table 6.8.1-2 Electrically Operated Air Cooled Unitary and Heat Pumps—Minimum *Efficiency* Requirements

Table 6.8.1-3 Water-Chilling Packages—Minimum *Efficiency* Requirements

Table 6.8.1-4 Electrically Operated Packaged Terminal Air Conditioners, Packaged Terminal Heat Pumps, Single-Package Vertical Air Conditioners, Single-Package Vertical Heat Pumps, Room Air Conditioners, and

Room Air Conditioner Heat Pumps—Minimum Efficiency Requirements

Table 6.8.1-5 Warm-Air Furnaces and Combination Warm-Air Furnaces/Air-Conditioning Units, Warm-Air Duct Furnaces, and Unit Heaters—Minimum *Efficiency* Requirements

Table 6.8.1-6 Gas- and Oil-Fired *Boilers*—Minimum *Efficiency* Requirements

Table 6.8.1-7 Performance Requirements for Heat Rejection *Equipment*—Minimum *Efficiency* Requirements

Table 6.8.1-8 Heat Transfer *Equipment*—Minimum *Efficiency* Requirements

Table 6.8.1-9 Electrically Operated Variable-Refrigerant-Flow Air Conditioners—Minimum *Efficiency* Requirements

**Table 6.8.1-10 Electrically Operated Variable-Refrigerant-Flow and Applied Heat Pumps—
Minimum *Efficiency* Requirements**

Table 6.8.1-11 Floor Mounted Air Conditioners and *Condensing Units* Serving *Computer Rooms*—Minimum *Efficiency* Requirements

Table 6.8.1-13 Commercial Refrigerators, Freezers and Refrigeration—Minimum *Efficiency* Requirements

Table 6.8.1-14 Vapor Compression Based *Indoor Pool Dehumidifiers*—Minimum *Efficiency* Requirements

Table 6.8.1-15 Electrically Operated *DX-DOAS Units*, Single-Package and Remote Condenser, without *Energy* Recovery—Minimum *Efficiency* Requirements

Table 6.8.1-16 Electrically Operated *DX-DOAS Units*, Single-Package and Remote Condenser, with *Energy* Recovery—Minimum *Efficiency* Requirements

Table 6.8.1-17 Electrically Operated Water Source Heat Pumps—Minimum *Efficiency* Requirements

Table 6.8.1-18 Heat Pump and Heat Reclaim Chiller Packages – Minimum Efficiency Requirements

Table 6.8.1-19 Ceiling Mounted Computer Room Air Conditioners—Minimum *Efficiency* Requirements

This proposal does add new tables for DOAS units, electrically operated water source heat pumps, heat pump and heat reclaim chiller packages, ceiling mounted computer room air conditioners, and commercial refrigerators and freezers that were previously not covered in the IECC.

The proposal includes six sections and a table which contain specific references to one or more individual tables in Section C403.3.2. In each of these the specific references are replaced by a generic reference to the tables in Section C403.3.2. It is our intent that any other sections which have a specific reference, that it will also be replaced by the generic reference.

Please note that replacement of the IECC tables will result in the following standards no longer being directly referenced in the IECC: AHRI 210/240, AHRI 340/360, AHRI 365, AHRI 390, AHRI 400, AHRI 460, AHRI 560, ANSI/AHAM RAC-1, ANSI Z21.47, ANSI Z83.8, ASHRAE 127, CTI ATC-105, CTI ATC 105S, CTI STD-201 RS, CTI ATC-106, CTI STD 201, ISO 13256-1, ISO 13256-2, UL727, UL731 and NAECA.

Bibliography: ANSI/ASHRAE/IES Standard 90.1

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Some efficiencies in 90.1 for various types of equipment have been changed, and there are some new efficiencies for products that were previously uncovered. In some of those instances, the cost of construction may increase.

CE113-19

Public Hearing Results

Committee Action: As Submitted

Committee Reason: The change provides better coordination with 90.1 which is available online and updates to federal minimum standards. Only some are federal standards are ASHRAE standards, if we want the numbers changed we need to know which are which. The ASHRAE system is better equipped for dealing with details such as fan efficiency numbers (Vote: 13-2).

Assembly Action: **None**

CE113-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C403.3.2

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C403.3.2 HVAC equipment performance requirements (Mandatory). Equipment shall meet the minimum efficiency requirements of Tables C403.3.2(1) through C403.3.2(?)(reprinted tables 6.8.1-1 through 6.8.1-19 of ASHRAE Standard 90.1) when tested and rated in accordance with the applicable test procedure. Plate-type liquid-to-liquid heat exchangers shall meet the minimum requirements of Table C403.3.2(10) (reprinted Table 6.8.1-8 of ASHRAE Standard 90.1). The efficiency shall be verified through certification under an approved certification program or, where a certification program does not exist, the equipment efficiency ratings shall be supported by data furnished by the manufacturer. Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements. Where components, such as indoor or outdoor coils, from different manufacturers are used, calculations and supporting data shall be furnished by the designer that demonstrates that the combined efficiency of the specified components meets the requirements herein. Table numbering located in parentheses is the table numbers found in ASHRAE 90.1

Table C403.3.2(1)(6.8.1-1) Electrically Operated Unitary Air Conditioners and Condensing Units - Minimum Efficiency Requirements

Table C403.3.2(2)(6.8.1-2) Electrically Operated Air Cooled Unitary and Heat Pumps - Minimum Efficiency Requirements

Table C403.3.2(7)(6.8.1-3) Water Chilling Packages - Minimum Efficiency Requirements

Table C403.3.2(3)(6.8.1-4) Electrically Operated Packaged Terminal Air Conditioners, Packaged Terminal Heat Pumps, Single-Package Vertical Air Conditioners, Single-Package Vertical Heat Pumps, Room Air Conditioners, and Room Air Conditioner Heat Pumps—Minimum Efficiency Requirements

Table C403.3.2(4)(6.8.1-5) Warm-Air Furnaces and Combination Warm-Air Furnaces/Air-Conditioning Units, Warm-Air Duct Furnaces, and Unit Heaters—Minimum Efficiency Requirements

Table C403.3.2(5)(6.8.1-6) Gas- and Oil-Fired Boilers—Minimum Efficiency Requirements

Table C403.3.2(8)(6.8.1-7) Performance Requirements for Heat Rejection Equipment—Minimum Efficiency Requirements

Table C403.3.2(10)(6.8.1-8) Heat Transfer Equipment—Minimum Efficiency Requirements

Table C403.3.2(6)(6.8.1-9) Electrically Operated Variable-Refrigerant-Flow Air Conditioners—Minimum Efficiency Requirements

Table C403.3.2(11)(6.8.1-10) Electrically Operated Variable-Refrigerant-Flow and Applied Heat Pumps— Minimum Efficiency Requirements[if supportFields]> FILENAME

Table C403.3.2(9)(6.8.1-11) Floor Mounted Air Conditioners and Condensing Units Serving Computer Rooms—Minimum Efficiency Requirements

Table C403.3.2(12)(6.8.1-13) Commercial Refrigerators, Freezers and Refrigeration—Minimum Efficiency Requirements

Table C403.3.2(13)(6.8.1-14) Vapor Compression Based Indoor Pool Dehumidifiers—Minimum Efficiency Requirements

Table C403.3.2(14)(6.8.1-15) Electrically Operated DX-DOAS Units, Single-Package and Remote Condenser, without Energy Recovery—Minimum Efficiency Requirements

Table C403.3.2(15)(6.8.1-16) Electrically Operated DX-DOAS Units, Single-Package and Remote Condenser, with Energy Recovery—Minimum Efficiency Requirements

Table C403.3.2(16)(6.8.1-17) Electrically Operated Water Source Heat Pumps—Minimum Efficiency Requirements

Table C403.3.2(17)(6.8.1-18) Heat Pump and Heat Reclaim Chiller Packages – Minimum Efficiency Requirements

Table C403.3.2(18)(6.8.1-19) Ceiling Mounted Computer Room Air Conditioners—Minimum Efficiency Requirements

Commenter's Reason: I appreciate the intent of this proposal for there to be one set of numbers for both IECC and 90.1, and I agree with the concern of diverging of numbers. These numbers often come from the minimum federal standards, so going around chasing numbers for both entities is time consuming.
With all of that being said and done this is the IECC, a member of the I-codes family. The numbering of these tables should be in the format of the IECC and not 90.1. What was done for the public comment is the table numbering was taken back to the IECC format, including the added tables not currently found in the IECC, with the 90.1 table format in parentheses to acknowledge that these came from ASHRAE 90.1. This format is similar to what is found in the 2018 IgCC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment is only a clarification to correct table numbering. Clarifications are cost neutral. The proposal cost impact is accurate and therefore, the net effect is cost neutral.

Public Comment# 1959

CE115-19 Part II

IECC: R403.1.2 (IRC N1103.1.2)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Revise as follows:

R403.1.2 (IRC N1103.1.2) Heat pump supplementary supplemental heat (Mandatory). Heat pumps having supplementary supplemental electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load. Vapor compression cycle can provide the necessary heating to satisfy the thermostat control.

Exceptions:

1.Defrost operation.
2.Vapor compression cycle heating malfunction.
3.Thermostat malfunction.

Reason: This proposal updates this requirement to account for real world operation of heat pumps. There are times when supplemental heat will be needed to be used apart from defrost operation. The reasons for the additional exceptions are as follows:
Vapor compression cycle heating malfunction. If the compressor or reversing valve or metering device (such as a capillary tube or thermal expansion valve) is not working properly, the current requirements do not allow supplemental heat to be used. As a result, the space will not be conditioned, and in extreme cases where the compressor is not fixed, the temperatures could fall to levels where unsafe situations (such as pipes freezing) could develop.

Thermostat malfunction. If the thermostat is not working properly, the current requirements do not allow supplemental heat to be used. As a result, the space may not be conditioned, and when the thermostat is repaired, supplemental heat may be needed in conjunction with the compressor and fan motor to get the space back to its programmed temperature in a short period of time.

It should also be noted that the energy efficiency standards for heat pumps (both commercial and residential) have increased significantly over the past 25 years. Standards increased again for commercial heat pumps on 1/1/2018, and will increase again as of 1/1/2023. Also, with more heat pumps having "smart" technology, the system owner or facility manager can be notified immediately on a smart phone or computer if such a malfunction is occurring, which will limit such operation.

Bibliography: "Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards for Small,Large, and Very Large Air-Cooled Commercial Package Air Conditioning and Heating Equipment and Commercial Warm Air Furnaces", 10 CFR Part 431 [Docket Number EERE–2013–BT–STD–0007 and EERE–2013–BT–STD–0021], US Department of Energy, 2016, Pages 32630-32631
Website for more information: https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=35

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This will not increase (or decrease) the cost of construction, as the exceptions shown are already aspects of current heat pump control strategies and will not increase the cost to purchase, install, or operate a commercial heat pump.

CE115-19 Part II

Public Hearing Results

Errata: This proposal includes no errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: As Modified

Committee Modification:
R403.1.2 (IRC N1103.1.2) Heat pump ~~supplementary~~ supplemental heat (Mandatory). Heat pumps having ~~supplementary~~ supplemental electric-resistance heat shall have controls that~~, except during defrost,~~ prevent supplemental heat operation when the heat pump ~~compressor can meet the heating load. V~~ vapor compression cycle can provide the necessary heating to satisfy the thermostat control.

Exceptions:

1. Defrost operation.
2. Vapor compression cycle heating malfunction.
3. Thermostat malfunction.

Committee Reason: The proposal cleans up language and supports systems as they operate today and adds exceptions and additional information for the builder and code official. The modification clarifies language from original proposal (Vote: 10-1).

Assembly Action: **None**

CE115-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:
Ted Williams, representing American Gas Association (twilliams@aga.org)

requests Disapprove

Commenter's Reason: "Compression cycle malfunction" and "thermostat malfunction" are not defined in the requirements text. Explanation in the "Reason" statement isn't insufficient to make the change properly enforceable. Is loss of heating capacity in a system due to loss of refrigerant a "malfunction?" If so, this provision would allow continuous heating using electric resistance supplemental heating as the sole source of heat for an indefinite period and waste great amounts of energy.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The change would retain the current requirements, thereby not affecting construction costs.

Public Comment# 2148

NOTE: CE115-19 PART I DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

CE115-19 Part I

IECC: Part I: C403.4.1.1 (New)

IECC: Part II: R403.1.2(N1103.1.2) (New)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C403.4.1.1 Heat pump ~~supplementary~~ supplemental heat (Mandatory). Heat pumps having ~~supplementary~~ supplemental electric resistance heat shall have controls that ~~, except during defrost,~~ prevent ~~supplementary~~ supplemental heat operation where the heat pump vapor compression cycle can provide the ~~heating load.~~ necessary heating to satisfy the thermostat control.

Exceptions:

1. Defrost operation.
2. Vapor compression cycle malfunction.
3. Thermostat malfunction.

Reason: This proposal updates this requirement to account for real world operation of heat pumps. There are times when supplemental heat will be needed to be used apart from defrost operation. The reasons for the additional exceptions are as follows:
Vapor compression cycle heating malfunction. If the compressor or reversing valve or metering device (such as a capillary tube or thermal expansion valve) is not working properly, the current requirements do not allow supplemental heat to be used. As a result, the space will not be conditioned, and in extreme cases where the compressor is not fixed, the temperatures could fall to levels where unsafe situations (such as pipes freezing) could develop.

Thermostat malfunction. If the thermostat is not working properly, the current requirements do not allow supplemental heat to be used. As a result, the space may not be conditioned, and when the thermostat is repaired, supplemental heat may be needed in conjunction with the compressor and fan motor to get the space back to its programmed temperature in a short period of time.

It should also be noted that the energy efficiency standards for heat pumps (both commercial and residential) have increased significantly over the past 25 years. Standards increased again for commercial heat pumps on 1/1/2018, and will increase again as of 1/1/2023. Also, with more heat pumps having "smart" technology, the system owner or facility manager can be notified immediately on a smart phone or computer if such a malfunction is occurring, which will limit such operation.

Bibliography: "Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards for Small,Large, and Very Large Air-Cooled Commercial Package Air Conditioning and Heating Equipment and Commercial Warm Air Furnaces", 10 CFR Part 431 [Docket Number EERE–2013–BT–STD–0007 and EERE–2013–BT–STD–0021], US Department of Energy, 2016, Pages 32630-32631
Website for more information: https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=35

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This will not increase (or decrease) the cost of construction, as the exceptions shown are already aspects of current heat pump control strategies and will not increase the cost to purchase, install, or operate a commercial heat pump.

CE115-19 Part I

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: Disapproved

Committee Reason: Not in support of calling out malfunctioning equipment, preference is for CE116 (Vote: 12-3).

Assembly Action: None

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

CE115-19 Part I

CE116-19 Part I

IECC®: C403.4.1.1

Proposed Change as Submitted

Proponents: Charles Foster, representing self (cfoster20187@yahoo.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C403.4.1.1 Heat pump supplementary heat (Mandatory). Heat pumps having supplementary electric resistance heat shall have controls that ~~, except during defrost, prevent supplementary heat operation where the heat pump can provide the heating load.~~ limit supplemental heat operation to only those times when:

1. The vapor compression cycle cannot provide the necessary heating energy to satisfy the thermostat setting,
2. The heat pump is operating in defrost mode,
3. The vapor compression cycle malfunctions, or
4. The thermostat malfunctions.

Reason: This proposal updates this requirement to account for real world operation of heat pumps. There are times when supplemental heat will be needed to be used apart from defrost operation. The reasons for the additional exceptions are as follows:
Vapor Compression cycle malfunction. If the compressor or reversing valve or metering device (such as a capillary tube or thermal expansion valve) is not working properly, the current requirements do not allow supplemental heat to be used. As a result, the space will not be conditioned, and in extreme cases where the compressor is not fixed, the temperatures could fall to levels where unsafe situations (such as pipes freezing) could develop.

Thermostat malfunction. If the thermostat is not working properly, the current requirements do not allow supplemental heat to be used. As a result, the space may not be conditioned, and when the thermostat is repaired, supplemental heat may be needed in conjunction with the compressor and fan motor to get the space back to its programmed temperature in a short period of time.

It should also be noted that the national energy efficiency standards for residential heat pumps have increased significantly over the past 25 years, and will increase again in January, 2023. Also, with more heat pumps having "smart" technology, the system owner can be notified immediately on a smart phone or computer if such a malfunction is occurring, which will limit such operation.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This will not increase (or decrease) the cost of construction, as the exceptions shown are already aspects of current heat pump control strategies and will not increase the cost to purchase, install, or operate a heat pump.

CE116-19 Part I

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This addresses the issue as a backstop for failures and malfunctions, addressing potential safety issues association with equipment failure (Vote: 11-4).

Assembly Action: **None**

CE116-19 Part I

Individual Consideration Agenda

Public Comment 1:

Proponents:

Ted Williams, representing American Gas Association (twilliams@aga.org)

requests Disapprove

Commenter's Reason: "Compression cycle malfunction" and "thermostat malfunction" are not defined. Is loss of heating capacity in a system due to loss of refrigerant a "malfunction?" If so, this provision would allow continuous heating using electric resistance supplemental heating as the sole source of heat for an indefinite period and waste great amounts of energy.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 2145

NOTE: CE116-19 PART II DID NOT RECEIVE A PUBLIC COMMENT AND IS REPRODUCED FOR INFORMATIONAL PURPOSES ONLY

CE116-19 Part II

IECC: R403.1.2 (IRC N1103.1.2)

Proposed Change as Submitted

Proponents: Charles Foster, representing self (cfoster20187@yahoo.com)

2018 International Energy Conservation Code

Revise as follows:

R403.1.2 (IRC N1103.1.2) Heat pump supplementary heat (Mandatory). Heat pumps having supplementary electric-resistance heat shall have controls that ~~, except during defrost, prevent~~ limit supplemental heat operation to only those times when :
1. The vapor compression cycle cannot provide the necessary heating energy to satisfy the ~~heat pump compressor can meet the heating load.~~ thermostat setting,
2. The heat pump is operating in defrost mode,
3. The vapor compression cycle malfunctions, or
4. The thermostat malfunctions.

Reason: This proposal updates this requirement to account for real world operation of heat pumps. There are times when supplemental heat will be needed to be used apart from defrost operation. The reasons for the additional
exceptions are as follows:
Vapor Compression cycle malfunction. If the compressor or reversing valve or metering device (such as a capillary tube or thermal expansion valve) is not working properly, the current requirements do not allow supplemental heat to be used. As a result, the space will not be conditioned, and in extreme cases where the compressor is not fixed, the temperatures could fall to levels where unsafe situations (such as pipes freezing) could develop.

Thermostat malfunction. If the thermostat is not working properly, the current requirements do not allow supplemental heat to be used. As a result, the space may not be conditioned, and when the thermostat is repaired, supplemental heat may be needed in conjunction with the compressor and fan motor to get the space back to its programmed temperature in a short period of time.

It should also be noted that the national energy efficiency standards for residential heat pumps have increased
significantly over the past 25 years, and will increase again in January, 2023. Also, with more heat pumps having "smart" technology, the system owner can be notified immediately on a smart phone or computer if such a malfunction is occurring, which will limit such operation.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This will not increase (or decrease) the cost of construction, as the exceptions shown are already aspects of current heat pump control strategies and will not increase the cost to purchase, install, or operate a heat pump.

CE116-19 Part II

Public Hearing Results

Committee Action: **Withdrawn**

Assembly Action: **None**

CE116-19 Part II

CE124-19

IECC®: C403.5

Proposed Change as Submitted

Proponents: Julius Ballanco, JB Engineering and Code Consulting, P.C., representing Daikin US (JBEngineer@aol.com)

2018 International Energy Conservation Code

Revise as follows:

C403.5 Economizers (Prescriptive). Economizers shall comply with Sections C403.5.1 through C403.5.5.

An air or water economizer shall be provided for the following cooling systems:

1. Chilled water systems with a total cooling capacity, less cooling capacity provided with air economizers, as specified in Table C403.5(1).
2. Individual fan systems with cooling capacity greater than or equal to 54,000 Btu/h (15.8 kW) in buildings having other than a *Group R* occupancy,The total supply capacity of all fan cooling units not provided with economizers shall not exceed 20 percent of the total supply capacity of all fan cooling units in the building or 300,000 Btu/h (88 kW), whichever is greater.
3. Individual fan systems with cooling capacity greater than or equal to 270,000 Btu/h (79.1 kW) in buildings having a *Group R* occupancy.The total supply capacity of all fan cooling units not provided with economizers shall not exceed 20 percent of the total supply capacity of all fan cooling units in the building or 1,500,000 Btu/h (440 kW), whichever is greater.

Exceptions: Economizers are not required for the following systems.

1. Individual fan systems not served by chilled water for buildings located in *Climate Zones* 1A and 1B.
2. Where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F (1.7°C) dew-point temperature to satisfy process needs.
3. Systems expected to operate less than 20 hours per week.
4. Systems serving supermarket areas with open refrigerated casework.
5. Where the cooling efficiency is greater than or equal to the efficiency requirements in Table C403.5(2).
6. Systems that include a heat recovery system in accordance with Section C403.9.5.
7. <u>VRF systems installed with a dedicated outdoor air system.</u>

Reason: VRF (variable refrigerant flow) systems are unique in that they rely on the heating and cooling of the air within a room of space. There is no massive installation of ducts to move air through a central air handling system. Outside air is provided by a dedicated outside air (DOA) system. This type of heating and cooling system does not lend itself to having an economizer. The DOA system would have to be completely oversized in order to accomplish cooling with outside air. That defeats the purpose of this highly efficient heating and cooling system.
An analysis was done compairing a VRF system with a DOA system to a typical roof top air handling unit having an economizer cycle. The two areas of the country analyzed were Chicago and Houston. The cooling energy use was compared since economizers provide cooling with outside air. The VRF with DOA used 45.5% less energy to cool a building in Chicago. For the same building in Houston, the VRF with DOA used 32.9% less energy than a rooftop unit.

This proves that a VRF system with a DOA system is more efficient that a standard rooftop unit with an economizer cycle. The code should be modified to recognize this energy savings.

Cost Impact: The code change proposal will decrease the cost of construction
An economizer for a VRF system is very expensive since there would have to be oversizing of DOA ducts and a larger air handler for the DOA system.

CE124-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This allows builder to take advantage of smaller duct sizes that go along with DOAZ (Vote: 14-1).

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

IECC®: C403.5

Proponents:
Eric Makela, New Buildings Institute, representing Northwest Energy Codes Group (ericM@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C403.5 Economizers (Prescriptive). Economizers shall comply with Sections C403.5.1 through C403.5.5.

An air or water economizer shall be provided for the following cooling systems:

1. Chilled water systems with a total cooling capacity, less cooling capacity provided with air economizers, as specified in Table C403.5(1).
2. Individual fan systems with cooling capacity greater than or equal to 54,000 Btu/h (15.8 kW) in buildings having other than a *Group R* occupancy,The total supply capacity of all fan cooling units not provided with economizers shall not exceed 20 percent of the total supply capacity of all fan cooling units in the building or 300,000 Btu/h (88 kW), whichever is greater.
3. Individual fan systems with cooling capacity greater than or equal to 270,000 Btu/h (79.1 kW) in buildings having a *Group R* occupancy.The total supply capacity of all fan cooling units not provided with economizers shall not exceed 20 percent of the total supply capacity of all fan cooling units in the building or 1,500,000 Btu/h (440 kW), whichever is greater.

Exceptions: Economizers are not required for the following systems.

1. Individual fan systems not served by chilled water for buildings located in *Climate Zones* 1A and 1B.
2. Where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F (1.7°C) dew-point temperature to satisfy process needs.
3. Systems expected to operate less than 20 hours per week.
4. Systems serving supermarket areas with open refrigerated casework.
5. Where the cooling efficiency is greater than or equal to the efficiency requirements in Table C403.5(2).
6. Systems that include a heat recovery system in accordance with Section C403.9.5.
7. VRF systems installed with a dedicated outdoor air system meeting the requirements of Section C406.6 and the exhaust energy recovery in compliance with Section C403.7.4, without exception. When this exception is used, credit shall not be allowed for Section C406.6.
.

Commenter's Reason: CE124 provides an exception from economizers for VRF systems that use a dedicated outdoor air system (DOAS) to provide ventilation air. Currently there is no definition of DOAS in Chapter 2 of the IECC and all of the requirements for DOAS are included in Options Packages language contained in C406.6. This Public Comment ensures that there is a link from the DOAS language in this proposed exception to the requirements for DOAS C406.6.
The second part of this Public Comment is to ensure energy recovery ventilation (ERV) is required as part of the DOAS system exception. ERV (see Section C403.7.4) and the minimum recovery efficiency contained within the provision are key components of DOAS. This Public Comment would require that ERV systems always be required for DOAS regardless of number of hours operation and fan CFM.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This public comment is only a clarification to the proposed language as the code already intends for dedicated outdoor air systems to comply with the indicated sections. Clarifications to the code do not impact cost. The proposal's cost impact statement is accurate.

Public Comment# 1897

Public Comment 2:

Proponents:
John Bade, Self, representing Self (john.bade-osorio@outlook.com)

requests Disapprove

Commenter's Reason: Thank you for the opportunity to submit comments on Proposal CE124-19. This proposal should be disapproved for the following reasons:

- It will increase energy use.
- “Dedicated outdoor air system” is not defined in the code for the purpose of this exemption.
- It unfairly favors a single type of zone cooling technology over others that are just as efficient.

Increased energy use

Though the proposer only modeled a VRF-DOAS system against an unspecified rooftop system in just two climate zones, the exemption applies to any size and type of building in all climate zones. So, even a large office building where the baseline is a central station VAV system and chiller is the baseline will not need an economizer even in a cool, dry climate zone where most hours are suitable for economizing.

Even VRF advocates recognize that economizing is important. During the committee presentation, a member of the committee noted that the State of Washington already has this provision in their code. But the Northwest Energy Efficiency Alliance (NEEA), one of the main advocates for the Washington’s adoption of code language favorable to VRF recognizes that economizing is important. In their *Very High Efficiency Dedicated Outside Air System Design Specification and Guidelines* (https://betterbricks.com/uploads/resources/VHE-DOAS-System-Design-Specifications.pdf) they require that the DOAS unit include an economizer bypass and be sized at twice the required outdoor airflow so that is large enough to provide at least some economizing. They explain this requirement in Note 4 of the specification:

When separating the ventilation function from the heating/cooling function, the outside air connection is not associated with the heating/cooling system, so this function must be provided through the HRV/ERV in order to maintain the ability to increase the number of hours annually during which mechanical cooling (and heating, as well, in some cases) is not required.

The State of Washington’s code (https://apps.des.wa.gov/sbcc/Page.aspx?nid=116) does indeed have a VRF economizer exception, but that code contains provisions designed to ensure that the VRF system is designed to save enough energy to make up for the lack of economizing. They include (1) that the VRF be the heat-recovery type, not just a simple heat pump, and (2) that the DOAS system always include exhaust air energy in all cases.

No definition nor requirements for DOAS, including energy recovery

There is no definition of “dedicated outdoor air system” nor requirements for a DOAS in the part of the code that applies to this exemption. It is true that Section 406 does require that the dedicated outside air system include a total energy recovery device to meet the requirements of that section, that requirement does not apply in general. The term “dedicated outdoor air system does not appear elsewhere in IECC-2018. This will allow designers excessively wide latitude to declare just about any system that provides a significant amount of outside air to be DOAS – even a simple makeup air unit with only a fan and a filter.

Some may have a mistaken impression that DOAS automatically includes energy recovery. In fact, most DX-DOAS units sold in the United States do not include energy recovery. One of the committee members asked if energy recovery would be required, and the proposer correctly cited Section 403.7.4 – Energy recovery ventilation systems and noted that the requirements of this section will apply. But members should understand that very often the requirements of that section do not require that energy recovery be provided.

In section 403.7.4 in “B” and “C” climates energy recovery is only required for large systems that are bigger than the typical DOAS unit. In “A” climates energy recovery there are exceptions that often allow designers to forego recovery.

Exception 7 applies to systems that “employ energy recovery in series with the coil.” Though this is not intended to apply to simple hot-gas reheat systems found in most DX-DOAS units, many users infer that hot-gas reheat systems do fall under this exemption. ASHRAE 90.1 has added language in the 2019 version to clarify this.

Exception 8 allows users to not use exhaust energy recovery if 75% of the design outdoor airflow cannot be recovered at a single location. This exception is often used in buildings with lower outdoor airflow rates, such as offices. Exhaust requirements for bathrooms, locker rooms and other spaces, along with air lost to maintaining positive building pressure often exceeds 25% of the outdoor airflow and automatically relieves users from the requirement to provide energy recovery.

Favoring a single zone-cooling technology

Regardless of the preceding discussion, even those that favor this proposal must be aware that the benefits of VRF cited by the user are not unique. There are other widely-used zone-cooling systems, such as water-source heat pumps, chilled beam, radiant panels, hydronic fan coils, fan-powered chilled water terminals that provide heating and cooling in a manner much like VRF systems. The language as proposed only applies to VRF systems, and unfairly puts these other systems at a disadvantage. Even if the exception is upheld, at a minimum it must be revised to include all technologies that operate in a similar manner.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 2168

CE127-19

IECC®: C403.7.1

Proposed Change as Submitted

Proponents: Nicholas O'Neil, NW Energy Codes Group, representing NW Energy Codes Group (noneil@energy350.com)

2018 International Energy Conservation Code

Revise as follows:

C403.7.1 Demand control ventilation (Mandatory). Demand control ventilation (DCV) shall be provided for all single-zone systems required to comply with Sections C403.5 through 403.5.3 and spaces larger than 500 square feet (46.5 m^2) and with an average occupant load of 25 people or greater per 1,000 square feet (93 m^2) of floor area, as established in Table 403.3.1.1 of the International Mechanical Code, and served by systems with one or more of the following:

1. An air-side economizer.
2. Automatic modulating control of the outdoor air damper.
3. A design outdoor airflow greater than 3,000 cfm (1416 L/s).

Exceptions:

1. Systems with energy recovery complying with Section C403.7.4.
2. Multiple-zone systems without direct digital control of individual zones communicating with a central control panel.
3. ~~Systems~~ Multiple-zone systems with a design outdoor airflow less than 1,200 cfm (566 L/s).
4. Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1,200 cfm (566 L/s).
5. Ventilation provided only for process loads.

Reason: Many spaces are over-ventilated due to design professionals establishing ventilation rates based on peak design conditions that rarely exist on a daily basis. Substantial energy savings can be obtained even in low-occupancy areas through the implementation of DCV. CO2 sensor costs have fallen in recent years making DCV on smaller sized units that already require economizers, (and therefore already have modulating dampers) more cost-effective than they have been in the past.

Cost Impact: The code change proposal will increase the cost of construction
A single CO_2 sensor in the return air duct of a single zone system is expected to cost less than $300 and provides assurance that indoor air quality in smaller spaces will be maintained to safe CO_2 levels. Note that the requirement for installing DCV is only on units that are already required to have an economizer installed, which drastically reduces the cost of implementing DCV.

CE127-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: We should not put a co sensor in places we do not have people, there is potential to bring in hot humid air. There is unclear use of "ands" and "ors" which a public comment to clarify (Vote: 10-5).

Assembly Action: **None**

CE127-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C403.7.1

Proponents:
Nicholas O'Neil, representing Energy 350 (noneil@energy350.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C403.7.1 Demand control ventilation (Mandatory). Demand control ventilation (DCV) shall be provided for all single-zone systems required to comply with Sections C403.5 through C403.5.3 and spaces larger than 500 square feet (46.5 m^2) and with an average occupant load of ~~25~~ 15 people or greater per 1,000 square feet (93 m^2) of floor area, as established in Table 403.3.1.1 of the International Mechanical Code, and served by systems with one or more of the following:

1. An air-side economizer.
2. Automatic modulating control of the outdoor air damper.
3. A design outdoor airflow greater than 3,000 cfm (1416 L/s).

Exceptions:

1. Systems with energy recovery complying with Section C403.7.4.
2. Multiple-zone systems without direct digital control of individual zones communicating with a central control panel.
3. Multiple-zone systems with a design outdoor airflow less than ~~1,200~~ 750 cfm (~~566~~ 354 L/s).
4. ~~Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1,200 cfm (566 L/s).~~ Spaces where >75% of the space design outdoor airflow is required for makeup air that is exhausted from the space or transfer air that is required for makeup air that is exhausted from other spaces.
5. Ventilation provided only for process loads.

Commenter's Reason: To address committee concerns, language has been modified to avoid possibly requiring DCV on spaces with little to no occupancy. Instead of requiring DCV on all single-zone systems, the occupant density threshold has been reduced from 25 to 15 people per 1000 sqft to maintain a cost-effective level and require more highly variable occupant spaces to implement DCV. In addition, exemptions 3 and 4 have been modified to align with ASHRAE 90.1 language to maintain consistency.
Original reason: One of the common issues we see out in the field is over ventilation of spaces which are based on deign loads and rarely occupied that way. The current code requires DCV to be installed in spaces that are 500sqft and have an occupant density of greater than 25 people per 1,000 sqft. Substantial energy savings can be obtained from lower occupancy spaces through the implementation of DCV. CO2 sensor costs have fallen in recent years making DCV more cost-effective than they have been in the past.

We believe this proposal would help reduce the over-ventilation of spaces that are not covered by DCV currently with a cost-effective control strategy.

Bibliography: Savings based on work done by PNNL for ASHRAE 90.1 to model energy reductions at reduced CFM threshold.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The cost to implement DCV is a return air CO2 sensor and given current prices of around $300 can provide a payback of a few months to 2 years depending on the unit size.

Public Comment# 1232

Public Comment 2:

IECC®: C403.7.1, TABLE C403.7.1 (New)

Proponents:
Louis Starr (lstarr@neea.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C403.7.1 Demand control ventilation (Mandatory). Demand control ventilation (DCV) shall be provided for all single-zone systems required to comply with Sections C403.5 through C403.5.3 and spaces larger than the floor area shown in Table C403.7.1 based on an occupant related outside airflow in cfm per 1000 square feet (L/s-100 m2) ~~500 square feet (46.5 m2) and with an average occupant load of 25 people or greater per 1,000 square feet (93 m2) of floor area, as established~~ and served by systems with one or more of the following:

1. An air-side economizer.
2. Automatic modulating control of the outdoor air damper.
3. A design outdoor airflow greater than 3,000 cfm (1416 L/s).

Exceptions:

1. ~~Systems with energy recovery complying with Section C403.7.4.~~ Spaces where greater than 75 percent of the space design outdoor airflow is required for makeup air that is exhausted from the space or transfer air that is required for makeup air that is exhausted from other spaces.
2. ~~Multiple-zone systems without direct digital control of individual zones communicating with a central control panel.~~ Spaces with one of the following occupancy categories as defined in Table 403.3.1.1 of the International Mechanical Code: correctional facility cells, science laboratories, barber, beauty and nail salons, and bowling alley seating.
3. ~~3.~~ ~~Multiple-zone systems with a design outdoor airflow less than 1,200 cfm (566 L/s).~~
4. ~~4.~~ ~~Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1,200 cfm (566 L/s).~~

~~5~~ 3. Ventilation provided only for process loads.

TABLE C403.7.1
DEMAND CONTROLLED VENTILATION THRESHOLDS

Climate Zones	Occupant Related Outside Airflow Rate (CFM/1000 ft^2)[a]							
	112 to 124	125 to 199	200 to 399	≥400	112 to 124	125 to 199	200 to 399	≥400
	Space floor area (ft^2) for spaces served by systems without ERV or HRV				Space floor area (ft^2) for spaces served by systems with ERV or HRV complying with Section C403.7.4			
8	250	225	125	50	450	400	225	100
6A, 6B, 7	450	400	200	100	1,125	1,000	500	250
0B, 1B, 4A, 5A, 5C	600	550	275	150	1,775	1,625	825	450
3A, 4C, 5B	750	675	350	175	2,050	1,850	950	475
2A, 2B	950	850	425	225	1,875	1,675	850	450
3B, 4B	1,300	1,175	575	300	4,950	4,475	2,200	1,150
0A, 1A	2,000	1,800	900	450	4,850	4,375	2,175	1,100
3C	6,000	5,400	2,700	1,375	10,775	9,700	4,850	2,475

For SI: 1 ft^2 = 0.093 m^2 , 1 CFM/1000 ft^2 = 0.508 L/s-100 m^2

a. An occupant related outside airflow in cfm per 1000 square feet (L/s-100 m2) is calculated as the product of occupant density and per occupant outdoor airflow rate as shown in Table 403.3.1.1 of the International Mechanical Code.

Commenter's Reason: In response to public comment, DCV should be required when cost-effective and for occupied spaces, as well as equitable across varying space sizes, use of energy recovery equipment, and climate zones. This proposal seeks to more effectively align DCV requirements with all those variables to produce a cost-effective solution and bases the square footage threshold requirement on climate zone and occupant airflow rates per 1,000 sqft determined through the IMC. This proposal cleans up unnecessary exemptions and aligns language with submissions to ASHRAE for consideration in the next 90.1 standard.
The exceptions were modified as follows:

- The exhaust air energy recovery exception was removed and replaced with higher floor area thresholds in the table.
- The non-DDC control exception was removed as practically all multi-zone systems installed today have DDC.
- Exceptions were added for spaces that are not recommend for DCV.
- The transfer air exception was simplified and coordinated with ASHRAE 90.1
- The exception for design airflow less than 1,200 cfm was removed, as system size is essentially covered when an economizer is required.

Bibliography: Square foot thresholds based on CFM ranges and code language sourced from PNNL ASHRAE 90.1 analysis.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Since an economizer or motorized dampers are already required as part of the charging language of this section, the cost to add a sensor and wiring is expected to be $300 or less per unit. The square footage thresholds in the table result in cost effectiveness for a 15 year life control measure, based on a discounted payback of 11.8 years.

Public Comment# 1863

CE129-19

IECC®: C403.7.2

Proposed Change as Submitted

Proponents: Nicholas O'Neil, Energy 350, representing Energy 350 (noneil@energy350.com)

2018 International Energy Conservation Code

Revise as follows:

C403.7.2 Enclosed parking garage ventilation controls (Mandatory). Enclosed parking garages used for storing or handling automobiles operating under their own power shall employ ~~contamination-sensing devices~~ carbon monoxide detectors applied in conjunction with nitrogen dioxide detectors and automatic controls configured to stage fans or modulate fan average airflow rates to 50 percent or less of design capacity, or intermittently operate fans less than 20 percent of the occupied time or as required to maintain acceptable contaminant levels in accordance with International Mechanical Code provisions. Failure of contamination-sensing devices shall cause the exhaust fans to operate continuously at design airflow.

Exceptions:

1. Garages with a total exhaust capacity less than ~~22~~ 8,~~500~~ 000 cfm (~~10 620~~ 3 775 L/s) with ventilation systems that do not utilize heating or mechanical cooling and use occupant sensors to activate the full required ventilation rate.
2. Garages that have a garage area to ventilation system motor nameplate power ratio that exceeds 1125 cfm/hp (710 L/s/kW) and do not utilize heating or mechanical cooling.

Reason: The current threshold for exempting parking ventilation controls ignores a substantial percentage of the parking garage market that could benefit from reduced fan ventilation during times of low (or no) occupancy. The cost of fan system controls and sensors has fallen in recent years making ventilation controls on smaller sized garages more cost-effective than they have been in the past.

Cost Impact: The code change proposal will increase the cost of construction
The primary components required are sensors, controllers and fan variable frequency drives (VFDs). The cost for implementing this code requirement is estimated at $400 per 1,000 square feet of parking garage, or $0.40 per square foot. Additionally, the payback for this code proposal is less than 5 years and will be faster for larger garage sizes.

CE129-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: The mechanical code indicates how much air to deliver, the IECC indicates when to reduce ventilation - it is valuable to state when both carbon monoxide and dioxide sensors are required and it is appropriate for the IECC to drop the square foot threshold for ventilation rates (Vote: 11-4).

Assembly Action: **None**

CE129-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C403.7.2

Proponents:
Nicholas O'Neil, representing Energy 350 (noneil@energy350.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C403.7.2 Enclosed parking garage ventilation controls (Mandatory). Enclosed parking garages used for storing or handling automobiles operating under their own power shall employ carbon monoxide detectors applied in conjunction with nitrogen dioxide detectors and automatic controls configured to stage fans or modulate fan average airflow rates to 50 percent or less of design capacity, or intermittently operate fans less than 20 percent of the occupied time or as required to maintain acceptable contaminant levels in accordance with International Mechanical Code provisions. Failure of contamination-sensing devices shall cause the exhaust fans to operate continuously at design airflow.

Exceptions:

1. Garages with a total exhaust capacity less than 8,000 cfm (3 775 L/s) with ventilation systems that do not utilize heating or mechanical cooling~~ and use occupant sensors to activate the full required ventilation rate~~.
2. Garages that have a garage area to ventilation system motor nameplate power ratio that exceeds 1125 cfm/hp (710 L/s/kW) and do not utilize heating or mechanical cooling.

Commenter's Reason: Public comment modifies proposal to remove occupancy sensors for smaller garages to eliminate conflict with IMC on means to safely control ventilation.

Original reason statement: The current threshold for exempting parking ventilation controls ignores a substantial percentage of the parking garage market that could benefit from reduced fan ventilation during times of low (or no) occupancy. The cost of fan system controls and sensors has fallen in recent years making ventilation controls on smaller sized garages more cost-effective than they have been in the past.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Original cost statement: The primary components required are sensors, controllers and fan variable frequency drives (VFDs). The cost for implementing this code requirement is estimated at $400 per 1,000 square feet of parking garage, or $0.40 per square foot. Additionally, the payback for this code proposal is less than 5 years and will be faster for larger garage sizes.

Public Comment# 1410

Public Comment 2:

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests Disapprove

Commenter's Reason: The energy code should be utilized for components that are considered to be energy provisions. The requirement for the use of carbon monoxide detectors and nitrogen detectors for enclosed parking garages is already required in Section 404.1 of the 2018 IMC, and does not need to be duplicated in the energy code. When you place duplicated sections in two or more of the codes you have the opportunity for these requirements to diverge since they are heard by different committees and during different code cycles. This provision is a good provisions, but the mechanical code is the correct code for these type of requirements to be placed.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1507

CE133-19

IECC: SECTION C202 (New), C403.7.4, C403.7.4.1(New), C403.7.4.2(New)

Proposed Change as Submitted

Proponents: Connor Barbaree, representing ASHRAE (cbarbaree@ashrae.org)

2018 International Energy Conservation Code

SECTION C202
GENERAL DEFINITIONS

Add new definition as follows:

ENTHALPY RECOVERY RATIO. Change in the enthalpy of the *outdoor air* supply divided by the difference between the *outdoor air* and entering exhaust air enthalpy, expressed as a percentage.

Add new text as follows:

C403.7.4 **Energy Recovery Systems** .Energy recovery ventilation systems shall be provided as specified in either Section 403.7.1 or 403.7.2, as applicable.

C403.7.4.1 **Nontransient dwelling units (Prescriptive).** Nontransient dwelling units shall be provided with outdoor air energy recovery ventilation systems with an enthalpy recovery ratio of not less than 50 percent at cooling design condition and not less than 60 percent at heating design condition.

Exceptions:

1.Nontransient dwelling units in Climate Zone 3C.
2.Nontransient dwelling units with no more than 500 square feet (46 $m^{2)}$ of conditioned floor area in Climate Zones 0, 1, 2, 3, 4C, and 5C.
3.Enthalpy recovery ratio requirements at heating design condition in Climate Zones 0, 1, and 2.
4.Enthalpy recovery ratio requirements at cooling design condition in Climate Zones 4, 5, 6, 7, and 8.

Revise as follows:

~~**C403.7.4**~~ **C403.7.4.2** ~~**Energy recovery ventilation systems**~~ **Spaces other than nontransient dwelling units (Mandatory).** Where the supply airflow rate of a fan system serving a space other than a nontransient dwelling unit exceeds the values specified in Tables C403.7.4(1) and C403.7.4(2), the system shall include an energy recovery system. The energy recovery system shall ~~be configured to provide a change in the enthalpy of the outdoor air supply of~~ provide an enthalpy recovery ratio of not less than 50 percent ~~of the difference between the outdoor air and return air enthalpies,~~ at design conditions. Where an air economizer is required, the energy recovery system shall include a bypass or controls that permit operation of the economizer as required by Section C403.5.

Exception: An energy recovery ventilation system shall not be required in any of the following conditions:

1. Where energy recovery systems are prohibited by the International Mechanical Code .
2. Laboratory fume hood systems that include not fewer than one of the following features:
   2.1. Variable-air-volume hood exhaust and room supply systems configured to reduce exhaust and makeup air volume to 50 percent or less of design values.
   2.2. Direct makeup (auxiliary) air supply equal to or greater than 75 percent of the exhaust rate, heated not warmer than 2°F (1.1°C) above room setpoint, cooled to not cooler than 3°F (1.7°C) below room setpoint, with no humidification added, and no simultaneous heating and cooling used for dehumidification control.
3. Systems serving spaces that are heated to less than 60°F (15.5°C) and that are not cooled.
4. Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site-solar energy.
5. ~~Heating energy~~ Enthalpy recovery ratio requirements in Climate Zones 0, 1 and 2.
6. ~~Cooling energy~~ Enthalpy recovery ratio requirements in Climate Zones 3C, 4C, 5B, 5C, 6B, 7 and 8.
7. Systems requiring dehumidification that employ energy recovery in series with the cooling coil.
8. Where the largest source of air exhausted at a single location at the building exterior is less than 75 percent of the design outdoor air flow rate.
9. Systems expected to operate less than 20 hours per week at the outdoor air percentage covered by Table C403.7.4(1).
10. Systems exhausting toxic, flammable, paint or corrosive fumes or dust.

11. Commercial kitchen hoods used for collecting and removing grease vapors and smoke.

Reason: This proposal aligns ASHRAE 90.1 and the IECC requirements for energy recovery ventilation systems by:
1) Changing the specification of energy recovery ventilation systems from Mandatory to Prescriptive, and

2) Adding minimum prescriptive path requirements for nontransient* dwelling unit H/ERVs in the prescriptive path, where cost effective.

*Based on the IBC definition of "transient", "nontransient" dwelling units are those that are occupied for more than 30 days; this term carries the same meaning as used in Section 310 of the 2018 IBC.

Prior to the publication of addendum ay to ASHRAE 90.1-2017, both 90.1 and IECC Section C403.7.4 contained energy recovery ventilation requirements that were developed without consideration given for dwelling units within the scope of 90.1 and the IECC. In an effort to develop rational energy recovery ventilation requirements for nontransient dwelling units, 90.1 considered building energy simulations that were conducted on a nominal 1000 ft^2, 2-bedroom apartment in compliance with the prescriptive path of 90.1 across all climate zones. Four ventilation systems were evaluated for outdoor air: exhaust-only, dedicated supply, central fan integrated supply, and balanced with energy recovery. Ventilation rates were set in accordance with the minimum permitted by ASHRAE 62.2 (comparable to 2018 IMC minimum requirements for mechanical ventilation of high-rise dwelling units). Simulations were run in EnergyPlus. A list of detailed inputs and outputs is also provided in a separate Excel file, with a narrative available in a PowerPoint document. The simulations and accompanying economic analysis resulted in a very favorable scalar ratio (ASHRAE 90.1's metric for cost effectiveness**) for dwelling unit energy recovery ventilation systems in all climate zones except for 3C for typical dwelling units and except for climate zones 0B, 1, 2, 3, 4C, and 5C for small dwelling units (i.e., no more than 500 ft^2). Additionally, the proposal exempts all dwelling units in climate zones 0, 1, 2, and 3C from heating energy recovery requirements and climate zones 3C, 4, 5, 6, 7, and 8 from cooling energy recovery requirements based on insignificant savings. This proposal to the IECC mirrors what was vetted and developed over several months by ASHRAE Technical Committee TC5.5 prior to submitting to the 90.1 Mechanical Subcommittee and ultimately approved as addendum ay by the full 90.1 committee.

**A "favorable scalar" is 12.5 or less for heat exchangers with an expected life of 15 years. The economic analysis behind 90.1 addendum ay and this proposal showed an average scalar of 2.9 for the 1008 ft^2 apartment across all climate zones, and an average of 9.3 for the 500 ft^2apartment across all climate zones but the exempted climate zones 0, 1, 2, 3, 4C, and 5C.

For an overview of ASHRAE 90.1's economic model and the scalar method, a presentation summarizing the building energy simulations supporting ASHRAE 90.1 addendum ay and this proposal, and an Excel workbook with the building energy simulation inputs, results, and economic analysis, see this link: https://www.dropbox.com/sh/tbjpbqyz2tccqlk/AADJUnPOIwumQVcJJeVGjsNoa?dl=0.

Bibliography: Addendum AY to 90.1-2016.

Cost Impact: The code change proposal will increase the cost of construction
By moving the requirement for H/ERVs from the Mandatory path to the Prescriptive path, first costs may be reduced for some projects. For other projects that are not currently required to have H/ERVs in the prescriptive path, would not normally install H/ERVS, and for which this proposal introduces new prescriptive path requirements, the first cost will increase. As explained in the rationale, however, where new requirements are introduced by this proposal, they have been vetted by ASHRAE 90.1 and shown to be cost effective based on energy savings over the useful life of the equipment and a favorable scalar ratio. A detailed explanation of costs and benefits associated with this proposal can be found with this link: https://www.dropbox.com/sh/tbjpbqyz2tccqlk/AADJUnPOIwumQVcJJeVGjsNoa?dl=0.

CE133-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
C403.7.4 Energy Recovery Systems. .Energy recovery ventilation systems shall be provided as specified in either Section 403.7. 4.1 or 403.7. 4.2, as applicable.

C403.7.4.2 Spaces other than nontransient dwelling units (Mandatory). Where the supply airflow rate of a fan system serving a space other than a nontransient dwelling unit exceeds the values specified in Tables C403.7.4(1) and C403.7.4(2), the system shall include an energy recovery system. The energy recovery system shall provide an enthalpy recovery ratio of not less than 50 percent at design conditions. Where an air economizer is required, the energy recovery system shall include a bypass or controls that permit operation of the economizer as required by Section C403.5.

Exception: An energy recovery ventilation system shall not be required in any of the following conditions:

Where energy recovery systems are prohibited by the International Mechanical Code .
Laboratory fume hood systems that include not fewer than one of the following features:

2.1.Variable-air-volume hood exhaust and room supply systems configured to reduce exhaust and makeup air volume to 50 percent or less of design values.

2.2.Direct makeup (auxiliary) air supply equal to or greater than 75 percent of the exhaust rate, heated not warmer than 2°F (1.1°C) above room setpoint, cooled to not cooler than 3°F (1.7°C) below room setpoint, with no humidification added, and no simultaneous heating and cooling used for dehumidification control.
Systems serving spaces that are heated to less than 60°F (15.5°C) and that are not cooled.
Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site-solar energy.
Enthalpy recovery ratio requirements at heating design condition in Climate Zones 0, 1 and 2.
Enthalpy recovery ratio requirements at cooling design condition in Climate Zones 3C, 4C, 5B, 5C, 6B, 7 and 8.
Systems requiring dehumidification that employ energy recovery in series with the cooling coil.
Where the largest source of air exhausted at a single location at the building exterior is less than 75 percent of the design outdoor air flow rate.
Systems expected to operate less than 20 hours per week at the outdoor air percentage covered by Table C403.7.4(1).
Systems exhausting toxic, flammable, paint or corrosive fumes or dust.
Commercial kitchen hoods used for collecting and removing grease vapors and smoke.

Committee Reason: This adds important energy savings, energy recovery becomes increasingly important as we tighten the building envelope, the modification clarifies section numbers and exceptions (Vote: 11-4).

Assembly Action: **None**

CE133-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Aaron Gary, representing Tempo Partners (aaron.gary@texenergy.org)

requests Disapprove

Commenter's Reason: This Code Change Proposal will greatly increase the cost of construction in non-transient dwelling units to an unsustainable level. Per the proponents own supporting documents, the increase in cost of an ERV for a two-bedroom apartment versus other ventilation systems is between $854 and $1,198 per dwelling unit. For a 303-unit apartment property (which was the average number of units per property for mid-rise and high-rise apartment properties found in a 2016 National Apartment Association survey) this would equate to an increase in construction cost of approximately $259,000 to $363,000 per property.

Bibliography: https://www.naahq.org/news-publications/units/august-2016/article/2016-naa-survey-operating-income-expenses-rental

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 2108

Public Comment 2:

Proponents:
Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

requests Disapprove

Commenter's Reason: This code change would require all apartments except transient to install an energy recovery system and would add significant cost to construction and tenants of these buildings. The cost analysis of this code change was done based on small apartments which do not represent the typical non-transient apartment, the proponent did not take all apartments and the typical size into consideration when conducting the cost analysis. This change does not make sense in all types of apartments.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The code change is approved with add significant cost to construction. However, if disapproved there will be no effect on the cost because there will be no change to the code.

Public Comment# 1655

CE134-19

IECC: C403.7.5, TABLE C403.7.5

Proposed Change as Submitted

Proponents: Guy McMann, Jefferson County, Colorado, representing Colorado Association of Plumbing and Mechanical Officials (CAPMO) (gmcmann@jeffco.us)

2018 International Energy Conservation Code

Delete without substitution:

~~**C403.7.5 Kitchen exhaust systems (Mandatory).** Replacement air introduced directly into the exhaust hood cavity shall not be greater than 10 percent of the hood exhaust airflow rate. Conditioned supply air delivered to any space shall not exceed the greater of the following:~~

~~1.The ventilation rate required to meet the space heating or cooling load.~~
~~2.The hood exhaust flow minus the available transfer air from adjacent space where available transfer air is considered to be that portion of outdoor ventilation air not required to satisfy other exhaust needs, such as restrooms, and not required to maintain pressurization of adjacent spaces.~~

~~Where total kitchen hood exhaust airflow rate is greater than 5,000 cfm (2360 L/s), each hood shall be a factory-built commercial exhaust hood listed by a nationally recognized testing laboratory in compliance with UL 710. Each hood shall have a maximum exhaust rate as specified in Table C403.7.5 and shall comply with one of the following:~~

~~1.Not less than 50 percent of all replacement air shall be transfer air that would otherwise be exhausted.~~
~~2.Demand ventilation systems on not less than 75 percent of the exhaust air that are configured to provide not less than a 50-percent reduction in exhaust and replacement air system airflow rates, including controls necessary to modulate airflow in response to appliance operation and to maintain full capture and containment of smoke, effluent and combustion products during cooking and idle.~~
~~3.Listed energy recovery devices with a sensible heat recovery effectiveness of not less than 40 percent on not less than 50 percent of the total exhaust airflow.~~

~~Where a single hood, or hood section, is installed over appliances with different duty ratings, the maximum allowable flow rate for the hood or hood section shall be based on the requirements for the highest appliance duty rating under the hood or hood section.~~

~~**Exception:** Where not less than 75 percent of all the replacement air is transfer air that would otherwise be exhausted.~~

~~**TABLE C403.7.5**~~
~~**MAXIMUM NET EXHAUST FLOW RATE, CFM PER LINEAR FOOT OF HOOD LENGTH**~~

~~TYPE OF HOOD~~	~~LIGHT-DUTY EQUIPMENT~~	~~MEDIUM-DUTY EQUIPMENT~~	~~HEAVY-DUTY EQUIPMENT~~	~~EXTRA-HEAVY-DUTY EQUIPMENT~~
~~Wall-mounted canopy~~	~~140~~	~~210~~	~~280~~	~~385~~
~~Single island~~	~~280~~	~~350~~	~~420~~	~~490~~
~~Double island (per side)~~	~~175~~	~~210~~	~~280~~	~~385~~
~~Eyebrow~~	~~175~~	~~175~~	~~NA~~	~~NA~~
~~Backshelf/Pass-over~~	~~210~~	~~210~~	~~280~~	~~NA~~

~~For SI: 1 cfm = 0.4719 L/s; 1 foot = 305 mm.~~

~~NA = Not Allowed.~~

Reason: These sections are inconsistent with the IMC and was never coordinated for the last two cycles. This requirement is also a job killer in that non-710 hoods over 5000 cfm can no longer be constructed where the IMC still permits it. This does nothing to help the economy whatsoever. This has created a tremendous conflict between the two codes. The unintended consequence is that it results in the inability to re-locate a non-710 hood over 5000 cfm to a new location even though it was lawfully installed at the time. Whats the logic in tossing a perfectly good system and having to spend thousands of dollars to replace it. The table is already in the IMC where it belongs and not in the IECC. Yes a 710 hood moves less air than a non-listed hood but the savings will never be realized if a new system has to be employed. This will eliminate the ability to build a custom hood if a designer so chose to do so. The cost of this code section presents an unfair burden on the owners. This subject matter belongs in the IMC, not the IECC.

Cost Impact: The code change proposal will decrease the cost of construction
Not having to toss a perfectly good system will decrease cost.

CE134-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **Disapproved**

Committee Reason: This was vetted in 90.1 including manufacturer input, the concern over conflicts with the mechanical code was debated and refuted (Vote 14-1).

Assembly Action: **None**

CE134-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Richard Grace, representing VPMIA/VBCOA (richard.grace@fairfaxcounty.gov)

requests As Submitted

Commenter's Reason: The committee indicated in their disapproval of this proposal was based on "this was vetted in 90.1 including manufacturer input, the concern over conflicts with the mechanical code was debated and refuted." I am not sure what was debated and refuted, but this could not possibly have been it. When you put the International Mechanical Code (IMC) Section 507.5 next to the International Energy Conservation Code (IECC) Section C403.7.5, the conflict is crystal clear. This is a conflict to minimum life safety requirements outlined in the IMC. The minimum exhaust flow rates provided in the IMC are there to capture and contain airborne grease particles produced by cooking operations from specific cooking appliances. These rates, along with many other significant changes associated with hood design and performance, were incorporated into the IMC (starting with the 2003 IMC) and were the result of extensive testing by a specialized group of experts, many committee members of ASHRAE 154. This IECC section and table provides for maximum exhaust flow rates. These rates are much less than those minimum rates prescribed by the IMC for non-factory-built hoods. Factory-built hoods are required to be tested to UL 710. In many cases, the IECC maximum rates are much less than the minimum rates prescribed by UL 710 as well.

Looking back on the code change proposal that ultimately placed this section and table into the IECC (CE220-13, included as an attachment with this proposal), the actual intent of the proposal was not to contradict airflow properties prescribed by the IMC or UL 710, but to eliminate the use of short-cycle hoods and to force designers to take more advantage of an HVAC system for use as makeup air for a hood instead of supplying a dedicated makeup air unit. Unfortunately, this was not the right path to accomplish these goals. When the committee disapproved the CE220-13 proposal, they indicated that "the proposal needs better coordination with the International Mechanical Code." Instead of doing this, the public comment that the proponent submitted provided less coordination and more contradiction. Another problem with this proposal was that the proponent was attempting to align this requirement up with the language contained in AHSRAE 90.1-10 without bringing forth all other pertinent information contained in 90.1. This includes specific definitions contained within 90.1 applicable to this topic, not found or addressed in either IECC or IMC. Also, 90.1 does not dictate that only 710 hoods be installed where the exhaust flow rates exceed 5,000 cfm. That was the proponent's unusual response to the committee's disapproval, as the IMC ('needs better coordination') does not provide for this requirement either. Other issues that didn't get carried over accurately from 90.1 include (1) 90.1 section 6.5.7.1.3 references ASHRAE 154 Ventilation for Commercial Cooking Operations, whereas the proposal did not; (2) the exception at the end of this proposal is in a different location in 90.1, changing the meaning of the exception entirely. For all practical purposes, the proponent moved the exception in 90.1 from 6.5.7.1.3 to 6.5.7.1.4. The proposal also left out Section 6.5.7.1.5 entirely. This is not a coordination between codes. With the number of errors contained within, this cannot even constitute a coordination between code and standard.

CE220-13

C403.2.7 (NEW), Table C403.2.7 (NEW)

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C403.2.7 Kitchen exhaust systems. Replacement air introduced directly into the exhaust hood cavity shall not exceed 10 percent of the hood exhaust airflow rate. Conditioned supply air delivered to any space containing a kitchen hood shall not exceed the greater of the ventilation rate required to meet the space heating or cooling load or the hood exhaust flow minus the available transfer air from adjacent space where available transfer air is considered that portion of outdoor ventilation air not required to satisfy other exhaust needs, such as restrooms, and not required to maintain pressurization of adjacent spaces.
When total kitchen hood exhaust airflow rate is greater than 5,000 cfm each hood shall have a maximum exhaust rate in accordance with Table C403.2.7 and shall meet one of the following:

1. At least 50 percent of all replacement air is transfer air that would otherwise be exhausted.
2. Demand ventilation systems on at least 75 percent of the exhaust air that are capable of at least 50 percent reduction in exhaust and replacement air system airflow rates, including controls necessary to modulate airflow in response to appliance operation and to maintain full capture and containment of smoke, effluent and combustion products during cooking and idle.
3. Listed energy recovery devices with a sensible heat recovery effectiveness of at least 40 percent on at least 50 percent of the total exhaust airflow.

When a single hood, or hood section, is installed over appliances with different duty ratings, then the maximum allowable flow rate for the hood or hood section shall be based on the requirements for the highest appliance duty rating under the hood or hood section.

Exception: When at least 75 percent of all the replacement air is transfer air that would otherwise be exhausted

TABLE C403.2.7
MAXIMUM NET EXHAUST FLOW RATE, CFM PER LINEAR FOOT OF HOOD LENGTH

Type of Hood	Light Duty Equipment	Medium Duty Equipment	Heavy Duty Equipment	Extra Heavy Duty Equipment
Wall-mounted canopy	140	210	280	385
Single island	280	350	420	490
Double island (per side)	175	210	280	385
Eyebrow	175	175	Not allowed	Not allowed
Backshelf/Pass-over	210	210	280	Not allowed

Reason: For consistency with Standard 90.1-2010. Considering that the IECC Commercial Provisions are intended to be technically compatible with that standard to facilitate adoption and implementation, ASHRAE is interested in keeping 2012 IECC Commercial Provisions aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010.
The proposal basically outlaws "short-circuit" hoods.
Research and California Energy Commission has shown that direct supply of makeup air, in excess of 10% of hood exhaust airflow, into the hood cavity significantly deteriorates the Capture and Containment (C&C) performance of hoods. This research has also demonstrated that short-circuit hoods waste energy and degrade kitchen environment and hygiene. If we assume a generic baseline C&C rate for a cooking process, studies show the exhaust rates for short-circuit hoods generally exceed those for exhaust-only hoods by at least the amount of air short-circuited, thus decreasing performance and increasing energy consumption.

Engineers are often in the habit of simply providing makeup air units in kitchens to provide makeup air equal to the exhaust flow rate even when "free" transfer air is available from adjacent spaces. Adding makeup air when transfer air is available is a wasteful design practice and should be prohibited. Using available transfer air saves energy and reduces the first cost of the makeup unit and exhaust system in the adjacent spaces. It simply requires some engineering and coordination to provide a path for the transfer air. The proposed change is also intended to get rid of a wasteful common practice: specifying excessive exhaust airflow by selecting hoods that are not listed or have not been subjected to a recognized performance test. The exhaust airflow flow rates in Table C403.2.7 are 30% below the minimum airflow rates in ASHRAE Standard 154-2003.

ASHRAE Research Project 1202 shows that hoods listed per UL Standard 710 and/or are engineered and tested per ASTM/ANSI 1704 have exhaust rates that are at least 30% less than the exhaust airflow requirements for unlisted or untested hoods. The intent is to conserve energy through the use of engineered hoods or performance based hoods that have been validated based on consensus standard test methods it should be noted that ASHRAE research has not demonstrated that exhaust rate reductions substantially beyond the 30% can or should be recommended at this time. This requirement should not increase first cost and in many cases will reduce first cost through downsizing of exhaust, supply and cooling equipment.

The 5,000 CFM threshold recognizes small restaurants. In addition makeup air can be fully conditioned. As a result there are now cost effective opportunities to reduce energy with demand ventilation systems or energy recovery devices.

Cost Impact: The code change proposal will not increase the cost of construction.

C403.2.7 (NEW)-EC-FERGUSON.doc

Committee Action Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee recognized that there is significant potential for energy savings, but expressed concern that these systems are already difficult to balance properly without this added challenge. The proposal needs better coordination with the *International Mechanical Code*.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Steve Ferguson, ASHRAE, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C403.2.7 Kitchen Exhaust Systems. Replacement air introduced directly into the exhaust hood cavity shall not exceed 10 percent of the hood exhaust airflow rate. Conditioned supply air delivered to any space containing a kitchen hood shall not exceed the greater of the ventilation rate required to meet the space heating or cooling load or the hood exhaust flow minus the available transfer air from adjacent space where available transfer air is considered that portion of outdoor ventilation air not required to satisfy other exhaust needs, such as restrooms, and not required to maintain pressurization of adjacent spaces.

When total kitchen hood exhaust airflow rate is greater than 5,000 cfm, each hood shall be a factory-built commercial exhaust hood listed by a nationally recognized testing laboratory to comply with the requirements of UL710. Each hood shall have a maximum exhaust rate in accordance with Table C403.2.7 and shall meet one of the following:

(Portions of proposal not shown remain unchanged)

Commenter's Reason: This will make the IECC consistent with 90.1-2010 and 90.1-2013. Considering that the IECC Commercial Provisions are intended to be technically compatible with that standard to facilitate adoption and implementation. ASHRAE is interested in keeping 2012 IECC Commercial Provisions aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010.

The proposal basically outlaws "short-circuit" hoods.

Research and California Energy Commission has shown that direct supply of makeup air, in excess of 10% of hood exhaust airflow, into the hood cavity significantly deteriorates the Capture and Containment (C&C) performance of hoods. This research has also demonstrated that short-circuit hoods waste energy and degrade kitchen environment and hygiene. If we assume a generic baseline C&C rate for a cooking process, studies show the exhaust rates for short-circuit hoods generally exceed those for exhaust-only hoods by at least the amount of air short-circuited, thus decreasing performance and increasing energy consumption.

Engineers are often in the habit of simply providing makeup air units in kitchens to provide makeup air equal to the exhaust flow rate even when "free" transfer air is available from adjacent spaces. Adding makeup air when transfer air is available is a wasteful design practice and should be prohibited. Using available transfer air saves energy and reduces the first cost of the makeup unit and exhaust system in the adjacent spaces. It simply requires some engineering and coordination to provide a path for the transfer air.

The proposed change is also intended to get rid of a wasteful common practice: specifying excessive exhaust airflow by selecting hoods that are not listed or have not been subjected to a recognized performance test. The exhaust airflow flow rates in Table C403.2.7 are 30% below the minimum airflow rates in ASHRAE Standard 154-2003.

ASHRAE Research Project 1202 shows that hoods listed per UL Standard 710 and/or are engineered and tested per ASTM/ANSI 1704 have exhaust rates that are at least 30% less than the exhaust airflow requirements for unlisted or untested hoods. The intent is to conserve energy through the use of engineered hoods or performance based hoods that have been validated based on consensus standard test methods it should be noted that ASHRAE research has not demonstrated that exhaust rate reductions substantially beyond the 30% can or should be recommended at this time. This requirement should not increase first cost and in many cases will reduce first cost through downsizing of exhaust, supply and cooling equipment.

The 5,000 CFM threshold recognizes small restaurants. In addition makeup air can be fully conditioned. As a result there are now cost effective opportunities to reduce energy with demand ventilation systems or energy recovery devices.

This comment adds a requirement that hoods must be listed (which is required by the IMC to utilize exhaust rates lower than the IMC has for unlisted hood values).

Equipment manufacturers reviewed and agreed to the values proposed in the new table.

To address the Code Development Committee's concerns, this proposal has been modified to be such that hoods must be listed (which is required by the IMC to utilize exhaust rates lower than the IMC has for unlisted hood values).

Staff Note: The UL 710 standard is already a referenced standard in the *International Mechanical Code*.

CE220-13

Final Action: AS AM AMPC____ D

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

This public comment supports the proposal for removal of a code requirement. This will result in a decrease in the cost of construction because custom non-UL710 certified hoods will be able to be used for high flow (above 5000 cfm) applications as the IMC already allows.

Public Comment# 1693

Public Comment 2:

Proponents:

Guy McMann, representing Colorado Association of Plumbing and Mechanical Officials (CAPMO) (gmcmann@jeffco.us)

requests As Submitted

Commenter's Reason: The committee got this wrong. They seemed more concerned about energy savings thus not seeing the conflict created

between the IECC and the IMC.
There is no technical justification for the 5000 cfm threshold. The IECC Table mandates maximum flow rates where the IMC utilizes minimum flow rates which much research was performed to justify the rates. Maximum rates wont capture and contain grease particals in some circumstances. Existing systems over 500 cfm cannot be relocated even though they were lawfully installed at the time. Custom non-710 hoods over 5000 cfm can no longer be manufactured affecting jobs. Some opponents openly admitted they never looked to the IMC to see if there was a conflict. We request AS. This needs to be deleted.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This public comment supports the proposal for removal of a code limitation. This will result in a decrease in the cost of construction because custom non-UL710 certified hoods will be able to be used for high flow (above 5000 cfm) applications. The IMC already allows for non-UL710 certified hoods to be used currently. This eliminates a costly conflict between the IECC and IMC.

Public Comment# 1169

CE140-19

IECC®: C403.8.5 (New), TABLE C403.8.5 (New)

Proposed Change as Submitted

Proponents: Eric Makela, representing New Buildings Institute (ericm@newbuildings.org); Mike Moore, Newport Ventures, representing Broan-NuTone (mmoore@newportventures.net)

2018 International Energy Conservation Code

Add new text as follows:

C403.8.5 **Low-capacity ventilation fans.** Mechanical ventilation system fans with motors less than 1/12 horsepower in capacity shall meet the efficacy requirements of Table C403.8.5.

Exceptions:

1. Where ventilation fans are a component of a listed heating or cooling appliance.
2. Dryer exhaust duct power ventilators, domestic range hoods, and domestic range booster fans that operate intermittently.

TABLE C403.8.5
LOW-CAPACITY VENTILATION FAN EFFICACY

FAN LOCATION	AIR FLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY (CFM/WATT)	AIR FLOW RATE MAXIMUM (CFM)
HRV or ERV	Any	1.2 cfm/watt	Any
In-line fan	Any	3.8 cfm/watt	Any
Bathroom, utility room	10	2.8 cfm/watt	< 90
Bathroom, utility room	90	3.5 cfm/watt	Any

a. When tested in accordance with HVI Standard 916. Fan efficacy for HRV, ERV, balanced, and in-line fans shall be taken at a static pressure >= 0.2 in. w.c. Fan efficacy for range hoods, bathroom, and utility room fans shall be taken at a static pressure >= 0.1 in. w.c.

Reason: Exhaust fan efficacies were introduced in the code in 2012 IECC for whole-house ventilation in low-rise residential buildings, but have never been included in the commercial provisions of the IECC. Mid-rise residential occupancies and small commercial buildings often utilize the same small ventilation fans leaving a loophole for a common energy load. These fans are used for point-of-source contaminant exhaust and are frequently utilized as part of a ventilation strategy in multifamily buildings. These fans are also smaller than the threshold for fan size (1/12 HP) that is attached to the other commercial fan requirements. This makes them a common load, and a potentially significant load in multifamily buildings, that is completely unregulated in commercial buildings.
This proposal adopts the table approach already utilized for these fans in the residential section of the code. However, it updates the efficiency requirements. The current residential IECC fan efficacies are from an older version of Energy Star (Version 2.0), so these have been updated to align the latest Energy Star requirement Version 4.0. These fan efficacy values are very conservative based on what is currently on the market.

It sets the efficiency requirement at a level that can reasonably be met by a large number of products available on the market. According to the HVI database of fans, the average efficiency of bath fans is around 7 CFM/W, and the average efficiency of in-line fans is 3.1. This proposal, therefore, places the requirement far below the market average efficiency for bath fans and close to the market average for in-line fans, making this a reasonable requirement.

Another proposal has been submitted to the residential section of the code to update those fan efficacy requirements to the same levels.

Cost Impact: The code change proposal will increase the cost of construction
The proposal could increase the cost of construction. Cost for the kinds of fans covered by this requirement are not driven solely by efficacy. Cost is also a function of flow rate, finishes, design and noise and whether they include other features like lights, sensors, or heaters. In some cases, fans that meet this requirement can be obtained for less other fans that do not. Nevertheless, a comparison of the low-cost exhaust fans shows that this proposal can result in no incremental first costs or short simple paybacks where incremental costs are incurred.

For example, no-frills bath fans from major manufacturers moving a minimum of 50 to ~100 cfm at 0.25” w.c. have an immediate payback (i.e., no cost premium) or a simple payback estimated at ≤6 years where there is a cost premium (see Tables 1 and 2). The 2021 IRC requires exhaust fans to be rated at a static pressure of 0.25” w.c., which is widely recognized as a typical installed static pressure found in bath fan exhaust ducts.

Table 1. Lowest cost exhaust fans for major manufacturers having a flow rate ≥ 50 cfm and < 90 cfm at 0.25” w.c.:

Fan	Efficacy at 0.1” w.c.	Flow at 0.25” w.c.	Price Premium by Manufacturer	Simple Payback (years)
AirKing BFQ75 (compliant with proposal)	3.0	70	--	N/A
AirKing AS70 (entry-level at 0.25” w.c.)	1.4	62	$11.02	6
Broan AE80B (compliant with proposal)	3.0	60	--	N/A
Broan A70L (entry-level at 0.25” w.c.)	1.7	60	$1.61	1
DeltaBreeze SLM70 (entry-level at 0.25” w.c. is compliant with proposal)	4.7	54	--	immediate

*Simple payback assumes $0.1178/kWh (DOE EIA national average for residential and commercial), 1-hour of operation per day. Pricing sourced from homedepot.com on 1/9/2019. For Delta, the lowest price fan having at flow rate ≥ 50 cfm and < 90 cfm at 0.25” w.c. also had a fan efficacy meeting the proposed value, so there is no price premium associated with the manufacturer’s lowest cost product, and payback is “immediate”.

Table 2. Lowest cost exhaust fans for major manufacturers having a flow rate ≥ 90 cfm at 0.25” w.c:

Fan	Efficacy at 0.1" w.c.	Flow at 0.25" w.c.	Price Premium by Manufacturer	Simple Payback (years)
AirKing BFQ140 (entry-level at 0.25" w.c.)	1.6	109	--	N/A
AirKing AK110LS (compliant with proposal)	3.9	90	$48.32	6
Broan AN110 (entry-level at 0.25" w.c.)	2.3	102	--	N/A
Broan AEN110 (compliant with proposal)	4.7	92	$41.09	6
DeltaBreeze VFB25AEH (entry-level at 0.25" w.c. is compliant with proposal)	5.9	105	--	immediate
Panasonic FV-08-11VF5 (entry-level at 0.25" w.c. is compliant with proposal)	4.2	104	--	immediate

*Simple payback assumes $0.1178/kWh (DOE EIA national average for residential and commercial), 4-hours of operation per day (higher run time associated with assumption that higher flow rate bath fans are more likely to be installed in commercial bathrooms which are more likely to run continuously or at longer run times than a typical 1-hour residential assumption). Pricing sourced from homedepot.com on 1/9/2019. For some manufacturers, such as Delta and Panasonic, the lowest price fan having at flow rate ≥ 50 cfm and < 90 cfm at 0.25" w.c. also had a fan efficacy meeting the proposed value, so there is no price premium associated with the manufacturer's lowest cost product, and payback is "immediate".

CE140-19

Public Hearing Results

Committee Action: As Modified

Committee Modification:
C403.8.5 Low-capacity ventilation fans (Mandatory). Mechanical ventilation system fans with motors less than 1/12 horsepower in capacity shall meet the efficacy requirements of Table C403.8.5.

Exceptions:

1. Where ventilation fans are a component of a listed heating or cooling appliance.
2. Dryer exhaust duct power ventilators, domestic range hoods, and domestic range booster fans that operate intermittently.

TABLE C403.8.5

LOW-CAPACITY VENTILATION FAN EFFICACY[a]

FAN LOCATION	AIR FLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY (CFM/WATT)	AIR FLOW RATE MAXIMUM (CFM)
HRV or ERV	Any	1.2 cfm/watt	Any
In-line fan	Any	3.8 cfm/watt	Any
Bathroom, utility room	10	2.8 cfm/watt	< 90
Bathroom, utility room	90	3.5 cfm/watt	Any

a. When tested in accordance with HVI Standard 916. Fan efficacy for HRV, ERV, balanced, and in-line fans shall be taken at a static pressure ~~>=~~ not less than 0.2 in. w.c. Fan efficacy for range hoods, bathroom, and utility room fans shall be taken at a static pressure ~~>=~~ not less than 0.1 in. w.c.

Committee Reason: The proposal as modified provides cost effective energy savings related to residential ventilation, the modification clarifies the location of the footnote and the mandatory nature of proposal (Vote: 14-1).

Assembly Action: None

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

Individual Consideration Agenda

Public Comment 1:

IECC®: C403.8.5 (New), TABLE C403.8.5 (New)

Proponents:
Mike Moore, representing Broan-NuTone (mmoore@newportventures.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C403.8.5 Low-capacity ventilation fans. Mechanical ventilation system fans with motors less than 1/12 horsepower in capacity shall meet the efficacy requirements of Table C403.8.5 <u>at one or more rating points</u>.

Exceptions:

1. Where ventilation fans are a component of a listed heating or cooling appliance.
2. Dryer exhaust duct power ventilators, domestic range hoods, and domestic range booster fans that operate intermittently.

TABLE C403.8.5
LOW-CAPACITY VENTILATION FAN EFFICACYa

Portions of table not shown remain unchanged.

FAN LOCATION	**AIR FLOW RATE MINIMUM (CFM)**	**MINIMUM EFFICACY (CFM/WATT)**	**AIR FLOW RATE MAXIMUM (CFM)**
HRV or ERV	Any	1.2 cfm/watt	Any
In-line fan	Any	3.8 cfm/watt	Any
Bathroom, utility room	10	2.8 cfm/watt	< 90
Bathroom, utility room	90	3.5 cfm/watt	Any

a. ~~When~~ Air flow shall be tested in accordance with HVI Standard 916 and listed. Efficacy shall be listed, or shall be derived from listed power and air flow. Fan efficacy for fully ducted HRV, ERV, balanced, and in-line fans shall be ~~taken~~ determined at a static pressure not less than 0.2 in. w.c. Fan efficacy for ducted range hoods, bathroom, and utility room fans shall be ~~taken~~ determined at a static pressure not less than 0.1 in. w.c.

Commenter's Reason: These edits to the original proposal bring needed clarification for enforcement and coordination with other sections of the code. For example, the clarification that air flow shall be listed aligns with IMC Section 403.3.2.5, as modified by Group A's M28, which was approved as submitted. Additionally, fan efficacy is not listed by industry, but should be determined from listed values of air flow and power draw. The modifications in this public comment are also coordinated with a PC to RE136, to ensure that the IRC and IMC requirements for determining efficacy are aligned.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The original rationale for the code change proposal demonstrates the cost-effectiveness of this measure. The modifications in this PC provide clarifications only and do not impact the proposal's cost effectiveness.

Public Comment# 1917

CE150-19 Part I

IECC®: C403.11.3.1

Proposed Change as Submitted

Proponents: Howard Ahern, representing self (howard.ahern@airexmfg.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C403.11.3.1 Protection of piping insulation (Mandatory). Piping insulation exposed to the weather shall be protected from damage, including that caused by sunlight, moisture, ~~equipment maintenance and~~ wind, and physical damge. Protective barrier shall be removable for equipment maintenance and shall provide shielding from solar radiation that can cause degradation of the material. Adhesive tape shall not be permitted.

Reason: Part I of this proposal will clarify the intent of Section C403.11.3.1. Part II of this proposal will clarify the intent of Section R403.4.1. The intent of these sections is not only protection of pipe insulation from weather but to insure the insulations thermal conductivity energy savings integrity last the life of the mechanical system as per the intent of the code . In order to remove the opportunity for misunderstanding so that the code has its's intended result the term "equipment maintenance" must be clarified.
The intent is in the original proponents reason statement of this requirement EC207-09/10 which stated this was originally from the ASHRAE 90.1 standard to Harmonize the IECC with ASHRAE 90.1 for the 2012 code the reason statement also stated -" All AC units require periodic maintenance. The frequency varies with how hard the unit operates, exterior temperature, preventive maintenance program, and many others. In every occasion, every maintenance provides an excuse for the Freon line insulation to be touched and removed." The intent is clear that the protection be removable and independent of the pipe insulation for maintenance without damaging the pipe insulation.

Removing protection without damaging the insulation is stated in EC207-09/10 "Adhesives Tape is not permitted as it will limit maintenance and damage insulations permeability characteristics. Removal of tape damages the integrity of the original insulation into pieces, specially, if the insulation has reached thermo set state.

Protective covering must also protect from physical damage so if the protection covering does get damaged from stepping on it, dropping tools on it, birds, lawn trimmers etc.it can be replaced keeping the insulations thermal conductivity integrity and insuring the insulation system last the life of the mechanical system and avoiding the costly replacement of the insulation.

2012 & 2018 IECC Code and commentary both state that Equipment maintenance also include protection from physical damage to the pipe insulation.

The code section also requires the removal protection to shield from solar radiation that can cause degradation on of the insulation. This sometime get confused with UV protection that is under damage from "sunlight". The additional requirement to shield against solar radiation that is more than just UV, solar radiation also includes heat. Heat is a major factor in the degradation of insulation .UV testing while a good start can be unreliable as it depends on product placement.

Removable protection also allows less costly maintance and replacement of any damaged insulation.

Bibliography: Impact and Advantages of
Removable Insulation Protective Covers

Dr. "Saum" K. Nourmohammadi, PEx3, Ph.D. CPD, CIPE, CFPE,

LEED AP

2017 ASHRAE Handbook

2012, 2018 IECC Code & Commentary

Cost Impact: The code change proposal will not increase or decrease the cost of construction

There are a wide variety of removable protective coverings and are available at most supply distributors. These can be as simple as sheet metal or plastic channels, or cladding, PVC covers, Jackets, aluminum covers etc. Many covering require much less labor compared to painting or banding and they are currently being used all over the US so there no increase cost.

CE150-19 Part I

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Submitted**

Committee Reason: The proposal provides important clarification of requirements for pipe insulation, proponent is encouraged to return with a public comment to add the words "protective barrier" to the first sentence (Vote: 9-6).

Assembly Action: **None**

CE150-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC®: C403.11.3.1

Proponents:
Howard Ahern, representing self (howard.ahern@airexmfg.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C403.11.3.1 Protection of piping insulation (Mandatory). Piping insulation exposed to the weather shall be protected from damage by a protective barrier that is removable for equipment maintenance.. Protection from damage shall ~~including~~ include ~~t~~hat caused by sunlight, moisture, wind, and physical damage,~~Protective barrier shall be removable for equipment maintenance~~ and shall provide shielding from solar radiation that can cause degradation of the material. Adhesive tape shall not be permitted.

Exception: Chilled water piping system protection is not required to be removable.

Commenter's Reason: This proposal has approved "as submitted" by the committee with a suggestion that a public comment add the words "protective barrier to the first sentence.

The majority of pipe insulation is installed indoors this section only cover exposed or outdoor pipe insulation.There are over 30 manufacturers making a removable protective covers and this Does not even include sheet metal or pipe manufacturers. Protection need to be independent of the insulation.UV is not enough as heat and other factors destroy exposed insulation.

This proposal will clarify the intent of section C403.11.1 this section is not only protection of pipe insulation from weather but to insure the insulations thermal conductivity energy savings integrity last the life of the mechanical system as per the intent of the code . In order to remove the opportunity for misunderstanding so that the code has it's intended result , **the term "equipment maintenance" must be clarified.**

Removable protective barrier will also allow for required visual inspection by the AHJ of refrigerant piping and joint as per the International Mechanical code Chapter 11 section 1107.7 and Uniformed Mechanical Code.

The intent is in the original proponents reason statement of this requirement 2012 IECC proposal EC110-09/10 stated -" All AC units require periodic maintenance. The frequency varies with how hard the unit operates, exterior temperature, preventive maintenance program, and many others. In every occasion, every maintenance provides an excuse for the Freon line insulation to be touched and removed." The intent is clear that the protection be removable and independent of the pipe insulation for maintenance without damaging the pipe insulation.

The ASHRAE handbook states pipe insulation protection must be independent of the insulation and an addition to any factory or field applied vapor retarder.

Removing protection without damaging the insulation is stated in EC110-09/10 "Adhesives Tape is not permitted as it will limit maintenance and damage insulations permeability characteristics. Removal of tape damages the integrity of the original insulation into pieces, specially, if the insulation has reached thermo set state."

The

majority of pipe insulation is used indoors this section is only for the pipe insulation outdoor or exposed to weather.this proposal will allow competition among manufactures to keep cost down and as there are over 30 manufactures with removable protection products for pipe insulation and this does not even include all the sheet metal manufactures.

Protective covering must also protect from physical damage so if the protection covering does get damaged from stepping on it, dropping tools on it, birds, lawn trimmers etc.it can be replaced keeping the insulations thermal conductivity integrity and insuring the insulation system last the life of the mechanical system and avoiding the costly replacement of the insulation. The 2012 & 2018 IECC Code and commentary both state that Equipment maintenance also include protection from physical damage to the pipe insulation.

Pipe insulation maintenance is mostly non existence and when there is repair such as elastomeric foam pipe insulation the damaged section is cut out and replaced. Then the slits and joints are glued together with adhesives, but without a protective covering the newly glued slits and joints are exposed to sun, heat, and moisture leading to failed repairs remember a 1% moisture gain is equal to a 7.5 % reduction in thermal efficiency in time leading to a complete failure and the lost of energy this code is trying to save.

The 2018 IECC list many exceptions for chilled water piping systems. In fact vapor retarders which are critical to chilled water piping systems are not even listed in the IECC or IMC.

Vapor retarders are critical to a Chilled system piping insulation as any amount of moisture can lead to disastrous results ,as such chilled water piping systems insulation designers take enormous steps to ensure protection of the insulation. Many such systems are in steel piping that is welded shut to ensure zero moisture, although the piping is removable t is not readily removable.

In collaboration with the North American Insulation Manufacturers Association specifically Charles C. Cottrell Vice President, Technical Services an exception for Chilled water piping system protection to not be required to be removable has been added.
Charles C. Cottrell
Vice President, Technical Services
North American Insulation Manufacturers Association
Ph:

Bibliography:

Impact and Advantages of
Removable Insulation Protective Covers
Dr. "Saum" K. Nourmohammadi, PEx3, Ph.D. CPD, CIPE, CFPE,
LEED AP

2017 ASHRAE Handbook

2012, 2018 IECC Code & Commentary

Advantages of Using

Removable & Reusable Protective Insulation Covers on Cold, Outdoor Pipes

by Gordon H. Hart, P.E., Consulting Engineer, Artek Engineering, LLC

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
There are a wide variety of removable protective coverings and are available at most supply distributors. These can be as simple as sheet metal or plastic channels, or cladding, PVC covers, Jackets, aluminum covers etc. Many covering require much less labor compared to painting or banding and they are currently being used all over the US so there no increase cost.

Public Comment# 1905

Public Comment 2:

IECC®: C403.11.3.1

Proponents:
Howard Ahern, representing self (howard.ahern@airexmfg.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C403.11.3.1 Protection of piping insulation (Mandatory). Piping insulation exposed to the weather shall be protected from damage, including that caused by sunlight, moisture, wind, and physical damge. Protective barrier shall be removable for equipment maintenance and shall provide shielding from solar radiation that can cause degradation of the material. Adhesive tape shall not be permitted.

<u>**Exception:** Chilled Water piping system protection is not required to be removable</u>

Commenter's Reason: This proposal has approved "as submitted" by the committee .
The words “protective barrier “ to suggested by the committee to be added to the first sentence , unfortunately however that changed the language and made it less clear.

The original language is clear to understand and follow, this public comment is to add An exception for chilled water system piping i**n collaboration with the North American Insulation Manufacturers Association** as justified below.

There are over 30 manufacturers making a removable protective covers(jacket's, cladding, covers, Channel covers, etc.) and this does not even include sheet metal or pipe manufacturers.

Protection needs to be independent of the insulation as ASHRAE states. This IECC code section has always specifically stated "shall be shielded from solar radiation " heat is a major factor in insulation degradation and is not covered by UV test.

Example: Ever put a bicycle in your garage and notice the tires degrading, it was not exposed to UV ? Heat !

There has been 10's of thousand of feet of line set pipe insulation installed in the last few years , and although it had UV there is vast amount of degraded insulation. Inspector, builders , designers have been assured that insulation coating for solar use , where has been national recall due to it melting. Were the thousands of home and building owners notified?

There have been so many pipe insulation protection failures across the country and now there is a wide spread problem with pin hole leaks in copper piping in line set insulation with this plastic factory applied coatings due to bad protection, bad installation, not sealing or covering ends of insulation , corrosive material etc.

This is the text of a letter Armacell issued to the industry

dated September 19, 2017

Subject: Outdoor Protection of White Line Set Insulation

To whom it may concern:

In response to recent questions concerning the longevity of polyethylene insulation when installed outdoors, Armacell believes that there is some misunderstanding about the UV protection provided by the outer coating on white line set (WLS) insulation. The outer coating on WLS is designed to protect the insulation from damage during the installation process. While it is also UV retardant, it will only protect the **insulation from short-term exposure of no more than a year without additional protection** in the form of jacketing or coating. Actual UV performance will vary based on the amount of exposure and other weather conditions. Therefore, especially for longer-term performance, WLS must be protected from sunlight when installed outdoors. This is especially critical for rooftop applications and any other applications where there is high UV exposure.

Sincerely,
Timothy R. Ledden

Technical Manager, Insulation

See also attachment Armacell- "Installation practices observed in the field have been found to compromise the integrity and performance of copper pre-insulated linesets with coated polyethylene insulation material installed and sold primarily into the HVAC industry. A number of key installation deficiencies are identified-"

There is a real problem in that much of the insulation being installed under the guise that the insulations factory applied coatings will protect , however these types only have 1 or 3 year warranty against UV but again the code states that it must be shielded from solar radiation (heat) and this is a large part of the degradation. The coating become thermoset crack split etc. allowing moisture into the insulation and it take only 1% moisture gain to lose 7.5 % in thermal efficiency.

Removable Protection will solve all these problems and is the intent of this code section as well as the intent of the code. If we are to gain the energy saving set forth in this section then Removable protection is required.

Protection needs to be removable so:
1. so pipe insulation can be repaired
2. that it protects the glued seams of the repaired insulation without a removable cover the seams are exposed to the weather
3. removable covers can be replaced if damaged to ensure energy savings

Again the majority of pipe insulation is indoors we are only taking about the pipe insulation outdoors.

This proposal will clarify the intent of section C403.11.1 this section is not only protection of pipe insulation from weather but to insure the insulations thermal conductivity energy savings integrity last the life of the mechanical system as per the intent of the code . In order to remove the opportunity for misunderstanding so that the code has it's intended result , **the term "equipment maintenance" must be clarified.**

Removable protective barrier will also allow for required visual inspection by the AHJ of refrigerant piping and joint as per the International Mechanical code Chapter 11 section 1107.7 and Uniformed Mechanical Code.

The intent is in the original proponents reason statement of this requirement 2012 IECC proposal EC110-09/10 stated -" All AC units require periodic maintenance. The frequency varies with how hard the unit operates, exterior temperature, preventive maintenance program, and many others. In every occasion, every maintenance provides an excuse for the Freon line insulation to be touched and removed." The intent is clear that the protection be removable and independent of the pipe insulation for maintenance without damaging the pipe insulation.

The ASHRAE handbook states pipe insulation protection must be independent of the insulation and an addition to any factory or field applied vapor retarder.

Removing protection without damaging the insulation is stated in EC110-09/10 "Adhesives Tape is not permitted as it will limit maintenance and damage insulations permeability characteristics. Removal of tape damages the integrity of the original insulation into pieces, specially, if the insulation has reached thermo set state."

The majority of pipe insulation is used indoors this section is only for the pipe insulation outdoor or exposed to weather.this proposal will allow competition among manufactures to keep cost down and as there are over 30 manufactures with removable protection products for pipe insulation and this does not even include all the sheet metal manufactures.

Protective covering must also protect from physical damage so if the protection covering does get damaged from stepping on it, dropping tools on it, birds, lawn trimmers etc.it can be replaced keeping the insulations thermal conductivity integrity and insuring the insulation system last the life of the mechanical system and avoiding the costly replacement of the insulation. The 2012 & 2018 IECC Code and commentary both state that Equipment maintenance also include protection from physical damage to the pipe insulation.

Pipe insulation maintenance is mostly non existence and when there is repair such as elastomeric foam pipe insulation the damaged section is cut out and replaced. Then the slits and joints are glued together with adhesives, but without a protective covering the newly glued slits and joints are exposed to sun, heat, and moisture leading to failed repairs remember a 1% moisture gain is equal to a 7.5 % reduction in thermal efficiency in time leading to a complete failure and the lost of energy this code is trying to save.

The 2018 IECC list many exceptions for chilled water piping systems. In fact vapor retarders which are critical to chilled water piping systems are not even listed in the IECC or IMC.

Vapor retarders are critical to a Chilled system piping insulation as any amount of moisture can lead to disastrous results ,as such chilled water piping systems insulation designers take enormous steps to ensure protection of the insulation. Many such systems are in steel piping that is welded shut to ensure zero moisture, although the piping is removable t is not readily removable.

The exemption is in collaboration with the North American Insulation Manufacturers Association specifically Charles C. Cottrell Vice President, Technical Services

exception for Chilled water piping system protection to not be required to be removable has been added.
Charles C. Cottrell
Vice President, Technical Services
North American Insulation Manufacturers Association

Bibliography: Impact and Advantages of Removable Insulation Protective Covers by Dr. “Saum” K. Nourmohammadi, PEx3, Ph.D. CPD, CIPE, CFPE.
2017 ASHRAE Handbook.

2012, 2018 IECC Code & Commentary.

Advantages of Using Removable & Reusable Protective Insulation Covers on Cold, Outdoor Pipes by Gordon H. Hart, P.E., Consulting Engineer, Artek Engineering, LLC

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
There are a wide variety of removable protective coverings and are available at most supply distributors. These can be as simple as sheet metal or plastic channels, or cladding, PVC covers, jackets, aluminum covers etc. Many covering require much less labor compared to painting or banding and they are currently being used all over the US so there no increase in cost.

Public Comment# 2128

Public Comment 3:

IECC®: C403.11.3.1

Proponents:
Duane Jonlin, representing Seattle Department of Construction and Inspections (duane.jonlin@seattle.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C403.11.3.1 Protection of piping insulation (Mandatory). Piping insulation exposed to the weather shall be protected from damage, including that caused by sunlight, moisture, wind, and physical damge. Protective barrier shall be removable <u>where required </u>for equipment maintenance and shall provide shielding from solar radiation that can cause degradation of the material. Adhesive tape shall not be permitted.

Commenter's Reason: As currently stated, this code change proposal requires <u>all</u> exterior piping insulation to have removable covering.
This change restricts the requirement specifically to those sections of pipe where removal is necessary to service equipment.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This public comment minimizes the cost increase caused by the original proposal. Whereas the original proposal requires removable and reusable covers for *all* exterior insulated piping, this public comment restricts that requirement to only those pipe segments where periodic removal of the covers will be necessary for equipment maintenance. The net effect will still be a cost increase, but a smaller increase.

Public Comment# 2054

Public Comment 4:

Proponents:
Berner, Custom Laminating, representing Custom Laminating

requests Disapprove

Commenter's Reason: The proposed code change rationale is based on a number of erroneous assumptions and fails to recognize advances in insulation material and jacketing technology since the reasons stated when EC110-09/10 were published. Since this is a two part proposal, we will address our objections to the proposed changes in two parts.
Part I: It is our opinion that the proposed revision to IECC section C403.11.3.1 will result in increased costs, will not result in any cost savings on commercial construction, and will deprive owners and specifiers of the code compliance benefits and performance benefits of a fully adhered jacketing system. This proposed change will affect *all* outdoor piping systems.

It should be noted that commercial construction is also subject to the requirements if the International Mechanical Code. IMC sections 1107.4 (refrigerant piping) and IMC section 1206.11 (hydronic piping) require prevention of condensation on the surface of the pipe, and IRC section M1411.6 requires a maximum permeability of 0.05 perm for refrigerant piping. This is typically accomplished through a combination of insulation with a vapor barrier, the vapor barrier often being fully adhered. If these piping systems are installed outdoors, many of the available fully adhered jacketing systems can provide both the requisite condensation protection and perm rating while also providing the protection from physical damage and solar radiation as required in the existing code. Note that a "removable" jacketing material such as that manufactured by the proponent cannot provide a perm rating because while the *body* of the jacket may meet the perm rating, a Velcro seam provides no resistance to moisture vapor entry. Water flows right through it and by the very nature of being removable, it cannot be sealed to the insulation. Since it cannot act as a vapor barrier, many systems would require the addition of an actual vapor barrier under the removable jacketing at added material and labor cost and adding time to the project. The proponent's claims that there is no additional cost are questionable. And ironically, the vapor barrier could be fully adhered, which would defeat the (dubious) advantage of a removable jacket.

The 2009 / 2010 argument in favor of a removable jacket was focused specifically on Freon systems. No case has been made to support extension of these provisions to commercial construction. In fact, commercial insulation systems installed outdoors not only don't have unprotected insulation, they typically have very robust jacketing systems, including PVC (may or may not be removable, not reusable) and metal jacketing (possibly removable but often not reusable) as well as fully adhered jacketing systems and mastic and mesh systems. This code change would eliminate the use of all of the traditionally utilized systems, causing significant financial harm to numerous manufacturers, their distributors and installers.

A fully adhered jacketing system provides performance advantages and potentially significant cost savings. A fully adhered jacket limits any moisture intrusion (rain, snow or water vapor) to a small confined area. Damaged areas are easily detected using any of a number of non-destructive test methods, and cost to repair damage is minimized by the small area involved. A removable jacket would allow moisture migration under the jacket, and unless there was a vapor barrier between the jacket and insulation, very large areas of insulation could be damaged. In addition, since there would be an air gap between the jacket and insulation or vapor barrier, the gap would potentially subject to algae, mold and bacteria growth as well as providing a haven for insects. Were this to occur, the removable jacket would not be reusable, and the insulation could be damaged beyond repair.

Lastly, we would request that you ask yourself, "If the jacketing is removed, what do I see or now have access to"? The answer is "the insulation or vapor barrier". *Not* the pipe. Access to the pipe for maintenance would *still* require removal of the insulation. The insulation itself may or may not be reusable depending upon the nature of the problem and the type of insulation. So in reality, what is the benefit of a removable jacket other than to benefit the manufacturers of removable jacketing?

We urge you to let specifiers and owners decide the relative benefits of insulation systems and disapprove this proposal.

Part II: Much of the same argument made for Part I is also applicable to Part II. When discussing Freon systems, we are typically talking about linesets that are common in residential construction as well as some other occupancies such as hotels. Based on a review of the proponent's reason and justification for this code change, I would offer the following comments.

Removable jacketing is not necessary "… to insure the insulations (sic) thermal conductivity energy savings integrity last the life of the mechanical system as per the intent of the code". In 2009 – 2010 installers were still applying unjacketed elastomeric or polyolefin insulation to outdoor AC unit lines and were not applying the recommended protective coatings. This process has changed since the 2012 introduction of code language requiring both protection from UV (solar radiation) and physical damage. Many insulation manufacturers responded to these changes by developing UV and damage resistant factory coatings that also provide the required perm rating for refrigerant lines for this application. These coatings are not removable from the insulation, but the *entire insulation system is easily removable from the lines* with only minor loss of insulation at the insulation termination points *which must be sealed to the lines to provide the required moisture barrier to prevent condensation as required by code.* Because the insulation is protected from UV degradation (heat is *not* a significant factor in these applications since the insulation is rated to 200 or 220°F continuous operation), the insulation is also readily reusable (with the exception of maybe 2" on the ends). It should be further noted that many of these factory coatings are clear or translucent, making inspection of the insulation easier without having to remove the jacket.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

The proponent's cost impact statement alleges that the proposed code change will neither increase nor decrease the cost of construction. ALL of the stated options cost money and require labor (cost) to install. And again, none meet the code requirements for moisture condensation control or perm rating. As a simple example, we can use the proponent's removable jacket product as an example. The cost to purchase enough jacket to install over a 5 ft. line at retail is approximately $40. It is less on a per foot basis, but the scrap is not really usable. So for a $1 a year annual savings, the ROI to the homeowner would be 40 years. Since this exceeds the life expectancy of the AC equipment, the homeowner will never attain a return on his investment, even assuming he lives in the house for the 40 years. And of course, if we look beyond California where the proponent is based, the annual AC usage hours could be significantly less, making the ROI even longer. And many states have lower electricity costs (Louisiana is $0.0962 per kwhr), further extending the time to ROI.

A removable jacket is more likely to allow the ingress of moisture. This will damage the insulation layer and result in addition cost in materials and labor to mitigate. A fully adhered jacket is much less likely to allow ingress of moisture into the insulation.

Public Comment# 1855

Public Comment 5:

Proponents:
Ron Borst, 3M, representing Self (rborst@mmm.com)

requests Disapprove

Commenter's Reason: Commercial construction is subject to the requirements of the International Mechanical Code. IMC sections 1107.4 (refrigerant piping) and IMC section 1206.11 (hydronic piping) require prevention of condensation on the surface of the pipe, and IRC section M1411.6 requires a permeability not exceeding 0.05 perm per ASTM E 96.
Protection of pipes and pipe insulation is typically accomplished by using a systems approach that includes the installation of a vapor barrier/protective cladding system. When these insulated pipe systems are located outdoors, they are exposed to various weather conditions such as, but not limited to, sunlight, moisture, and wind; as well as physical damage. The current code change request would require that all jacketing be removable.

It’s important to note that multiple cladding systems in use today are already removable; if desired. However, by design, such cladding systems are typically tightly sealed using caulks / sealants to keep moisture out. The overall strategy is to do the best possible job to keep wind, water, etc. from getting past the cladding and to protect the vapor barrier and the insulation. Removal and replacement of insulation is cost prohibitive and is generally avoided as much as possible. Even when these pipe systems are being inspected for Corrosion Under Insulation (CUI), considerable effort is made to minimize the removal of insulation during the inspection process. Inspections ports are typically installed to minimize disruption to insulation. Having a jacket that is removable does not help protect the insulation from moisture; especially if it utilizes a hook & loop attachment system (such as VELCRO™), that does not guarantee a water-resistant seal around the insulation. In order to meet current code, a removable cladding system would need to be further sealed itself just to meet existing codes.

Additionally, a removable cladding system doesn’t offer any advantages over the existing systems currently in use, because the high cost of insulation replacement would still limit any potential advantages that this removable cladding would offer.

The quality of PVC’s varies widely, and some PVC’s show a tendency to crack after long term UV exposure. One approach that should be adopted would be to establish specific UV resistance standards.

Our Recommendations:

- Require a high-quality insulation.
- Require integral vapor barrier/ insulation jacketing solution that offers a zero-perm rating and improved insulation protection.
- Require a very specific, UV resistance standard that is more comprehensive then what is currently in place.
- Allow the use of UV resistant adhesive tape products to provide an improved seal on various cladding systems. Tape products can be a very durable, cost effective and efficient means of sealing various cladding materials to ensure the overall cladding system meets code requirements.

The 3M™ VentureClad™ system, for example, is available in both a white and reflective option. It utilizes an adhesive closure system to ensure the insulation is fully sealed when subjected to weather such as, but not limited to, sunlight, moisture and wind which are all required by code; as well as providing an integral zero perm vapor barrier.

All physical properties, statements, and suggestions are either based on tests we believe to be reliable or our experience. There are many factors that can affect the performance of a 3M product, some of which are uniquely within the user's knowledge and control. It is essential that the you thoroughly evaluate the VentureClad(TM) product and capability for your method of application and testing

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1985

Public Comment 6:

Proponents:
Charles Cottrell, NAIMA, representing NAIMA

requests Disapprove

Commenter's Reason: The proposed code change adds the requirement that the protective barrier be “removable.” This requirement would eliminate the use of PVC jacketing systems that serve very effectively as both a protective barrier and vapor retarder. This is because in order to serve as a vapor retarder on cold pipe systems the joints must be permanently sealed. And if they are sealed, the PVC jacket would not be removable without significant effort to cut the PVC jacketing and remove it from the insulation.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this proposal will not change the code and therefore, there will be no impact to cost of construction.

Public Comment# 2051

Public Comment 7:

Proponents:
Anthony Garone, representing Polyguard Products (tgarone@polyguard.com)

requests Disapprove

Commenter's Reason: The proposed code change rationale is based on a number of erroneous assumptions and fails to recognize advances in insulation material and jacketing technology since the reasons stated when EC110-09/10 were published. Since this is a two part proposal, we will address our objections to the proposed changes in two parts.
Part I: It is our opinion that the proposed revision to IECC section C403.11.3.1 will result in increased costs, will not result in any cost savings on commercial construction, and will deprive owners and specifiers of the code compliance benefits and performance benefits of a fully adhered jacketing system. This proposed change will affect *all* outdoor piping systems.

It should be noted that commercial construction is also subject to the requirements if the International Mechanical Code. IMC sections 1107.4 (refrigerant piping) and IMC section 1206.11 (hydronic piping) require prevention of condensation on the surface of the pipe, and IRC section M1411.6 requires a maximum permeability of 0.05 perm for refrigerant piping. This is typically accomplished through a combination of insulation with a vapor barrier, the vapor barrier often being fully adhered. If these piping systems are installed outdoors, many of the available fully adhered jacketing systems can provide both the requisite condensation protection and perm rating while also providing the protection from physical damage and solar radiation as required in the existing code. Note that a “removable” jacketing material such as that manufactured by the proponent cannot provide a perm rating because while the *body* of the jacket may meet the perm rating, a Velcro seam has a perm rating approaching *infinity.* Water flows right through it and by the very nature of being removable, it cannot be sealed to the insulation. Since it cannot act as a vapor barrier, many systems would require the addition of an actual vapor barrier under the removable jacketing at added material and labor cost and adding time to the project. The proponent’s claims that there is no additional cost are questionable. And ironically, the vapor barrier could be fully adhered, which would defeat the (dubious) advantage of a removable jacket.

The 2009 / 2010 argument in favor of a removable jacket was focused specifically on Freon systems. No case has been made to support extension of these provisions to commercial construction. In fact, commercial insulation systems installed outdoors not only don’t have unprotected insulation, they typically have very robust jacketing systems, including PVC (may or may not be removable, not reusable) and metal jacketing (possibly removable but often not reusable) as well as fully adhered jacketing systems and mastic and mesh systems. This code change would eliminate the use of all of the traditionally utilized systems, causing significant financial harm to numerous manufacturers, their distributors and installers.

A fully adhered jacketing system provides performance advantages and potentially significant cost savings. A fully adhered jacket limits any moisture intrusion (rain, snow or water vapor) to a small confined area. Damaged areas are easily detected using any of a number of non-destructive test methods, and cost to repair damage is minimized by the small area involved. A removable jacket would allow moisture migration under the jacket, and unless there was a vapor barrier between the jacket and insulation, very large areas of insulation could be damaged. In addition, since there would be an air gap between the jacket and insulation or vapor barrier, the gap would potentially subject to algae, mold and bacteria growth as well as providing a haven for insects. Were this to occur, the removable jacket would not be reusable, and the insulation could be damaged beyond repair.

Many manufacturers now provide pipe insulation with factory applied, fully adhered jacketing. The application of the jacketing under controlled conditions in a factory allows for a higher quality installation, reduced labor time on a project and reduced installed cost. These popular systems would be eliminated if this code change is approved.

Lastly, we would request that you ask yourself, “If the jacketing is removed, what do I see or now have access to”? The answer is “the insulation or vapor barrier”. *Not* the pipe. Access to the pipe for maintenance would *still* require removal of the insulation. The insulation itself may or may not be reusable depending upon the nature of the problem and the type of insulation. So in reality, what is the benefit of a removable jacket other than to benefit the manufacturers or removable jacketing?

We urge you to let specifiers and owners decide the relative benefits of insulation systems and disapprove this proposal.

Part II: Much of the same argument made for Part I is also applicable to Part II. When discussing Freon systems, we are typically talking about linesets that are common in residential construction as well as some other occupancies such as hotels. Based on a review of the proponent’s reason and justification for this code change, I would offer the following comments.

Removable jacketing is not necessary “… to insure the insulations (sic) thermal conductivity energy savings integrity last the life of the mechanical system as per the intent of the code”. In 2009 – 2010 installers were still applying unjacketed elastomeric or polyolefin insulation to outdoor AC unit lines and were not applying the recommended protective coatings. This process has changed since the 2012 introduction of code language requiring both protection from UV (solar radiation) and physical damage. Many insulation manufacturers responded to these changes by developing UV and damage resistant factory coatings that also provide the required perm rating for refrigerant lines for this application. These coatings are not removable from the insulation, but the *entire insulation system is easily removable from the lines* with only minor loss of insulation at the insulation termination points *which must be sealed to the lines to provide the required moisture barrier to prevent condensation as required by code.* Because the insulation is protected from UV degradation (heat is *not* a significant factor in these applications since the insulation is rated to 200 or 220°F continuous operation), the insulation is also readily reusable (with the exception of maybe 2” on the ends). It should be further noted that many of these factory coatings are clear or translucent, making inspection of the insulation easier without having to remove the jacket.

The proponent’s rationale cites an article written by Dr. Saum Nourhammadi, PEx3, Ph.D. CPD, CIPE, CFPE, and LEED AP on the impact and advantages of removable insulation protective covers. While we would be interested in knowing who sponsored this article, the article itself is very flawed. It does not address the basic issues as to whether a removable cover can address the code requirements for moisture protection, corrosion protection and perm rating. It does not weigh the *benefits* of adhered jackets versus the benefits of removable jackets, and the cost savings example is both obsolete due to the introduction of new products and just plain *wrong.* Fully adhered jackets can provide UV, moisture and physical damage protection as well as or better than removable jackets. So the calculations on the cost of damaged insulation become moot as there is no degraded insulation to result in increased energy costs over the life of the equipment. In fact, removable jackets are more likely to result in degraded insulation as they cannot provide an effective moisture, insect or mold, algae or bacteria barrier (think Velcro). Regardless, the math is incorrect. First, 39.5 million is pretty close to the total population of California. But that does not mean that every man, woman and child in the state of California has their own personal outdoor AC unit with 5 feet of exposed refrigerant line. There are approximately 9.6 million *households* in the state, and not all of them have individual AC units. High rise apartment dwellers certainly don’t have them. Even multi-unit dwellings don’t all have outdoor AC units. But let’s assume that they all have an outdoor AC. Using the same half the *households* premise as used by the author, the savings would be 4.8 million households times $5 annual savings for a total savings of $24 million annually. This is a far cry from the proponent’s alleged $975 million. The author is off by a factor of 40!

The proponent’s cost impact statement alleges that the proposed code change will neither increase nor decrease the cost of construction. We have already demonstrated that this is not the case in Part I. It is not the case in part II either. ALL of the stated options cost money and require labor (cost) to install. And again, none meet the code requirements for moisture condensation control or perm rating. As a simple example, we can use the proponent’s removable jacket product as an example. The cost to purchase enough jacket to install over a 5 ft. line at retail is approximately $40. It is less on a per foot basis, but the scrap is not really usable. So for a $1 a year annual savings, the ROI to the homeowner would be 40 years. Since this exceeds the life expectancy of the AC equipment, the homeowner will never attain a return on his investment, even assuming he lives in the house for the 40 years. And of course, if we look beyond California where the proponent is based, the annual AC usage hours could be significantly less, making the ROI even longer. And many states have lower electricity costs (Louisiana is $0.0962 per kwhr), further extending the time to ROI.

Based on the above, we urge you to disapprove this code change. We would also urge you to consider the following revisions for the next code cycle:

1. Clarify that adhesive tape cannot be applied *directly to the insulation*. Many jacketing systems utilize tape as an accessory to seal their systems, and these tale have a long successful history of outdoor use when used for this purpose.

2. Develop or adopt UV resistance standards. Do not leave this to the discretion of the AHJ. It makes it difficult for manufacturers to compete on a national level and it creates an uneven playing field.

3. Develop or adopt damage resistance standards for the same reason as above.

4. Develop or adopt wind resistance standards for removable jacketing.

Bibliography: see attached file.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The net effect is an increase in the cost of construction, in part because ALL of the stated options cost money and require labor (cost) to install

Public Comment# 1810

Public Comment 8:

Proponents:
Christopher Mueller, Mueller Streamline Co, representing self (cmueller@muellerindustries.com)

requests Disapprove

Commenter's Reason: Pipe insulation should be made more resistant to weather - including UV - but mandating a removable barrier does not ensure better or worse performance or longevity. This change merely supports an individual manufacturer's business goals. Removable barriers that can trap moisture have proven to be detrimental to the underlying tubing. Copper is highly durable in wet environments; however, trapped moisture will can eventually develop into aggressive substances that attack the copper tube and cause premature failures and loss of refrigerant. The focus should be on durability and performance, not whether some brand has a Velcro closure.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code text. Individual building owners and AHJs can enforce special requirements as desired. This is not appropriate use of a building code requirement.

Public Comment# 2070

Public Comment 9:

Proponents:
Darrell Peil, representing Knauf Insulation (darrell.peil@knaufinsulation.com)

requests Disapprove

Commenter's Reason: INTERNATIONAL CODE COUNCIL, INC.
500 New Jersey Avenue, NW 6th Floor
Washington, DC 20001

July 23, 2019

Dear ICC Review Members,

I am writing in response to the proposal for an amended statement regarding CE150-19 Part I, IECC®: C403.11.3.1 to be included in the 2018 International Energy Conservation Code.

As the Business Development Manager for Commercial and Industrial Insulation for Knauf Insulation, I am recommending that the International Code Council decline to accept the proposed revision to the 2018 International Energy Conservation Code. Knauf Insulation is one of the world's largest producers of mechanical and structural insulation, with 6 manufacturing locations in the United States.

I have represented multiple kinds of insulation materials and finish systems in my 36+ year career in the mechanical insulation industry. I am a current member of ASHRAE TC1.8, ASTM serving on many Task Groups, including those devoted to finish systems, Chair of the National Insulation Association's Technical Insulation Committee, and an editorial member of the National Commercial and Industrial Insulation Standards manual committee.

The proponent states in the proposed revision referencing pipe insulation protection, that the barrier should be removable for equipment maintenance. All supplemental jacketing materials are removable since jacketing is a separate product and operation when added to insulation installations, and removable after installation, some more easily than others. Insulation materials are supplied that have an integral jacketing for the specific reasons given of weather and impact resistance. These jackets are highly satisfactory in providing the desired functions. Many are tested for impact resistance and weatherability. If the insulation system needs work after installation, these finishes/barriers can be removed with the insulation. The term "removable" has a particular connotation in the mechanical insulation industry that can cause confusion and be misconstrued. This is inappropriate to have included.

The exclusion of tape is inappropriate. Excluding this type of product from the code excludes a whole class of products from the market inappropriately and unfairly, that are designed for and provide high-performance protection. Certain tapes are produced from the same materials that are used for weather and impact resistance, such as polymer films, multi-material laminates, and metallic backings. The adhesives used are designed for long-term, outdoor residence, recognizing the function they are designed to serve. Some products carry 10-year warranty coverage when used outdoors, to lend credence to the use of the products for outdoor service. The adhesives used provide a highly positive method of attachment and closure. In applications where the pipe system is operating at temperatures below ambient temperatures, and vapor-retarder properties are needed, these pressure-sensitive-adhesive protective materials provide the most positive and best performing vapor-retarders. No other weather-protective material does this as well or as cost effectively.

A premise is presented that removing pressure-sensitive-adhesive jackets or tapes will degrade the moisture and water vapor retardant ability of insulation materials. No insulation product has the inherent water and water-vapor resistance properties deteriorated by removing pressure-sensitive jackets. Water and water vapor-resistance properties of insulation materials, no matter how good or how bad, are uniform through the entire matrix of the material. There are insulation materials that have a competitive advantage because superior moisture and water vapor resistance properties do go through the entire thickness of the material. These materials are unchanged because of the homogenous nature of these products. Removal of the outer surface does not change the property.
A reference to thermoset materials is made, indicating materials achieve the property of becoming a thermoset material after insulation. Insulation made from polymers are determined to be thermoset materials at the time of chemical formulation, not based on exposure to elements. Vulcanized synthetic rubber, used as insulation, is a thermoset polymer. The product maintains flexibility after the vulcanizing process. Thermoplastic polymers cannot be transformed to thermoset polymers. The thermoset is achieved in the vulcanizing portion of the production process, much the same as making a tire. There is no changing this. Thermoset materials are no different in their ability to resist weather deterioration and damage after installation.

The premise of HVAC equipment maintenance is discussed. Most HVAC equipment maintenance procedures do not require accessing the insulated piping that carries the refrigerant. Most service is conducted inside the condenser unit cabinet that contains the compressor, condensing coil, condenser fan motor, contactors, capacitors, circuit boards, valves and wiring. The refrigerant piping is almost never serviced, except when the condensing unit is disconnected from the piping. No routine service happens on this part of the system. Secondly, if the piping or equipment beneath the insulation needs to be serviced, the insulation AND the protective finish must be removed. Replacement with new material is standard in the rare instance that this operation must be performed.

The precept that all insulation cannot withstand impacts or direct weather exposure is erroneous. There are insulation materials that are resistant to the effects of weather and impacts as produced. The flexibility and compressibility of the materials, along with the chemical formulation, provide these properties. This is much the same as automotive rubber, like tires, belts, hoses, gaskets and other building materials such as roofing, glazing gaskets and sealants.

The premise that solar radiant heat gain damages all insulation is not sound. Insulation is designed for heat and cold, and to control the flow of energy between the two conditions. Like all materials, there are an array of formulations of insulation materials. The material used to produce the insulation has a significant impact on the material's ability to resist heat degradation. It is important to specify the correct insulation type for the application. This is a base selection criteria used in all insulation system selection.

The savings calculations presented by the proponent Ahern applies to the insulation material, not the jacket. The jacket lends no savings to the system. Some jacketings detract from the ability of the system to retard energy flow. Part of a proper system design includes compensation for the added energy flow that can be caused by certain protective finishes, and may change the selection of the protective finish to avoid the added flow/loss caused by the finish.

The proponent goes on to discuss savings of installation and maintenance. Protective finishes on insulation systems generally double the cost of the insulation installation. The assertion of no impact on construction cost is erroneous. The assumption of reduced costs of damaged insulation systems is erroneous. When the insulation is compromised, the entire system is removed and replaced, including protective finishes. This is a base requirement and assumption to properly restore the system.

Properly installed and sealed insulation systems are required to deliver long-term performance. The system is the insulation material itself, and any kind of finish that achieves the desired goals of the design professional, including avoiding weather intrusion, insect infestation, water vapor, ice, and other deleterious impacts. A system that is not properly applied and sealed will not provide long-term function. This includes a seal that is complete and will not pass moisture or water vapor for below-ambient operation systems.

The proponent makes a reference to the 2017 ASHRAE Handbook. The only Handbook published in 2017, is the Handbook of Fundamentals. As the Chair of the 2013 TC1.8 Handbook subcommittee, and a member of ASHRAE TC1.8 for the Handbook, I am intimately familiar with the contents of Chapter 23, Mechanical Insulation for HVAC Systems. The 2013 version was adopted for 2017, with no changes. References to finish and jacketing systems are very neutral and no specific direction is given regarding one kind of finish or the other.

The code language proposed could be considered to restrict the use of common insulation finish systems from outdoor use, that are specifically designed for, highly suited for, and effective in outdoor applications for all kinds of systems.

Please consider the above comments as proposed changes are reviewed for adoption.

Regards,
Darrell Peil, Business Development, Commercial & Industrial
Knauf Insulation
Darrell.peil@knaufinsulation.com
http://www.imanson.com
https://www.knaufinsulation.us/

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1929

Public Comment 10:

Proponents:
William Ronca, K-Flex USA, representing K-Flex USA (bill.ronca@kflexusa.com)

requests Disapprove

Commenter's Reason: It is our opinion that the proposed revision to IECC section C403.11.3.1 will result in increased costs, will not result in any cost savings on commercial construction, and will deprive owners and specifiers of the code compliance benefits and performance benefits of a fully adhered jacketing system. The proposed code change rationale is based on a number of erroneous assumptions and fails to recognize advances in insulation material and jacketing technology since the reasons stated when EC110-09/10 were published.
It should be noted that commercial construction is also subject to the requirements of the International Mechanical Code. IMC sections 1107.4 (refrigerant piping) and IMC section 1206.11 (hydronic piping) require prevention of condensation on the surface of the pipe, and IRC section M1411.6 requires a maximum permeability of 0.05 perm for refrigerant piping. This is typically accomplished through a combination of insulation with a vapor barrier, the vapor barrier often being fully adhered. If these piping systems are installed outdoors, many of the available fully adhered jacketing systems can provide both the requisite condensation / corrosion protection and the specified perm rating while also providing the protection from physical damage and solar radiation as required in the existing code. Note that a “removable” jacketing material such as that manufactured by the proponent cannot provide a perm rating because while the *body* of the jacket may meet the perm rating, a Velcro seam has a perm rating greater than 100. Water flows right through it and by the very nature of being removable, it cannot be sealed to the insulation. Since it cannot act as a vapor barrier, many systems would require the addition of an actual vapor barrier under the removable jacketing at added material and labor cost and adding time to the project. And ironically, the vapor barrier could be fully adhered, which would defeat the (dubious) advantage of a removable jacket. The proponent’s claims that there is no additional cost are questionable.

The 2009 / 2010 argument in favor of a removable jacket was focused specifically on Freon systems. No case has been made to support extension of these provisions to commercial construction. In fact, commercial insulation systems installed outdoors not only don’t have unprotected insulation, they typically have very robust jacketing systems, including PVC (may or may not be removable, not reusable) and metal jacketing (usually removable but often not reusable) as well as fully adhered jacketing systems and mastic and mesh systems. This code change would potentially eliminate the use of all of the traditionally utilized systems, causing significant financial harm to numerous manufacturers, their distributors and installers.

A fully adhered jacketing system provides performance advantages and potentially significant cost savings. In the event of a jacketing failure, a fully adhered jacket limits any moisture intrusion (rain, snow or water vapor) to a small, confined area. Damaged areas are easily detected using any of a number of non-destructive test methods, and cost to repair damage is minimized by the small area involved. A removable jacket would allow moisture migration under the jacket, and unless there was a vapor barrier between the jacket and insulation, very large areas of insulation could be damaged. In addition, since there would be an air gap between the jacket and insulation or vapor barrier, the gap would potentially be subject to algae, mold and bacteria growth as well as providing a haven for insects. Were this to occur, the removable jacket would not be reusable, and the insulation could be damaged beyond repair.

Many manufacturers and fabricator / distributors now provide pipe insulation with factory applied, fully adhered jacketing. The application of the jacketing under factory controlled conditions allows for a higher quality installation, reduced labor time on a project and reduced installation cost. These popular systems would be eliminated if this code change is approved.

Lastly, we would request that you ask yourself, “If the jacketing is removed, what do I see or now have access to”? The answer is “the insulation or vapor barrier”. *Not* the pipe. Access to the pipe for maintenance would *still* require removal of the insulation. The insulation itself may or may not be reusable depending upon the nature of the problem and the type of insulation. So in reality, what is the benefit of requiring a removable jacket other than to benefit the manufacturers or removable jacketing?

We urge you to let specifiers and owners decide the relative benefits of insulation systems and disapprove this proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment 11:

Proponents:
Louis Walton, representing VP Sales & Marketing (louis@protocorporation.com)

requests Disapprove

Commenter's Reason: Reference: ICC Proposed code changes: July 23, 2019
CE150-19 Part I and CE150-19 Part II
Opponent: Louis Walton – Proto Corporation

Requested Action: Disapproval

Reason: The code changes as proposed, are flawed and if implemented will contribute to "in-field failures" to the insulation system.

Currently insulation packages are fully sealed with appropriate vapor barriers to prevent condensation within the insulation system and surrounding areas. These systems also provide exterior protection for abuse and outside use.

If this type of system is not used then the insulation package will be compromised and the following types of issues may occur:

· Icing within the system

· Potential for mold growth

· Reduced Insulating value

· System expansion possibly leading to piping failure

For any below ambient piping, including air conditioning tubing, the insulation system **must be** fully sealed.

As with any pipe maintenance, including air conditioning repairs, appropriate steps must be taken to ensure that the insulation system is returned to its original condition after the repairs are completed. In many cases the insulation and barriers may be reused. This assumes that the worker is properly trained and has the appropriate materials to repair the insulation system and provide the necessary vapor barrier.

· Self-sealing tape (double sided acrylic based)

· Butt strips or sealing tape (acrylic based)

· ASJ jacketing

· PVC or CPVC jacket or strips

· Vapor barrier mastic

· Additional insulation

A barrier, which is designed to be removed, by its very nature is not designed to provide a sealed system. If this type of system is required, by this proposed code change, the use of it will result in field failures. A removable barrier may provide protection for exposure to outdoor, impact resistance, and act as a liquid watershed, but it is not designed to provide a vapor seal. Without this vapor barrier seal the aforementioned issues may occur. This type of failure would be very costly to the end user.

As part of this proposal the justification to use a removable barrier referenced potential energy savings. This reference appears to be incorrect, since all of the air conditioning systems referenced are currently protected using an industry approved insulation system.

If the ICC wants to strengthen the wording of this section of the code perhaps they should consider requiring the individual working on an air conditioning system be trained to remove, re-install or replace the insulation package. This would minimize the potential for field failures and have a minimal cost to the end user.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1891

CE150-19 Part II

IECC: R403.4.1 (IRC N1103.4.1)

Proposed Change as Submitted

Proponents: Howard Ahern, representing self (howard.ahern@airexmfg.com)

2018 International Energy Conservation Code

Revise as follows:

R403.4.1 (IRC N1103.4.1) Protection of piping insulation. Piping insulation exposed to weather shall be protected from damage, including that caused by sunlight, moisture, wind and physical damage. Protective barrier shall be removeable for equipment maintenance and ~~wind. The protection~~ shall provide shielding from solar radiation that can cause degradation of the material. Adhesive tape shall be prohibited.

Reason: Part I of this proposal will clarify the intent of Section C403.11.3.1. Part II of this proposal will clarify the intent of Section R403.4.1. The intent of these sections is not only protection of pipe insulation from weather but to insure the insulations thermal conductivity energy savings integrity last the life of the mechanical system as per the intent of the code . In order to remove the opportunity for misunderstanding so that the code has its's intended result the term "equipment maintenance" must be clarified.
The intent is in the original proponents reason statement of this requirement EC207-09/10 which stated this was originally from the ASHRAE 90.1 standard to Harmonize the IECC with ASHRAE 90.1 for the 2012 code the reason statement also stated -" All AC units require periodic maintenance. The frequency varies with how hard the unit operates, exterior temperature, preventive maintenance program, and many others. In every occasion, every maintenance provides an excuse for the Freon line insulation to be touched and removed." The intent is clear that the protection be removable and independent of the pipe insulation for maintenance without damaging the pipe insulation.

Removing protection without damaging the insulation is stated in EC207-09/10 "Adhesives Tape is not permitted as it will limit maintenance and damage insulations permeability characteristics. Removal of tape damages the integrity of the original insulation into pieces, specially, if the insulation has reached thermo set state.

Protective covering must also protect from physical damage so if the protection covering does get damaged from stepping on it, dropping tools on it, birds, lawn trimmers etc.it can be replaced keeping the insulations thermal conductivity integrity and insuring the insulation system last the life of the mechanical system and avoiding the costly replacement of the insulation.

2012 & 2018 IECC Code and commentary both state that Equipment maintenance also include protection from physical damage to the pipe insulation.

The code section also requires the removal protection to shield from solar radiation that can cause degradation on of the insulation. This sometime get confused with UV protection that is under damage from "sunlight". The additional requirement to shield against solar radiation that is more than just UV, solar radiation also includes heat. Heat is a major factor in the degradation of insulation .UV testing while a good start can be unreliable as it depends on product placement.

Removable protection also allows less costly maintance and replacement of any damaged insulation.

Bibliography: Impact and Advantages of
Removable Insulation Protective Covers

Dr. "Saum" K. Nourmohammadi, PEx3, Ph.D. CPD, CIPE, CFPE,

LEED AP

2017 ASHRAE Handbook

2012, 2018 IECC Code & Commentary

Cost Impact: The code change proposal will not increase or decrease the cost of construction
There are a wide variety of removable protective coverings and are available at most supply distributors. These can be as simple as sheet metal or plastic channels, or cladding, PVC covers, Jackets, aluminum covers etc. Many covering require much less labor compared to painting or banding

and they are currently being used all over the US so there no increase cost.

CE150-19 Part II

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Submitted**

Committee Reason: This is needed to protect the insulation and ensure it is removable (Vote: 9-2).

Assembly Action: **None**

CE150-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:
Troy Anderson, H.B. Fuller Company, representing H.B. Fuller Company

requests Disapprove

Commenter's Reason: The change to the code to require jacketing be removable does not consider the need to remove the insulation or jacketing in areas where maintenance is not required and does not acknowledge that there are many types of insulation systems available and that some systems may benefit from fully adhered jacketing such as mastics and coatings or adhesive tape type jacketing for the reasons as follows. The owner and specifiers should have the ability to design an implement the most cost effective total solution considering all factors for their specific system whether that include removable jackets or where a fully adhered jacket may provide the best weather protection at the best performance and cost.

1. Not all piping in the system would require maintenance or be affected by equipment maintenance so the need to have the insulation or jacketing removable over the entire pipe would not seem necessary. It would only affect that piping immediately adjacent to the equipment.
2. This change does not properly address the need for a continuous vapor retarder system with the insulation. Whether the jacketing is bonded to the insulation, such as would be the case with mastics and coatings or adhesive tape types, or the jacketing is removable once the insulation itself is disturbed the vapor retarder system will require repair. Vapor retarder mastics and adhesive bonded vapor retarder jackets, such as aluminum laminate tapes, have the advantage of being able to visually confirm the continuance of the vapor retarder and the integrity or existence of the underlying insulation. Simply re-installing a removable jacket over an insulated pipe does not address or ensure a proper vapor retarder for the insulation system or the integrity of the underlying insulation.
3. The argument that removable jackets can be replaced or repaired if damaged is no different than adhered vapor retarder jacketing or coatings. These may also be repaired. In fact in some cases the fact the vapor retarder is adhered to the insulation surface may be an advantage if damage occurs. The adhered system will not allow the movement of water or water vapor between the insulation surface and the jacket confining the damage just to the area where the damage occurred and continuing to provide the vapor retarder in unaffected areas. Removable jacketing will allow moisture to travel between the jacket and the insulation and provides no additional vapor retarder to the system.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 2077

Public Comment 2:

Proponents:

Berner, Custom Laminating, representing Custom Laminating (bernerdavid@customl.com)

requests Disapprove

Commenter's Reason: The proposed code change rationale is based on a number of erroneous assumptions and fails to recognize advances in insulation material and jacketing technology since the reasons stated when EC110-09/10 were published. Since this is a two part proposal, we will address our objections to the proposed changes in two parts.
Part I: It is our opinion that the proposed revision to IECC section C403.11.3.1 will result in increased costs, will not result in any cost savings on commercial construction, and will deprive owners and specifiers of the code compliance benefits and performance benefits of a fully adhered jacketing system. This proposed change will affect *all* outdoor piping systems.

It should be noted that commercial construction is also subject to the requirements if the International Mechanical Code. IMC sections 1107.4 (refrigerant piping) and IMC section 1206.11 (hydronic piping) require prevention of condensation on the surface of the pipe, and IRC section M1411.6 requires a maximum permeability of 0.05 perm for refrigerant piping. This is typically accomplished through a combination of insulation with a vapor barrier, the vapor barrier often being fully adhered. If these piping systems are installed outdoors, many of the available fully adhered jacketing systems can provide both the requisite condensation protection and perm rating while also providing the protection from physical damage and solar radiation as required in the existing code. Note that a “removable” jacketing material such as that manufactured by the proponent cannot provide a perm rating because while the *body* of the jacket may meet the perm rating, a Velcro seam provides no resistance to moisture vapor entry. Water flows right through it and by the very nature of being removable, it cannot be sealed to the insulation. Since it cannot act as a vapor barrier, many systems would require the addition of an actual vapor barrier under the removable jacketing at added material and labor cost and adding time to the project. The proponent’s claims that there is no additional cost are questionable. And ironically, the vapor barrier could be fully adhered, which would defeat the (dubious) advantage of a removable jacket.

The 2009 / 2010 argument in favor of a removable jacket was focused specifically on Freon systems. No case has been made to support extension of these provisions to commercial construction. In fact, commercial insulation systems installed outdoors not only don’t have unprotected insulation, they typically have very robust jacketing systems, including PVC (may or may not be removable, not reusable) and metal jacketing (possibly removable but often not reusable) as well as fully adhered jacketing systems and mastic and mesh systems. This code change would eliminate the use of all of the traditionally utilized systems, causing significant financial harm to numerous manufacturers, their distributors and installers.

A fully adhered jacketing system provides performance advantages and potentially significant cost savings. A fully adhered jacket limits any moisture intrusion (rain, snow or water vapor) to a small confined area. Damaged areas are easily detected using any of a number of non-destructive test methods, and cost to repair damage is minimized by the small area involved. A removable jacket would allow moisture migration under the jacket, and unless there was a vapor barrier between the jacket and insulation, very large areas of insulation could be damaged. In addition, since there would be an air gap between the jacket and insulation or vapor barrier, the gap would potentially subject to algae, mold and bacteria growth as well as providing a haven for insects. Were this to occur, the removable jacket would not be reusable, and the insulation could be damaged beyond repair.

Lastly, we would request that you ask yourself, “If the jacketing is removed, what do I see or now have access to”? The answer is “the insulation or vapor barrier”. *Not* the pipe. Access to the pipe for maintenance would *still* require removal of the insulation. The insulation itself may or may not be reusable depending upon the nature of the problem and the type of insulation. So in reality, what is the benefit of a removable jacket other than to benefit the manufacturers of removable jacketing?

We urge you to let specifiers and owners decide the relative benefits of insulation systems and disapprove this proposal.

Part II: Much of the same argument made for Part I is also applicable to Part II. When discussing Freon systems, we are typically talking about linesets that are common in residential construction as well as some other occupancies such as hotels. Based on a review of the proponent’s reason and justification for this code change, I would offer the following comments.

Removable jacketing is not necessary “… to insure the insulations (sic) thermal conductivity energy savings integrity last the life of the mechanical system as per the intent of the code”. In 2009 – 2010 installers were still applying unjacketed elastomeric or polyolefin insulation to outdoor AC unit lines and were not applying the recommended protective coatings. This process has changed since the 2012 introduction of code language requiring both protection from UV (solar radiation) and physical damage. Many insulation manufacturers responded to these changes by developing UV and damage resistant factory coatings that also provide the required perm rating for refrigerant lines for this application. These coatings are not removable from the insulation, but the *entire insulation system is easily removable from the lines* with only minor loss of insulation at the insulation termination points *which must be sealed to the lines to provide the required moisture barrier to prevent condensation as required by code.* Because the insulation is protected from UV degradation (heat is *not* a significant factor in these applications since the insulation is rated to 200 or 220°F continuous operation), the insulation is also readily reusable (with the exception of maybe 2” on the ends). It should be further noted that many of these factory coatings are clear or translucent, making inspection of the insulation easier without having to remove the jacket.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The proponent’s cost impact statement alleges that the proposed code change will neither increase nor decrease the cost of construction. ALL of the stated options cost money and require labor (cost) to install. And again, none meet the code requirements for moisture condensation control or perm rating. As a simple example, we can use the proponent’s removable jacket product as an example. The cost to purchase enough jacket to

install over a 5 ft. line at retail is approximately $40. It is less on a per foot basis, but the scrap is not really usable. So for a $1 a year annual savings, the ROI to the homeowner would be 40 years. Since this exceeds the life expectancy of the AC equipment, the homeowner will never attain a return on his investment, even assuming he lives in the house for the 40 years. And of course, if we look beyond California where the proponent is based, the annual AC usage hours could be significantly less, making the ROI even longer. And many states have lower electricity costs (Louisiana is $0.0962 per kwhr), further extending the time to ROI.

A removable jacket is more likely to allow the ingress of moisture. This will damage the insulation layer and result in addition cost in materials and labor to mitigate. A fully adhered jacket is much less likely to allow ingress of moisture into the insulation.

Public Comment# 1856

Public Comment 3:

Proponents:
Ron Borst, representing Self (rborst@mmm.com)

requests Disapprove

Commenter's Reason: R403.11.3.1 Protection of piping insulation (Mandatory) states that the piping insulation exposed to weather shall be protected from damage, including that caused by sunlight, moisture, equipment maintenance and wind. That protection shall provide shielding from solar radiation that can cause degradation of the material.
The change noted in the original proposed code change is “protective barrier shall be removable” for equipment maintenance. The claim is that all AC units require periodic maintenance and that all maintenance work provides an opportunity for any damaged Freon line insulation to be replaced. Maintenance on AC units, such as, but not limited to, getting temperatures and pressures from the line sets, do not always require the insulation “to be touched or removed” as stated in the code change request.

Also, it is claimed that a removable cover would enable easier insulation replacement. Requiring a removable insulation cover presupposes that a lower quality insulation was installed. A high-quality insulation would provide a much longer service life, provided the insulation is well protected, as currently required in the code.

In the proposed code change, the claim is made that insulation materials are fragile to many elements, including the heat generated by sunlight. The claim also asserts that this sunlight induced heat enhances the transformation of the insulation from a thermoplastic (soft) foam to a thermoset (brittle) foam. This is not a true statement for higher quality insulation, such as EPDM, when it is properly protected per the existing code. Based on the lifespan of many of these types of high-quality insulation materials in an industrial setting, where they are often exposed to a high heat environment; high quality elastomeric insulations are not inherently broken down by heat. Requiring a high-quality insulation, that does not break down with heat, would be a more cost effective and efficient solution. Furthermore, if it is desired to protect high quality elastomeric insulation, such as EPDM, from sunlight induced heat in a residential setting, the easiest and most cost-effective means would be to require that the covering that is used be either white or reflective.

Many of the insulation coverings suggested in the proposed code change, such as sheet metal, aluminum covers, jackets, and metal cladding would likely require additional labor costs to install due to the need to form, shape and install them. Additionally, these materials would not necessarily be easy to remove after installation, due to the inherent need for fasteners, sealants, etc. Furthermore, while the insulation covers listed above likely provide very good UV protection, these types of insulation covers often require the application of a sealant to meet other code requirements for protecting the insulation from moisture and wind. The need for sealants increases the complexity of installation and the cost.

The quality of PVC's varies widely, and some PVC's show a tendency to crack after long term UV exposure. One approach that should be adopted would be to establish specific UV resistance standards. Additionally, the current PVC/hook & loop system that is part of the code change request is likely not capable of providing moisture protections to the insulation, and therefore would not meet code requirements. In order to meet the requirements, a sealant or tape product would be needed to completely seal the removable cover.

Our Recommendations:

- Require a high-quality insulation.
- Require integral vapor barrier/ insulation jacketing solution that offers a zero-perm rating and offers improved insulation protection.
- Require a very specific, UV resistance standard that is more comprehensive then what is currently in place.
- Require the use of a white or reflective surface finish to diminish the effect of heat absorption on the insulation.
- Allow the use of UV resistant adhesive tape products to provide an improved seal on various cladding systems. Tape products can be a very durable, cost effective and efficient means of sealing various cladding materials to ensure the overall cladding system meets code requirements.

The 3M™ VentureClad™ product, for example, is available in both a white and reflective option. It utilizes an adhesive closure system to ensure the insulation is fully sealed when subjected to weather such as, but not limited to, sunlight, moisture and wind which are all required by code; as well as providing an integral zero perm vapor barrier. Restricting the use of an adhesive based system such as is currently being requested, would not be in the best interest on homeowners or contractors.

All physical properties, statements, and suggestions are either based on tests we believe to be reliable or our experience. There are many factors that can affect the performance of a 3M product, some of which are uniquely within the user's knowledge and control. It is essential that the you thoroughly evaluate the 3M VentureCladTM product and capability for your method of application and testing.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 2029

Public Comment 4:

Proponents:
Charles Cottrell, NAIMA, representing NAIMA

requests Disapprove

Commenter's Reason: The proposed code change adds the requirement that the protective barrier be "removable." This requirement would eliminate the use of PVC jacketing systems that serve very effectively as both a protective barrier and vapor retarder. This is because in order to serve as a vapor retarder on cold pipe systems the joints must be permanently sealed. And if they are sealed, the PVC jacket would not be removable without significant effort to cut the PVC jacketing and remove it from the insulation.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
No change to code.

Public Comment# 2053

Public Comment 5:

Proponents:
Christopher Mueller, representing self (cmueller@muellerindustries.com)

requests Disapprove

Commenter's Reason: Pipe insulation should be made more resistant to weather - including UV - but mandating a removable barrier does not ensure better or worse performance or longevity. This change merely supports an individual manufacturer's business goals. Removable barriers that can trap moisture have proven to be detrimental to the underlying tubing. Copper is highly durable in wet environments; however, trapped moisture will can eventually develop into aggressive substances that attack the copper tube and cause premature failures and loss of refrigerant. The focus should be on durability and performance, not whether some brand has a Velcro closure.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code text. Individual building owners and AHJs can enforce special requirements as desired. This is not appropriate use of a building code requirement.

Public Comment# 2081

Public Comment 6:

Proponents:
Darrell Peil, representing Knauf Insulation (darrell.peil@knaufinsulation.com)

requests Disapprove

Commenter's Reason: INTERNATIONAL CODE COUNCIL, INC.
500 New Jersey Avenue, NW 6th Floor

Washington, DC 20001

July 23, 2019

Dear ICC Review Members,

I am writing in response to the proposal for an amended statement regarding CE150-19 Part I, IECC®: C403.11.3.1 to be included in the 2018 International Energy Conservation Code.

As the Business Development Manager for Commercial and Industrial Insulation for Knauf Insulation, I am recommending that the International Code Council decline to accept the proposed revision to the 2018 International Energy Conservation Code. Knauf Insulation is one of the world's largest producers of mechanical and structural insulation, with 6 manufacturing locations in the United States.

I have represented multiple kinds of insulation materials and finish systems in my 36+ year career in the mechanical insulation industry. I am a current member of ASHRAE TC1.8, ASTM serving on many Task Groups, including those devoted to finish systems, Chair of the National Insulation Association's Technical Insulation Committee, and an editorial member of the National Commercial and Industrial Insulation Standards manual committee.

The proponent states in the proposed revision referencing pipe insulation protection, that the barrier should be removable for equipment maintenance. All supplemental jacketing materials are removable since jacketing is a separate product and operation when added to insulation installations, and removable after installation, some more easily than others. Insulation materials are supplied that have an integral jacketing for the specific reasons given of weather and impact resistance. These jackets are highly satisfactory in providing the desired functions. Many are tested for impact resistance and weatherability. If the insulation system needs work after installation, these finishes/barriers can be removed with the insulation. The term "removable" has a particular connotation in the mechanical insulation industry that can cause confusion and be misconstrued. This is inappropriate to have included.

The exclusion of tape is inappropriate. Excluding this type of product from the code excludes a whole class of products from the market inappropriately and unfairly, that are designed for and provide high-performance protection. Certain tapes are produced from the same materials that are used for weather and impact resistance, such as polymer films, multi-material laminates, and metallic backings. The adhesives used are designed for long-term, outdoor residence, recognizing the function they are designed to serve. Some products carry 10-year warranty coverage when used outdoors, to lend credence to the use of the products for outdoor service. The adhesives used provide a highly positive method of attachment and closure. In applications where the pipe system is operating at temperatures below ambient temperatures, and vapor-retarder properties are needed, these pressure-sensitive-adhesive protective materials provide the most positive and best performing vapor-retarders. No other weather-protective material does this as well or as cost effectively.

A premise is presented that removing pressure-sensitive-adhesive jackets or tapes will degrade the moisture and water vapor retardant ability of insulation materials. No insulation product has the inherent water and water-vapor resistance properties deteriorated by removing pressure-sensitive jackets. Water and water vapor-resistance properties of insulation materials, no matter how good or how bad, are uniform through the entire matrix of the material. There are insulation materials that have a competitive advantage because superior moisture and water vapor resistance properties do go through the entire thickness of the material. These materials are unchanged because of the homogenous nature of these products. Removal of the outer surface does not change the property.
A reference to thermoset materials is made, indicating materials achieve the property of becoming a thermoset material after insulation. Insulation made from polymers are determined to be thermoset materials at the time of chemical formulation, not based on exposure to elements. Vulcanized synthetic rubber, used as insulation, is a thermoset polymer. The product maintains flexibility after the vulcanizing process. Thermoplastic polymers cannot be transformed to thermoset polymers. The thermoset is achieved in the vulcanizing portion of the production process, much the same as making a tire. There is no changing this. Thermoset materials are no different in their ability to resist weather deterioration and damage after installation.

The premise of HVAC equipment maintenance is discussed. Most HVAC equipment maintenance procedures do not require accessing the insulated piping that carries the refrigerant. Most service is conducted inside the condenser unit cabinet that contains the compressor, condensing coil, condenser fan motor, contactors, capacitors, circuit boards, valves and wiring. The refrigerant piping is almost never serviced, except when the condensing unit is disconnected from the piping. No routine service happens on this part of the system. Secondly, if the piping or equipment beneath the insulation needs to be serviced, the insulation AND the protective finish must be removed. Replacement with new material is standard in the rare instance that this operation must be performed.

The precept that all insulation cannot withstand impacts or direct weather exposure is erroneous. There are insulation materials that are resistant to the effects of weather and impacts as produced. The flexibility and compressibility of the materials, along with the chemical formulation, provide these properties. This is much the same as automotive rubber, like tires, belts, hoses, gaskets and other building materials such as roofing, glazing gaskets and sealants.

The premise that solar radiant heat gain damages all insulation is not sound. Insulation is designed for heat and cold, and to control the flow of energy between the two conditions. Like all materials, there are an array of formulations of insulation materials. The material used to produce the insulation has a significant impact on the material's ability to resist heat degradation. It is important to specify the correct insulation type for the application. This is a base selection criteria used in all insulation system selection.

The savings calculations presented by the proponent Ahern applies to the insulation material, not the jacket. The jacket lends no savings to the system. Some jacketings detract from the ability of the system to retard energy flow. Part of a proper system design includes compensation for the added energy flow that can be caused by certain protective finishes, and may change the selection of the protective finish to avoid the added flow/loss caused by the finish.

The proponent goes on to discuss savings of installation and maintenance. Protective finishes on insulation systems generally double the cost of the insulation installation. The assertion of no impact on construction cost is erroneous. The assumption of reduced costs of damaged insulation systems is erroneous. When the insulation is compromised, the entire system is removed and replaced, including protective finishes. This is a base requirement and assumption to properly restore the system.

Properly installed and sealed insulation systems are required to deliver long-term performance. The system is the insulation material itself, and any kind of finish that achieves the desired goals of the design professional, including avoiding weather intrusion, insect infestation, water vapor, ice, and other deleterious impacts. A system that is not properly applied and sealed will not provide long-term function. This includes a seal that is complete and will not pass moisture or water vapor for below-ambient operation systems.

The proponent makes a reference to the 2017 ASHRAE Handbook. The only Handbook published in 2017, is the Handbook of Fundamentals. As the Chair of the 2013 TC1.8 Handbook subcommittee, and a member of ASHRAE TC1.8 for the Handbook, I am intimately familiar with the contents of Chapter 23, Mechanical Insulation for HVAC Systems. The 2013 version was adopted for 2017, with no changes. References to finish and jacketing systems are very neutral and no specific direction is given regarding one kind of finish or the other.

The code language proposed could be considered to restrict the use of common insulation finish systems from outdoor use, that are specifically designed for, highly suited for, and effective in outdoor applications for all kinds of systems.

Please consider the above comments as proposed changes are reviewed for adoption.

Regards,
Darrell Peil, Business Development, Commercial & Industrial
Knauf Insulation
Darrell.peil@knaufinsulation.com
http://www.imanson.com
https://www.knaufinsulation.us/

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1930

Public Comment 7:

Proponents:
Charles Petty, Lamtec Corporation, representing Lamtec Corporation (pettycharlie@lamtec.com)

requests Disapprove

Commenter's Reason: This proposal would make removable/reusable “protective barriers” (protective jacket) mandatory on piping insulation. I am opposed to this restriction, as it does not prevent damage or destruction of properly vapor-sealed insulation that is removed, and it could lead to mis-use of the product as a vapor retarder
The closures of removable jacketing are necessarily *temporary* and therefore not vapor-resistant. For instance, it would seem quite apparent that the Velcro type closure used on some products can offer no appreciable resistance to vapor flow, even though the base jacket material may be an adequate vapor retarder. I am not aware of published permeance values for the “resealable” closures, but certainly such data should be reviewed before a removable jacket could even be considered allowable for use as a combination vapor retarder. To provide adequate vapor resistance for below-ambient piping, a properly sealed vapor retarder or properly sealed low permeance insulation must be used; removable protective “barriers” will not provide the necessary level of vapor retardance.

While a removable jacket could be taken off and replaced, the same does not hold true for the sealed insulation and/or vapor retarder underneath it. With a properly sealed below-ambient insulation system, it will not be possible to remove the insulation itself for mechanical system repairs or maintenance without damaging or destroying that insulation, as the seam and joint seals in such products are inherently permanent.

As only the removable jacket itself can be re-used -not the insulation- re-using the jacket may provide some cost savings in maintenance and repair, but this does not impact or improve the longevity an insulation that has been properly vapor-sealed.

To summarize, (1) there are widely-used protective jacket products that provide all the benefits of a removable protective barrier or jacket, save for being reusable, some functioning as low-permeance vapor retarders with their permanently sealed joints, and (2) properly sealed insulation and vapor retarder will be damaged or destroyed when removed, regardless of outer jacket type. For these reasons, it is mis-guided to limit allowable protective jacket products to the removable type.

I would suggest this section verbiage:

C403.11.3.1 Protection of piping insulation (Mandatory). Piping insulation exposed to the weather shall be covered with an outer jacket that is resistant to, and will protect~~ed~~ the insulation from, damage or degradation ~~including that~~ caused by sunlight, moisture, ~~and~~ wind, and ~~shall provide shielding from~~ solar radiation ~~that can cause degradation of the material~~. ~~Adhesive tape shall not be permitted~~. Adhesives, sealants or tapes used with the jacket shall have the same weather resistance. Removable protective jackets shall not be used to provide the vapor retarder function on below-ambient systems.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code text. I do not have data to support this impact statement, but suspect that initial cost of construction could be lower depending on type of assembly that does not use a removable jacket.

Public Comment# 1851

Public Comment 8:

Proponents:
William Ronca, representing K-Flex USA (bill.ronca@kflexusa.com)

requests Disapprove

Commenter's Reason: The proposed code change rationale is based on a number of erroneous assumptions and fails to recognize advances in insulation material and jacketing technology since the reasons stated when EC110-09/10 were published.
When discussing Freon systems, we are typically talking about AC linesets that are common in residential construction as well as some other occupancies such as hotels. Based on a review of the proponent's reason and justification for this code change, we would offer the following comments:

A fully adhered jacketing system provides performance advantages and potentially significant cost savings. In the event of a jacketing failure, a fully adhered jacket limits any moisture intrusion (rain, snow or water vapor) to a small, confined area. Damaged areas are easily detected using any of a number of non-destructive test methods, and cost to repair damage is minimized by the small area involved. A removable jacket would allow moisture migration under the jacket, and unless there was a vapor barrier between the jacket and insulation, very large areas of insulation could be damaged. In addition, since there would be an air gap between the jacket and insulation or vapor barrier, the gap would potentially be subject to algae, mold and bacteria growth as well as providing a haven for insects. Were this to occur, the removable jacket would not be reusable, and the insulation could be damaged beyond repair.

Many manufacturers and fabricator / distributors now provide pipe insulation with factory applied, fully adhered jacketing. The application of the jacketing under factory controlled conditions allows for a higher quality installation, reduced labor time on a project and reduced installation cost. These popular systems would be eliminated if this code change is approved.

Removable jacketing is not necessary "… to insure the insulations (sic) thermal conductivity energy savings integrity last the life of the mechanical system as per the intent of the code". In 2009 – 2010 installers were still applying unjacketed elastomeric or polyolefin insulation to outdoor AC unit lines and were not applying the recommended protective coatings. This process has changed since the 2012 introduction of code language requiring both protection from UV (solar radiation) and physical damage. Many insulation manufacturers responded to these changes by developing UV and damage resistant factory applied jackets that also provide the required perm rating for refrigerant lines for this application. These jackets are not removable from the insulation, but the *entire insulation system is easily removable from the lines* with only minor loss of insulation at the insulation termination points *which must be sealed to the lines to provide the required moisture barrier to prevent condensation and corrosion as required by code.* Because the insulation is protected from UV degradation (heat is *not* a significant factor in these applications since the insulation is rated to 200 or 220°F continuous operation), the insulation is also readily reusable (with the exception of maybe 2" on the ends). It should be further noted that many of these factory jackets are clear or translucent, allowing for inspection of the insulation without even having to remove and then reinstall a jacket.

The proponent's cost savings rationale cites an article written by Dr. Saum Nourhammadi, PEx3, Ph.D. CPD, CIPE, CFPE, and LEED AP on the impact and advantages of removable insulation protective covers. While we would be interested in knowing who sponsored this article, the article itself is highly flawed and based on erroneous assumptions. It does not address the basic issues as to whether a removable cover can address the code requirements for moisture protection, corrosion protection and perm rating. It does not weigh the *benefits* of adhered jackets versus the benefits of removable jackets, and the cost savings example is both obsolete due to the introduction of new products and just plain *wrong.* Fully adhered jackets can provide UV, moisture and physical damage protection as well as or better than removable jackets. So the calculations on the cost of damaged insulation become moot as there is no degraded insulation to result in increased energy costs over the life of the equipment *as long as the existing code language is enforced*. In fact, removable jackets are more likely to result in degraded insulation as they cannot provide an effective moisture, insect or mold, algae or bacteria barrier (again, think Velcro). Regardless, the math is incorrect. First, 39.5 million is pretty close to the total population of California. But that does not mean that every man, woman and child in the state of California has their own personal outdoor AC unit with 5 feet of exposed refrigerant line. There are approximately 9.6 million *households* in the state, and not all of them have individual AC units. High rise apartment dwellers certainly don't have them. Even multi-unit dwellings don't all have outdoor AC units. But let's assume that they all have an outdoor AC. Using the same half the *households* premise as used by the author, the savings would be 4.8 million households times $5 annual savings for a total savings of $24 million annually. This is a far cry from the proponent's alleged $975 million. The author is off by a factor of 40.

The proponent's cost impact statement alleges that the proposed code change will neither increase nor decrease the cost of construction. We have already demonstrated that this is not the case in Part I. It is not the case in part II either. ALL of the stated options cost money and require labor (cost) to install. And again, none meet the code requirements for condensation / corrosion control or perm rating. As a simple example, we can again use the proponent's removable jacket product. The cost to purchase enough jacket to install over a 5 ft. line at a plumbing or HVAC/R supply house is approximately $40 (actual cost will vary by line size and insulation thickness as well as purchase quantity). It is less on a per foot basis, but the scrap is not really usable. So for a $5 a year annual savings, the ROI to the homeowner would be 8 years (this does not include cost of installation). But by simply enforcing the existing code language the insulation would not fail, and the homeowner would sane that $40. And of course, if we look beyond California where the proponent is based, the annual AC usage hours could be significantly less, making the ROI even longer. And many states have lower electricity costs (Louisiana is $0.0962 per kwhr), further extending the ROI.

Based on the above, we urge you to disapprove this code change. We would also urge you to consider the following revisions for the next code cycle:

1. Clarify that adhesive tape cannot be applied *directly to the insulation*. Many jacketing systems utilize tape as an accessory to seal their seams in their systems, and these tape have a long successful history of outdoor use when used for this purpose.
2. Develop or adopt UV resistance standards. Do not leave this to the discretion of the AHJ. It makes it difficult for manufacturers to compete on a national level and it creates an uneven playing field.
3. Develop or adopt damage resistance standards for the same reason as above.
4. Develop or adopt wind resistance standards for removable jacketing.
5. Enforce the existing code language.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 2015

Public Comment 9:

Proponents:
Louis Walton, representing VP Sales & Marketing (louis@protocorporation.com)

requests Disapprove

Commenter's Reason: Reference: ICC Proposed code changes: July 23, 2019
CE150-19 Part I and CE150-19 Part II
Opponent: Louis Walton – Proto Corporation

Requested Action: Disapproval

Reason: The code changes as proposed, are flawed and if implemented will contribute to “in-field failures” to the insulation system.

Currently insulation packages are fully sealed with appropriate vapor barriers to prevent condensation within the insulation system and surrounding areas. These systems also provide exterior protection for abuse and outside use.

If this type of system is not used then the insulation package will be compromised and the following types of issues may occur:

- Icing within the system
- Potential for mold growth
- Reduced Insulating value
- System expansion possibly leading to piping failure

For any below ambient piping, including air conditioning tubing, the insulation system **must be** fully sealed.

As with any pipe maintenance, including air conditioning repairs, appropriate steps must be taken to ensure that the insulation system is returned to its original condition after the repairs are completed. In many cases the insulation and barriers may be reused. This assumes that the worker is properly trained and has the appropriate materials to repair the insulation system and provide the necessary vapor barrier.

- Self-sealing tape (double sided acrylic based)
- Butt strips or sealing tape (acrylic based)
- ASJ jacketing
- PVC or CPVC jacket or strips
- Vapor barrier mastic
- Additional insulation

A barrier, which is designed to be removed, by its very nature is not designed to provide a sealed system. If this type of system is required, by this proposed code change, the use of it will result in field failures. A removable barrier may provide protection for exposure to outdoor, impact resistance, and act as a liquid watershed, but it is not designed to provide a vapor seal. Without this vapor barrier seal the aforementioned issues may occur. This type of failure would be very costly to the end user.

As part of this proposal the justification to use a removable barrier referenced potential energy savings. This reference appears to be incorrect, since all of the air conditioning systems referenced are currently protected using an industry approved insulation system.

If the ICC wants to strengthen the wording of this section of the code perhaps they should consider requiring the individual working on an air conditioning system be trained to remove, re-install or replace the insulation package. This would minimize the potential for field failures and have a minimal cost to the end user.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1892

CE158-19

IECC®: C404.5.2.1

Proposed Change as Submitted

Proponents: Michael Cudahy, PPFA, representing PPFA Plastic Pipe and Fittings Association (mikec@cmservices.com)

2018 International Energy Conservation Code

Revise as follows:

C404.5.2.1 Water volume determination. The volume shall be the sum of the internal volumes of pipe, fittings, valves, meters and manifolds between the nearest source of heated water and the termination of the fixture supply pipe. The volume in the piping shall be determined from the "Volume" column in Table ~~C404.5.1.~~ C404.5.1 or from Table E202.1 of the International Plumbing Code. The volume contained within fixture shutoff valves, within flexible water supply connectors to a fixture fitting and within a fixture fitting shall not be included in the water volume determination. Where heated water is supplied by a recirculating system or heat-traced piping, the volume shall include the portion of the fitting on the branch pipe that supplies water to the fixture.

Reason: Table E202.1 in the IPC, "Internal Volume of Various Water Distribution Tubing" is well suited for this calculation and should be specifically included as an option in calculations for the section. The table is shown below.

TABLE E202.1 - INTERNAL VOLUME OF VARIOUS WATER DISTRIBUTION TUBING

OUNCES OF WATER PER FOOT OF TUBE									
Size Nominal, Inch	**Copper Type M**	**Copper Type L**	**Copper Type K**	**CPVC CTS SDR 11**	**CPVC SCH 40**	**CPVC SCH 80**	**PE-RT SDR 9**	**Composite ASTM F 1281**	**PEX CTS SDR 9**
$^3/_8$	1.06	0.97	0.84	N/A	1.17	—	0.64	0.63	0.64
$^1/_2$	1.69	1.55	1.45	1.25	1.89	1.46	1.18	1.31	1.18
$^3/_4$	3.43	3.22	2.90	2.67	3.38	2.74	2.35	3.39	2.35
1	5.81	5.49	5.17	4.43	5.53	4.57	3.91	5.56	3.91
$1^1/_4$	8.70	8.36	8.09	6.61	9.66	8.24	5.81	8.49	5.81
$1^1/_2$	12.18	11.83	11.45	9.22	13.20	11.38	8.09	13.88	8.09
2	21.08	20.58	20.04	15.79	21.88	19.11	13.86	21.48	13.86

For SI: 1 ounce = 0.030 liter.

Bibliography: None

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The addition of the method of calculation is not expected to increase or decrease the cost of construction, it is simply a more accurate method for determining volume.

Staff Analysis: The table referenced is in Appendix E of the IPC.

CE158-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This offers an unnecessary pointer to a code not all jurisdictions use and complicates enforcement. Hopefully the proponent will bring forward a public comment that includes bringing in the referenced table (Vote: 15-0).

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

IECC®: C404.5.2.1; IPC®: TABLE C404.5.2.1

Proponents:
Michael Cudahy, Plastic Pipe and Fittings Association, representing PPFA Plastic Pipe and Fittings Association (mikec@cmservnet.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C404.5.2.1 Water volume determination. The volume shall be the sum of the internal volumes of pipe, fittings, valves, meters and manifolds between the nearest source of heated water and the termination of the fixture supply pipe. The volume in the piping shall be determined from the "Volume" column in Table C404.5.1 or from Table C404.5.2.1. ~~E202.1 of the International Plumbing Code~~. The volume contained within fixture shutoff valves, within flexible water supply connectors to a fixture fitting and within a fixture fitting shall not be included in the water volume determination. Where heated water is supplied by a recirculating system or heat-traced piping, the volume shall include the portion of the fitting on the branch pipe that supplies water to the fixture.

2018 International Plumbing Code

TABLE C404.5.2.1
INTERNAL VOLUME OF VARIOUS WATER DISTRIBUTION TUBING

OUNCES OF WATER PER FOOT OF TUBE									
Size Nominal, Inch	**Copper Type M**	**Copper Type L**	**Copper Type K**	**CPVC CTS SDR 11**	**CPVC SCH 40**	**CPVC SCH 80**	**PE-RT SDR 9**	**Composite ASTM F 1281**	**PEX CTS SDR 9**
$^3/_8$	1.06	0.97	0.84	N/A	1.17	—	0.64	0.63	0.64
$^1/_2$	1.69	1.55	1.45	1.25	1.89	1.46	1.18	1.31	1.18
$^3/_4$	3.43	3.22	2.90	2.67	3.38	2.74	2.35	3.39	2.35
1	5.81	5.49	5.17	4.43	5.53	4.57	3.91	5.56	3.91
$1^1/_4$	8.70	8.36	8.09	6.61	9.66	8.24	5.81	8.49	5.81
$1^1/_2$	12.18	11.83	11.45	9.22	13.20	11.38	8.09	13.88	8.09
2	21.08	20.58	20.04	15.79	21.88	19.11	13.86	21.48	13.86

For SI: 1 ounce = 0.030 liter.

Commenter's Reason: As asked by the committee, I offer a public comment to add the volume table directly in this modification.

Bibliography: None

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposal only refers to a table of pipe volume and will not change the costs of construction.

Staff Analysis: The new Table C404.X is TABLE E202.1 - INTERNAL VOLUME OF VARIOUS WATER DISTRIBUTION TUBING of the IPC

Public Comment# 1529

CE159-19 Part I

IECC®: C404.6.1, C404.6.1.1

Proposed Change as Submitted

Proponents: Anthony Floyd, City of Scottsdale, representing City of Scottsdale (afloyd@scottsdaleaz.gov)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Revise as follows:

C404.6.1 Circulation systems. Heated-water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermo-syphon circulation systems shall be prohibited. Controls for circulating hot water system pumps shall start the pump based on the identification of a demand for hot water within the occupancy. The controls shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is not a demand for hot water. <u>The controls shall limit the temperature of the water entering the cold-water piping to not greater than 104ºF (40ºC).</u>

~~C404.7~~ <u>C404.6.1.1</u> Demand recirculation controls. Demand recirculation water systems shall have controls that comply with both of the following:

1. The controls shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.
2. ~~The controls shall limit the temperature of the water entering the cold-water piping to not greater than 104°F (40°C)~~.

Reason:
Part I -

This code change clarifies the requirements for heated water circulation and demand recirculation systems. Section C404.7 - 'Demand recirculation water systems' is moved and renumbered as a subsection to C404.6.1 - 'Circulation systems' because a demand recirculation is a type of 'circulation system' with specific demand-initiated control requirements.

The temperature limit for cold-water return piping, item 2 of 'Demand recirculation water systems' is relocated to the body of section C404.6.1 (circulation systems) because this provision pertains to all heated water circulation systems that use cold-water piping as a return to the water-heating equipment.

This code change clarifies the intent of this section for the energy efficient delivery of hot water by correlating the existing provisions for circulation and demand recirculation water systems. These provisions are only applicable when heated water circulation and demand recirculation systems are installed.

Part II -

This code change clarifies the requirements for heated water circulation and demand recirculation systems. Section R403.5.2 - 'Demand recirculation water systems' is moved and renumbered as a subsection to R403.5.1.1 - 'Circulation systems' because demand recirculation is a type of 'circulation system' with specific demand-initiated control requirements.

The temperature limit for cold-water return piping, item 2 of 'Demand recirculation water systems' is relocated to the body of section R403.5.1.1 (circulation systems) because this provision pertains to all heated water circulation systems that use cold-water piping as a return to the water-heating equipment.

This code change clarifies the intent of this section for the energy efficient delivery of hot water by correlating the existing provisions for circulation and demand recirculation water systems. These provisions are only applicable when heated water circulation and demand recirculation systems are installed.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change does not add any new requirements.

CE159-19 Part I

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **Disapproved**

Committee Reason: This needs to be fixed in the public comment period, including bringing back the modification (Vote 8-7).

Assembly Action: **None**

CE159-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC®: C404.6.1, C404.6.1.1

Proponents:
Anthony Floyd, City of Scottsdale, representing City of Scottsdale (afloyd@scottsdaleaz.gov); David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C404.6.1 Circulation systems. Heated-water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermo-syphon circulation systems shall be prohibited. Controls for circulating hot water system pumps shall ~~start the pump based on the identification of a demand for hot water within the occupancy. The controls shall~~ automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is not a demand for hot water. The controls shall limit the temperature of the water entering the cold-water piping to not greater than 104ºF (40ºC).

C404.6.1.1 Demand recirculation controls. Demand recirculation water systems shall have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance. ~~comply with both of the following:~~

~~1. The controls shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.~~

Commenter's Reason: This code change clarifies the requirements for heated water circulation and demand recirculation systems. Section R403.5.2 (Demand recirculation water systems) is moved and renumbered as a subsection to R403.5.1.1 (Circulation systems) because demand recirculation is a type of 'circulation system' with specific demand-initiated control requirements.

The temperature limit for cold-water return piping, item 2 of (Demand recirculation water systems) is relocated to the body of section R403.5.1.1 (circulation systems) because this provision pertains to all heated water circulation systems that use cold-water piping as a return to the water-heating equipment.

This code change clarifies the intent of this section for the energy efficient delivery of hot water by correlating the existing provisions for circulation and demand recirculation water systems. The code change is also consistent with the committee approval of CE22-19, Parts I and II for revising the definition of "Demand Recirculation Water System". These provisions are only applicable when heated water circulation and demand recirculation systems are installed.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This code change only clarifies existing provisions and does not add new requirements.

CE159-19 Part II

IECC: R403.5.1.1 (IRC N1103.5.1.1), R403.5.2 (IRC N1103.5.2)

Proposed Change as Submitted

Proponents: Anthony Floyd, City of Scottsdale, representing City of Scottsdale (afloyd@scottsdaleaz.gov)

2018 International Energy Conservation Code

Revise as follows:

R403.5.1.1 (IRC N1103.5.1.1) Circulation systems. Heated water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermosyphon circulation systems shall be prohibited. Controls for circulating hot water system pumps shall start the pump based on the identification of a demand for hot water within the occupancy. The controls shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water. The controls shall limit the temperature of the water entering the cold-water piping to not greater than 104ºF (40ºC).

~~**R403.5.2 (IRC N1103.5.2)**~~ **R403.5.1.1.1 (IRC N1103.5.1.1.1) Demand recirculation water systems.** Demand recirculation water systems shall have controls that comply with both of the following:

1. The controls shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.
2. ~~The controls shall limit the temperature of the water entering the cold water piping to not greater than 104ºF (40ºC)~~.

Reason:
Part I -

This code change clarifies the requirements for heated water circulation and demand recirculation systems. Section C404.7 - 'Demand recirculation water systems' is moved and renumbered as a subsection to C404.6.1 - 'Circulation systems' because a demand recirculation is a type of 'circulation system' with specific demand-initiated control requirements.

The temperature limit for cold-water return piping, item 2 of 'Demand recirculation water systems' is relocated to the body of section C404.6.1 (circulation systems) because this provision pertains to all heated water circulation systems that use cold-water piping as a return to the water-heating equipment.

This code change clarifies the intent of this section for the energy efficient delivery of hot water by correlating the existing provisions for circulation and demand recirculation water systems. These provisions are only applicable when heated water circulation and demand recirculation systems are installed.

Part II -

This code change clarifies the requirements for heated water circulation and demand recirculation systems. Section R403.5.2 - 'Demand recirculation water systems' is moved and renumbered as a subsection to R403.5.1.1 - 'Circulation systems' because demand recirculation is a type of 'circulation system' with specific demand-initiated control requirements.

The temperature limit for cold-water return piping, item 2 of 'Demand recirculation water systems' is relocated to the body of section R403.5.1.1 (circulation systems) because this provision pertains to all heated water circulation systems that use cold-water piping as a return to the water-heating equipment.

This code change clarifies the intent of this section for the energy efficient delivery of hot water by correlating the existing provisions for circulation and demand recirculation water systems. These provisions are only applicable when heated water circulation and demand recirculation systems are installed.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change does not add any new requirements.

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Submitted**

Committee Reason: It provides a needed split into two separate sections (Vote: 11-0).

Assembly Action: **None**

CE159-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC®: R403.5.1.1 (IRC N1103.5.1.1), R403.5.1.1.1 (IRC N1103.5.1.1.1)

Proponents:
Anthony Floyd, representing City of Scottsdale (afloyd@scottsdaleaz.gov); David Collins (sehpcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R403.5.1.1 (IRC N1103.5.1.1) Circulation systems. Heated water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermosyphon circulation systems shall be prohibited. Controls for circulating hot water system pumps shall ~~start the pump based on the identification of a demand for hot water within the occupancy. The controls shall~~ automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water. The controls shall limit the temperature of the water entering the cold-water piping to not greater than 104ºF (40ºC).

R403.5.1.1.1 (IRC N1103.5.1.1.1) Demand recirculation water systems. Demand recirculation water systems shall have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.~~comply with both of the following:~~

~~1. The controls shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.~~

~~2. .~~

Commenter's Reason: This public comment removes the redundancy of language in Section R403.5.1.1 (Circulation systems) that pertains to controls based on the identification of a demand. This demand control provision is already covered in Section R403.5.1.1.1 for Demand recirculation water systems. Secondly, the demand control provision under Section R403.5.1.1.1 is consolidated into one sentence of the charging section. Subsection item #1 is no longer needed.

This code change clarifies the intent of this section for the energy efficient delivery of hot water by correlating the existing provisions for circulation and demand recirculation water systems. The public comment is also consistent with the committee approval of CE22-19, Parts I and II for revising the definition of "Demand Recirculation Water System". These provisions are only applicable when heated water circulation and demand recirculation systems are installed.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment on only further clarifies the proposal, both of which do not change the existing provisions and thus, does not impact the costs of contraction.

Public Comment# 1393

CE160-19 Part I

IECC: Part I: C404.9.1, C404.9.3, C404.10

IECC Part II: R403.10 (N1103.10). R403.10.2 (N1103.10.2), R403.10.3(N1103.10.3), R403.12 (N1103.12)

Proposed Change as Submitted

Proponents: Jennifer Hatfield, representing Association of Pool & Spa Professionals (jen@jhatfieldandassociates.com)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

C404.9 Energy consumption of pools and permanent spas (Mandatory). The energy consumption of pools and permanent spas shall be controlled by the requirements in Sections C404.9.1 through C404.9.3.

Revise as follows:

C404.9.1 Heaters. The electric power to ~~all~~ heaters shall be controlled by ~~an~~ a readily *accessible* on-off switch that is an integral part of the heater, mounted on the exterior of the heater ~~,~~ or external to and within 3 feet (914 mm) of the heater ~~in a location with *ready access*~~. Operation of such switch shall not change the setting of the heater thermostat. Such switches shall be in addition to a circuit breaker for the power to the heater. Gas-fired heaters shall not be equipped with continuously burning ignition pilots.

C404.9.2 Time switches. Time switches or other control methods that can automatically turn off and on heaters and pump motors according to a preset schedule shall be installed for heaters and pump motors. Heaters and pump motors that have built-in time switches shall be in compliance with this section.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Pumps that operate solar- and waste-heat-recovery pool heating systems.

Revise as follows:

C404.9.3 Covers. Outdoor heated pools and outdoor permanent spas shall be provided with a vapor-retardant cover or other *approved* vapor-retardant means.

Exception: Where more than ~~75~~ 70 percent of the energy for heating, computed over an operating season ~~of not fewer than 3 calendar months~~ , is ~~from site-recovered energy such as~~ from a heat pump or ~~on-site renewable~~ solar energy ~~system~~ source, covers or other vapor-retardant means shall not be required.

C404.10 ~~Energy consumption of portable~~ Portable spas (Mandatory). The energy consumption of electric-powered portable spas shall be controlled by the requirements of APSP 14.

Reason: This proposal aligns the energy efficiency provisions of the IECC for commercial pools, spas and portable spas (hot tubs) with those found in the 2018 International Swimming Pool & Spa Code. A similar proposal has been submitted to ensure IECC residential provisions are also aligned with the ISPSC pool & spa energy efficiency provisions found within Section 303. Without this proposal a jurisdiction who adopts both the IECC and ISPSC will have conflicting code requirements addressing covers for outdoor heated pools and outdoor permanent spas.
The original intent of the exception from the vapor retardant pool or outdoor permanent spa cover requirement found in section C404.9.3 is for when the owner of the facility chooses either a solar pool heater (on site renewable energy system) or an air-source swimming pool heat pump (site-recovered energy). However, the language that is currently in this section of the IECC uses the term "site-recovered energy" and provides a swimming pool heat pump as an example, but this was done without a proper understanding by the pool & spa industry that the “site-recovered energy” term is not defined to include an air-source swimming pool heat pump. In fact, there is no swimming pool heat pump on the market that would meet the ASHRAE 90.1 definition of "site-recovered energy" - if the industry had understood that from the beginning, we clearly would not have used those words when first providing for this exception.

An air-source swimming pool heat pump transfers heat from the air to the pool (or permanent spa) and is a more efficient way to heat a pool or outdoor permanent spa (the latter of which typically uses gas) over other types of heaters that exist. The definition of “site-recovered energy” in ASHRAE 90.1-16 is “waste *energy* recovered at the *building* site that is used to offset consumption of purchased *fuel* or electrical *energy* supplies.”

This exception has been used since it was included in the code, but they are when a consumer utilizes an air-source heat pump or a solar energy source, as originally intended by the exception. Therefore, this proposal is simply eliminating a term to clarify the original intent that if a pool or permanent spa utilizes an air-source heat pump or solar pool heating system for more than 70% of the energy used in heating the pool or permanent spa, it is exempt from the vapor retardant cover requirement.

To leave the code as it currently is written means the exception will either continue to be enforced incorrectly, as we know it has been or it will become pointless if enforced correctly since no swimming pool heating product exists that would meet the definition of “site-recovered energy”. This may in turn encourage less energy efficient ways to heat a pool or spa – the reality is after the pool or spa is installed and the final inspection has occurred, there is no way to ensure a cover is being put back on after every use; therefore, encouraging use of more energy efficient heating systems by providing an exception from the vapor-retardant cover provides a greater chance of energy savings.

The proposed change also aligns the cover exception with the ISPSC by using a 70% threshold computed over an operation season – there is no minimum operating season in the ISPSC due to the fact depending on the part of the country, an operating season can be from as little as a few months to an entire year.

The remaining code proposal language is simply cleanup to reflect consistent verbiage used between the two I-codes, because the pool & spa energy efficiency language is not completely consistent when comparing the IECC to the ISPSC. Further, within the IECC the commercial and residential provisions slightly differ as well (for example site-recovered energy is not included in the IECC residential provisions). Although the remaining differences are minor and may not affect the intent, eliminating differences do lessen the chance of interpretation errors.

By adopting this code change, a jurisdiction that adopts both the ISPSC and IECC, which is increasingly more likely and already exists in many cases (over 20 states and 160 localities have adopted the ISPSC), will not be left with conflicting code requirements. Rather, they will co-exist by providing consistent requirements that follow the original intent.

Bibliography: 2018 ISPSC, Section 303; 2018 IECC, Section R403.10; and ASHRAE 90.1, 2016 edition

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change should not affect the cost of construction but for any costs associated with differing provisions found within the current ISPSC and IECC editions, if the change is not adopted. The proposal simply ensures the IECC has consistent energy efficiency requirements for residential pools and spas from what is found in the ISPSC.

CE160-19 Part I

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **Disapproved**

Committee Reason: The purpose was to align, but then there was a modification and a rollback, it is not advancing energy conservation. It's eliminating minimum time factor (Vote:10-5).

Assembly Action: **None**

CE160-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC®: C404.9.3, C404.10

Proponents:
Jennifer Hatfield, representing Association of Pool & Spa Professionals (jen@jhatfieldandassociates.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Energy Conservation Code

C404.9.3 Covers. Outdoor heated pools and outdoor permanent spas shall be provided with a vapor-retardant cover or other *approved* vapor-retardant means.

> **Exception:** Where more than 75 percent of the energy for heating, computed over an operating season of not fewer than 3 calendar months, is from ~~site-recovered energy such as from~~ a heat pump or an on-site renewable energy system, covers or other vapor-retardant means shall not be required.

C404.10 ~~Energy consumption of p~~ Portable spas (Mandatory). The energy consumption of electric-powered portable spas shall be controlled by the requirements of APSP 14.

Commenter's Reason: The original proposal and the intent of this public comment was to align the energy efficiency provisions found in the IECC with the ISPSC, so there is no conflicting code requirements or issues of interpretation when verbiage is not the same.

This public comment replaces the original proposal in order to:

1. Revert back to the current "ready access" verbiage in C404.9.1 for heaters to follow the I-code elimination of the use of readily accessible or accessible for only when addressing it in regards to persons with disabilities and not to equipment. (This will now require a fix in the ISPSC to proper align.)

2. In the exception language for pool covers, it reverts back to 75% of the energy for heating, computed over an operating season of not fewer than 3 calendar months, but it cleans up the rest of the language to follow terminology and wording in the ISPSC and IECC-R proposal. (Additional tweaks will then need to be made to the ISPSC).

This public comment is being put forth as a two step process to get the language in the IECC-R, IECC-C and ISPSC to align. If public comments for the IECC-R and this one for the IECC-C go through, the second step will be alignment in the ISPSC to the cover provisions and removal of the readily accessible verbiage.

The goal is alignment to limit confusion in the field by inspectors and contractors. This public comment also ensures the water and energy conservation provisions are maintained, with no rollback, simply consistent terminology.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposal and comment are simply trying to align the codes and should not increase or decrease the cost of construction but for any issues that could arise if the two codes are not aligned.

Public Comment# 2033

CE160-19 Part II

IECC: R403.10 (IRC N1103.10), R403.10.1 (IRC N1103.10.1), R403.10.3 (IRC N1103.10.3), R403.12 (IRC N1103.12)

<u>Proposed Change as Submitted</u>

Proponents: Jennifer Hatfield, representing Association of Pool & Spa Professionals (jen@jhatfieldandassociates.com)

2018 International Energy Conservation Code

Revise as follows:

R403.10 (IRC N1103.10) ~~Pools~~ <u>Energy consumption of pools</u> and permanent ~~spa energy consumption~~ <u>spas</u> (Mandatory). The energy consumption of pools and permanent spas shall be <u>controlled by the requirements</u> in ~~accordance with~~ Sections R403.10.1 through R403.10.3.

R403.10.1 (IRC N1103.10.1) Heaters. The electric power to heaters shall be controlled by a readily *accessible* on-off switch that is an integral part of the heater<u>,</u> mounted on the exterior of the heater ~~,~~ or external to and within 3 feet (914 mm) of the heater. Operation of such switch shall not change the setting of the heater thermostat. Such switches shall be in addition to a circuit breaker for the power to the heater. Gas-fired heaters shall not be equipped with continuously burning ignition pilots.

R403.10.2 (IRC N1103.10.2) Time switches. Time switches or other control methods that can automatically turn off and on <u>heaters and pump motors</u> according to a preset schedule shall be installed for heaters and pump motors. Heaters and pump motors that have built-in time switches shall be in compliance with this section.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Pumps that operate solar- and waste-heat-recovery pool heating systems.

R403.10.3 (IRC N1103.10.3) Covers. Outdoor heated pools and outdoor permanent spas shall be provided with a vapor-retardant cover or other *approved* vapor-retardant means.

Exception: Where more than ~~75~~ <u>70</u> percent of the energy for heating, computed over an operation season ~~of not less than three calendar months~~, is from a heat pump or ~~an on-site renewable~~ <u>solar</u> energy ~~system~~ <u>source</u>, covers or other vapor-retardant means shall not be required.

R403.11 (IRC N1103.11) Portable spas (Mandatory). The energy consumption of electric-powered portable spas shall be controlled by the requirements of APSP-14.

R403.12 (IRC N1103.12) Residential pools and permanent residential ~~spas.~~ <u>spas (Mandatory).</u> ~~Residential~~ <u>The energy consumption of residential</u> swimming pools and permanent residential spas ~~that are accessory to detached one- and two-family dwellings and townhouses three stories or less in height above grade plane and that are available only to the household and its guests~~ shall be <u>controlled</u> in accordance with <u>the requirements of</u> APSP 15.

Reason: This proposal aligns the energy efficiency provisions of the IECC for commercial pools, spas and portable spas (hot tubs) with those found in the 2018 International Swimming Pool & Spa Code. A similar proposal has been submitted to ensure IECC residential provisions are also aligned with the ISPSC pool & spa energy efficiency provisions found within Section 303. Without this proposal a jurisdiction who adopts both the IECC and ISPSC will have conflicting code requirements addressing covers for outdoor heated pools and outdoor permanent spas.
The original intent of the exception from the vapor retardant pool or outdoor permanent spa cover requirement found in section C404.9.3 is for when the owner of the facility chooses either a solar pool heater (on site renewable energy system) or an air-source swimming pool heat pump (site-recovered energy). However, the language that is currently in this section of the IECC uses the term "site-recovered energy" and provides a swimming pool heat pump as an example, but this was done without a proper understanding by the pool & spa industry that the “site-recovered energy” term is not defined to include an air-source swimming pool heat pump. In fact, there is no swimming pool heat pump on the market that would meet the ASHRAE 90.1 definition of "site-recovered energy" - if the industry had understood that from the beginning, we clearly would not have used those words when first providing for this exception.

An air-source swimming pool heat pump transfers heat from the air to the pool (or permanent spa) and is a more efficient way to heat a pool or outdoor permanent spa (the latter of which typically uses gas) over other types of heaters that exist. The definition of “site-recovered energy” in ASHRAE 90.1-16 is “waste *energy* recovered at the *building* site that is used to offset consumption of purchased *fuel* or electrical *energy* supplies.”

This exception has been used since it was included in the code, but they are when a consumer utilizes an air-source heat pump or a solar energy source, as originally intended by the exception. Therefore, this proposal is simply eliminating a term to clarify the original intent that if a pool or permanent spa utilizes an air-source heat pump or solar pool heating system for more than 70% of the energy used in heating the pool or permanent spa, it is exempt from the vapor retardant cover requirement.

To leave the code as it currently is written means the exception will either continue to be enforced incorrectly, as we know it has been or it will become pointless if enforced correctly since no swimming pool heating product exists that would meet the definition of “site-recovered energy”. This may in turn encourage less energy efficient ways to heat a pool or spa – the reality is after the pool or spa is installed and the final inspection has occurred, there is no way to ensure a cover is being put back on after every use; therefore, encouraging use of more energy efficient heating systems by providing an exception from the vapor-retardant cover provides a greater chance of energy savings.

The proposed change also aligns the cover exception with the ISPSC by using a 70% threshold computed over an operation season – there is no minimum operating season in the ISPSC due to the fact depending on the part of the country, an operating season can be from as little as a few months to an entire year.

The remaining code proposal language is simply cleanup to reflect consistent verbiage used between the two I-codes, because the pool & spa energy efficiency language is not completely consistent when comparing the IECC to the ISPSC. Further, within the IECC the commercial and residential provisions slightly differ as well (for example site-recovered energy is not included in the IECC residential provisions). Although the remaining differences are minor and may not affect the intent, eliminating differences do lessen the chance of interpretation errors.

By adopting this code change, a jurisdiction that adopts both the ISPSC and IECC, which is increasingly more likely and already exists in many cases (over 20 states and 160 localities have adopted the ISPSC), will not be left with conflicting code requirements. Rather, they will co-exist by providing consistent requirements that follow the original intent.

Bibliography: 2018 ISPSC, Section 303; 2018 IECC, Section R403.10; and ASHRAE 90.1, 2016 edition

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change should not affect the cost of construction but for any costs associated with differing provisions found within the current ISPSC and IECC editions, if the change is not adopted. The proposal simply ensures the IECC has consistent energy efficiency requirements for residential pools and spas from what is found in the ISPSC.

CE160-19 Part II

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Modified**

Committee Modification:
R403.10.3 (IRC N1103.10.3) Covers. Outdoor heated pools and outdoor permanent spas shall be provided with a vapor-retardant cover or other *approved* vapor-retardant means.

Exception: Where more than 70 percent of the energy for heating, computed over an operation season , is from a heat pump or an *on-site renewable energy* system ~~solar energy source~~, covers or other vapor-retardant means shall not be required.

Committee Reason: This brings the ISPS and the IECC into alignment. The modifications restore language to be inclusive of all renewables (Vote 11-0).

Assembly Action: **None**

CE160-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC®: R403.10.1 (IRC N1103.10.1), R403.10.3 (IRC N1103.10.3)

Proponents:
Jennifer Hatfield, representing Association of Pool & Spa Professionals (jen@jhatfieldandassociates.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

R403.10.1 (IRC N1103.10.1) Heaters. The electric power to heaters shall be controlled by an ~~readily accessible~~ on-off switch that is an integral part of the heater, mounted on the exterior of the heater or external to and within 3 feet (914 mm) of the heater in a location with ready access. Operation of such switch shall not change the setting of the heater thermostat. Such switches shall be in addition to a circuit breaker for the power to the heater. Gas-fired heaters shall not be equipped with continuously burning ignition pilots.

R403.10.3 (IRC N1103.10.3) Covers. Outdoor heated pools and outdoor permanent spas shall be provided with a vapor-retardant cover or other *approved* vapor-retardant means.

> **Exception:** Where more than ~~70~~ 75 percent of the energy for heating, computed over an operation season of not fewer than 3 calendar months, is from a heat pump or an *on-site renewable energy* system, covers or other vapor-retardant means shall not be required.

Commenter's Reason: The original proposal's intent was to align the energy efficiency provisions found in the IECC with the ISPSC, so there is no conflicting code requirements or issues of interpretation when verbiage is not the same.

This public comment builds upon the original proposal by addressing two areas of concern:

1. Addresses the "readily accessible" verbiage for consistency with what is in C404.9.1 that provides the same pool heater requirements but with the new "ready access" terminology now being used across the I-codes.

2. Addresses concerns in the cover exception to align with the C404.9.3 that provides the same for commercial pools.

If the original proposal with these additional public comment modifications are made, most of the language in the ISPSC and IECC will then align. Step 2 will be putting forth a proposal for the ISPSC that now will make changes to the "readily accessible" verbiage and pool cover provisions to align with the IECC.

It is critical these two codes align to limit confusion in the field by inspectors and contractors. This is step one to ensure that occurs.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposal and comment are simply trying to align the codes and should not increase or decrease the cost of construction but for any issues that could arise if the two codes are not aligned.

Public Comment# 2024

Public Comment 2:

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests Disapprove

Commenter's Reason: I agree that these provisions have diverged from the provisions of the ISPC. These provisions are energy driven provisions and should reside in the IECC not the ISPC. My suggestion to the proponent is to take the provisions in the ISPC and just reference the sections of IECC for these particular provisions. In cycles past there have been pool and spa provisions in the various different I-codes, but when the ISPC was created these provisions were removed and the ISPC was referenced for the requirements. The same concept should be used with these energy driven provisions. ISPC should reference the IECC for the energy driven requirements. That is the purpose of the I-codes family is each code has it's specialty. To assist with keeping all requirements correlated is by not placing duplicate provisions in various codes, but to reference the specialty code it should reside in.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1796

CE162-19

IECC®: C405.1, C405.1.1 (New), C405.1.2 (New)

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing New Buildings Institute (ericM@newbuildings.org)

2018 International Energy Conservation Code

Revise as follows:

C405.1 General (Mandatory). ~~This section covers lighting~~ Lighting system controls, the maximum lighting power for interior and exterior applications and electrical energy consumption shall comply with this section.

~~*Dwelling units* within multifamily buildings shall comply with Section R404.1. All other *dwelling units* shall comply with Section R404.1, or with Sections C405.2.4 and C405.3. *Sleeping units* shall comply with Section C405.2.4, and with Section R404.1 or C405.3. Lighting installed in walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with the lighting requirements of Section C403.10.1 or C403.10.2.~~

Add new text as follows:

C405.1.1 Lighting for dwelling units. No less than 90 percent of the permanently installed lighting serving dwelling units shall be provided by lamps with an efficacy of not less than 65 lm/W or luminaires with an efficacy of not less than 45 lm/W, or shall comply with Sections C405.2.4 and C405.3.

C405.1.2 Lighting for refrigerated applications. Lighting installed in walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with the lighting requirements of Section C403.10.1 or C403.10.2.

Reason: The current language refers lighting in dwelling units to the lighting requirements in the residential section. The referenced residential code sections include a requirement that 90% of the lighting be provided by "high efficacy lamps." There are a handful of issues with the existing code requirements:

1. The definition of "high efficacy lamps" has not been updated to reflect the changes in the market due to increased federal minimums and greater availability/affordability of LED lighting. As a result the code has actually become less stringent as the baseline for lighting equipment is raised.
2. The categories in the definition of “high efficacy lamps” in the residential code is an artifact of incandescent and early compact fluorescent lamp wattages. As lamps have gotten more efficient, the higher wattage categories have become less meaningful. Even a “100W equivalent” LED lamp and “60W equivalent” CFL lamps generally uses 15W or less, which is the bottom category in the existing definition. As a result, the categories have become largely meaningless.
3. The definition is for high efficacy lamps. However, with the proliferation of LED lighting, the market is increasingly utilizing luminaires with integrated LEDs, which are not really lamps. This prevents this high-efficiency lighting solution from being used to meet the high efficacy requirement.

This proposal solves these problems by replacing the reference to the residential lamp efficacy requirements with built-in lighting requirements. Like the existing lighting requirement, this proposal would require that 90% of the lighting be provided by higher performance lighting, but it replaces the reference to “high efficacy lamps” with a built-in efficacy requirement. This requirement establishes minimums for both lamps and luminaires so that it is relevant to the current lighting market without the wattage bins that are no longer relevant to current technologies. The efficacy levels are widely available and are low enough that products with a wide array of color temperatures and CRIs can meet the requirement, providing lighting designers and customers with flexibility.

The proposal also structures the section for greater clarity. Requirements for dwelling unit lighting and refrigerated application have been somewhat shoe-horned into C405.1, leaving the section bloated and without focus. This proposal breaks the requirements for dwelling unit lighting and refrigerated applications into standalone sub-sections for greater clarity.

When modeled against IECC-2015 using the mid-rise and high-rise prototypes developed by Pacific Northwest National Lab for code determination studies, whole-building energy savings ranged from 0.1-0.5% and whole-building electricity savings ranged from 5.3-6.5%. While the 2018 IECC is not exactly the same baseline as 2015, the lighting requirements did not change and these results give a reasonable approximation of savings. Based on U.S. DOE studies, the cost savings by replacing all of the CFLs with higher efficacy LED lighting saves approximately $6 per year per dwelling unit in overall regulated energy costs.

Cost Impact: The code change proposal will increase the cost of construction
This change could potentially increase the cost of construction because it requires higher efficacy lighting (lamps and/or fixtures), which will likely eliminate some lower-end CFL options and/or push builders to newer LED technologies. However, the cost of LEDs has been steadily declining over the last several years and is expected to continue to decline. Based on an analysis by the U.S. Department of Energy’s Building Energy Codes Program conducted during the 2018 IECC Code Development cycle, the estimated and projected prices for LEDs were $4.84 per lamp compared to

CFLs at $3.10 per lamp. However, the rapid expansion of the LED lighting market has changed the economics. A spot check of Home Depot in early 2019 showed that a warm white, 60W equivalent A-lamp is as low as $1.24 for both CFL and LED when purchased in packs. And, LEDs are actually cheaper than CFLs at some sources. At 1000bulbs.com, on online retailer, the same lamps are $1.79/bulb for CFL and $0.99 for LED. Therefore, this code change may actually reduce the cost of construction.

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
C405.1 General (Mandatory). Lighting system controls, the maximum lighting power for interior and exterior applications and electrical energy consumption shall comply with this section. *Sleeping units* shall comply with Section C405.2.4, and with Section C505.1.1 or C405.3.

C405.1.1 Lighting for dwelling units. No less than 90 percent of the permanently installed lighting , excluding kitchen appliance lighting, serving dwelling units shall be provided by lamps with an efficacy of not less than 65 lm/W or luminaires with an efficacy of not less than 45 lm/W, or shall comply with Sections C405.2.4 and C405.3.

C405.1.2 ~~**Lighting for refrigerated applications.** Lighting installed in walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with the lighting requirements of Section C403.10.1 or C403.10.2.~~

Committee Reason: The proposal enhances efficacy units for R1 and R2. The modifications correct the pointer, provide consistency with actions on CE144 and CE149 and exempts the particular light in the kitchen that the stakeholders agreed was necessary (Vote: 14-1).

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

IECC®: C405.1.1 (New)

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C405.1.1 Lighting for dwelling units. No less than 90 percent of the permanently installed lighting, excluding kitchen appliance lighting, serving dwelling units shall be provided by lamps with an initial efficacy of not less than ~~65~~ 61 lm/W or luminaires with an initial efficacy of not less than ~~45~~ 50 lm/W, or shall comply with Sections C405.2.4 and C405.3.

Commenter's Reason: These changes are based on the most recent Energy Star specifications for lamps and luminaires. By aligning with the Energy Star values, it will help with compliance and enforcement.
-For the Energy Star ratings, the minimum lamp efficiency (efficacy rating) is based on their initial light output, not their mean output.

-For lamps, to obtain the Energy Star label (Version 2.1), there are different minimum efficiencies based on the type of lamp (omnidirectional, directional, or decorative) and their Color Rendering Index (CRI) values ($\geq$ 90 CRI or < 90 CRI). The minimum required initial values range from 61 lumens/Watt to 80 lumens/Watt. Changing the value from 65 to 61 will help align with the latest Energy Star specifications.

-For luminaires, to obtain the Energy Star label (Version 2.1), there are different minimum efficiencies based on the type of fixture (e.g., cove, downlight, accent, outdoor, etc.). The minimum required initial values range from 50 lumens/Watt to 70 lumens/Watt. Changing the value from 45 to 50 will help align with the latest Energy Star specifications and increase efficiency.

Bibliography: ENERGY STAR Lamps Final Specification Version 2.1, June 20, 2017, Table 9.1, available at
https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Lamps%20V2.1%20Final%20Specification.pdf
ENERGY STAR Luminaires Final Specification Version 2.1, March 15, 2018, Table 9.2, available at
https://www.energystar.gov/sites/default/files/Luminaires%20V2.1%20Spec%20Final%20with%20Partner%20Commitments.pdf

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Lamps and luminaires that have higher efficacies are usually more expensive than standard lamps and luminaires.

Public Comment# 1291

CE181-19

IECC®: C405.2.2.2

Proposed Change as Submitted

Proponents: Marilyn Williams, representing National Electrical Manufacturers Association (mar_williams@nema.org)

2018 International Energy Conservation Code

Revise as follows:

C405.2.2.2 Light-reduction controls. Spaces required to have light-reduction controls shall have a *manual control* that allows the occupant to reduce the connected lighting load by not less than 50 percent in a reasonably uniform illumination pattern ~~by not less than 50 percent.~~ with an intermediate step in addition to full on or off, or with continuous dimming control. Lighting reduction shall be achieved by one of the following or another *approved* method:

1. Controlling all lamps or luminaires.
2. Dual switching of alternate rows of luminaires, alternate luminaires or alternate lamps.
3. Switching the middle lamp luminaires independently of the outer lamps.
4. Switching each luminaire or each lamp.

Exception: Light reduction controls are not required in *daylight zones* with *daylight responsive controls* complying with Section C405.2.3.

Reason: Revising this language will:
1. Increase energy efficiency

2. Reduce inconsistency and confusion with light-reduction control requirements

3. Increase code interpretation, application and enforcement

4. Correct an unintended loophole

The ability to reduce light level either by lighting load on/off switch control or by coninuouse dimming, provides energy savings as well as lighting adjustibility benefits for the occupant. The intent of the provision is to allow space occupants to manually reduce their lighting level by at least 50% of lighting load for personal preference, to avoid glare or simply because full lighting levels is not needed in the space. The light-reduction control requirement has a loophole which allows provision compliance without meeting the intent. Manual lighting controls which turns lighting all the way off, can be interpreted as a reduciton of the lighting load of "not less than 50 percent." The way the language is written, full shut off would comply with the provision, bu would not meet the intent of the code.

The proposed language would indicate light-reduction control is an intermediate step, in addition to lighting full on and full off control steps, typically provided by manual control requirements. This language eliminates the present loop hole allowing no light reduction control, as the code intends just the opposite. The proposed language also clarifies that continuous dimming would comply with the control requirement while providing further adjustibility benefits to the space occupants.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial change to clarify the code's intent. It will improve compliance and consistency for energy efficient control of lighting.

CE181-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: The accomplishes an intermediate step for noncontinuous lighting with reasonable coverage (Vote: 8-7).

Assembly Action: **None**

CE181-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C405.2.2.2

Proponents:
Harold Jepsen, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us); Megan Hayes, representing NEMA (megan.hayes@nema.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C405.2.2.2 Light-reduction controls. Spaces required to have light-reduction controls shall have a *manual control* that allows the occupant to reduce the connected lighting load ~~by not less than 50 percent~~ in a reasonably uniform illumination pattern ~~with an intermediate step in addition to full on or off, or with continuous dimming control. Lighting reduction shall be achieved by~~ using one of the following or another *approved* method:

1. ~~Controlling all lamps or luminaires~~ Continuous dimming of all luminaires from full output to less than 20 percent of full power.
2. ~~Dual switching of alternate rows of luminaires, alternate luminaires or alternate lamps~~ Switching all luminaires to a reduced output of not less than 30 percent, and not more than 70 percent of full power.
3. Switching alternate luminaires or alternate rows of luminaires to achieve a reduced output of not less than 30 percent, and not more than 70 percent of full power ~~the middle lamp luminaires independently of the outer lamps~~.
4. ~~Switching each luminaire or each lamp.~~

~~**Exception:** Light reduction controls are not required in *daylight zones* with *daylight responsive controls* complying with Section C405.2.3.~~

Commenter's Reason: This public comment and modification responds to the Committee Action Hearing guidance by coordinating proposals CE179-19 and CE181-19, and resolving the dated lighting control language by accomplishing the following:

- Making the code language technology neutral
- Removing archaic terminology that only applies to fluorescent lighting
- Assuring lighting uniformity when space lighting levels are reduced
- Incorporating the word “dimming”, clarifying it as an acceptable Light Reduction Control method(as currently written, unclear to some practitioners)
- Fixing a gap in the code language by clarifying that Light Reduction Control is an intermediate lighting control step between On and Off
- Maintaining light controllability for occupants in spaces with daylight responsive zones
- Creating language that is clear and enforceable by building officials without the burden of a additional requirements. In fact, it reduces the requirements and exceptions that need to be verified.

These modifications make the code understandable to read, clear to implement, up to date with technology and easy to enforce by building officials.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This code change proposal and public comment modifications modernizes the language to fit with today's lighting technology and clarifies acceptable lighting control methods used more prodominantly in today's buildings without increasing the cost of construction.

Public Comment# 1414

CE185-19

IECC®: C405.2.3.1

Proposed Change as Submitted

Proponents: Jack Bailey, One Lux Studio, representing International Association of Lighting Designers (jbailey@oneluxstudio.com); Glenn Heinmiller, Lam Partners, representing International Association of Lighting Designers (glenn@lampartners.com)

2018 International Energy Conservation Code

Revise as follows:

C405.2.3.1 Daylight-responsive control function. Where required, daylight-responsive controls shall be provided within each space for control of lights in that space and shall comply with all of the following:

1. Lights in toplit zones in accordance with Section C405.2.3.3 shall be controlled independently of lights in sidelit zones in accordance with Section C405.2.3.2.
2. Daylight responsive controls within each space shall be configured so that they can be calibrated from within that space by authorized personnel.
3. Calibration mechanisms shall be in a location with ready access.
4. ~~Where located in offices, classrooms, laboratories and library reading rooms, daylight~~ Daylight responsive controls shall dim lights continuously from full light output to 15 percent of full light output or lower.
5. Daylight responsive controls shall be configured to completely shut off all controlled lights.
6. Lights in sidelit zones in accordance with Section C405.2.3.2 facing different cardinal orientations [within 45 degrees (0.79 rad) of due north, east, south, west] shall be controlled independently of each other.

Exception: Up to 150 watts of lighting in each space is permitted to be controlled together with lighting in a daylight zone facing a different cardinal orientation.

Reason: Currently daylight responsive controls are only required to dim lights in offices, classrooms, laboratories, and library reading rooms. In all other spaces, daylight responsive controls are only required to switch lights off.
Switching lights off leaves a lot of potential energy savings "on the table", as the daylight responsive controls will only save energy when there is sufficient daylight to entirely replace the electric lights. In some installations this may never happen. By contrast, when dimming is required, there will be energy savings whenever there is any useful daylight in the space. Making this change will result in additional energy savings in literally every installation.

This change is feasible today because of the incredibly fast penetration of LED technilogy into the marketplace. LED luminaires are already almost universally dimmable, and taking advantage of this capability will usually mean running a couple of additional wires. This cost is trivial compared to the cost of installing and commissioning the control systems to begin with.

Functionally, we know that dimming is prefered by building occupants, since the change in light levels is less noticeable, so this will also qualitatively improve the lighting, and increase user acceptance of the controls.

Cost Impact: The code change proposal will increase the cost of construction
Dimming is already the preferred strategy for daylight responsive control of interior lights, and is almost universally used in new construction. With increasing penetration of LED technology in coming years, the cost increase compared to switching will be trivial. But still, there will be some additional cost.

CE185-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This is an important update and there is an alternative compliance path for lower efficacy lights. The code should lead, not follow (Vote: 10-5).

Assembly Action: **None**

CE185-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests Disapprove

Commenter's Reason: This change will prevent the use of high-efficiency lamps, such as metal halide and high-pressure sodium, from being used for all daylighting applications (such as high-bay applications), not just those in offices, classrooms, laboratories and library reading rooms as currently required.
As shown in NEMA publication, high-efficiency HID lamps (such as metal halide) can only be safely dimmed to 50-70% of their rated lamp wattage. With the requirement to dim to 15% of full light output or lower, it effectively bans the use of a high-efficiency technology that is still on the market.

A minimum energy code should not have language that prevents the use of a high-efficiency technology. This change should be disapproved, in favor of other proposals (such as CE-188) that will save energy and are more technology neutral.

Bibliography: NEMA LSD 14-2012 (R2019) *Guidelines on the Application of Dimming to High-Intensity Discharge Lamps,* June 21, 2019

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval will not change the current code.

Public Comment# 1292

CE188-19

IECC®: C405.2.3.1

<u>Proposed Change as Submitted</u>

Proponents: Jonathan McHugh, representing McHugh Energy Consultants Inc. (jon@mchughenergy.com)

2018 International Energy Conservation Code

Revise as follows:

C405.2.3.1 Daylight responsive control function. Where required, daylight-responsive *controls* shall be provided within each space for control of lights in that space and shall comply with all of the following:

1. Lights in *toplitzones* in accordance with Section C405.2.3.3 shall be controlled independently of lights in sidelit zones in accordance with Section C405.2.3.2.
2. *Daylight responsive controls* within each space shall be configured so that they can be calibrated from within that space by authorized personnel.
3. Calibration mechanisms shall be in a location with *ready access*.
4. Where located in offices, classrooms, laboratories and library reading rooms, *daylight responsive controls* shall dim lights continuously from full light output to 15 percent of full light output or lower. <u>In all other spaces,*daylight responsive controls* shall dim lights continuously from full output to 20 percent of full light output or reduce power to between 30 and 70 percent of full power by controlling all luminaires to a reduced light output or by switching alternate luminaires.</u>
5. *Daylight responsive controls* shall be configured to completely shut off all controlled lights.
6. Lights in *sidelitzones* in accordance with Section C405.2.3.2 facing different cardinal orientations [within 45 degrees (0.79 rad) of due north, east, south, west] shall be controlled independently of each other.

Exception: Up to 150 watts of lighting in each space is permitted to be controlled together with lighting in a daylight zone facing a different cardinal orientation.

Reason: Currently the IECC daylight-responsive controls requirements includes dimming for a few spaces and for all other spaces, a minimally compliant daylight-responsive control only need turn the lights off under full daylight availability. For light sources that are difficult to dim continuously (such as HID), the savings associated with daylight controls is substantially less than it could be with multi-level controls. Multi-level controls increase energy savings by approximately 50% as compared to on/off controls. This is documented in the CASE sidelighting and skylighting reports. By allowing other forms of multi-level controls besides continuous dimming, the code is being technology neutral and accommodating light sources that are hard to dim. Requiring multi-levels switching or continuous dimming for daylighting controls is aligned with most other energy codes in the United States including ASHRAE 90.1.

Bibliography:

CASE (Codes and Standards Enhancement Updates to Title 24 Treatment of Skylights. 2005 California Title 24 Building Energy Efficiency Standards. May 2002.
https://mchughenergy.com/papers/2002-05-17_SKY-LT_PROP_T24.pdf

CASE (Codes and Standards Enhancement) Draft Report Sidelighting – Daylighting Requirements for Sidelit Areas near Windows. 2008 California Title 24 Building Energy Efficiency Standards July 6, 2006 https://mchughenergy.com/papers/2006-07-07_DRAFT_SIDELIGHTING_REP.pdf

HMG/PNNL 90.1 Skylighting Requirements Code Change Proposal, Submitted to ASHRAE 90.1 Standard Envelope and Lighting Subcommittees June 2008.
https://mchughenergy.com/papers/PNNL_Daylight901_pt4.pdf

Cost Impact: The code change proposal will increase the cost of construction
As documented in the HMG/PNNL (2008) report "As a result of discussion with the ASHRAE 90.1 Lighting Subcommittee, the following variable and fixed costs were associated with dimming and switching controls systems. For switching control systems the additional circuiting costs associated with bi-level switching is $0.108/sf..." In comparison for warehouse spaces, the added life cycle savings from using multi-level controls instead of On/Off controls are around $0.25/sf (CASE 2002) and in sidelit spaces the life cycle savings are around $0.50/sf. (CASE 2006). Thus the added costs are well outweighed by the life cycle savings.

CE188-19

<u>Public Hearing Results</u>

Committee Action: **Disapproved**

Committee Reason: Based on proponent's request for disapproval and committee action on CE185 (Vote 15-0).

Assembly Action: **None**

CE188-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Jonathan McHugh, representing McHugh Energy Consultants Inc. (jon@mchughenergy.com)

requests As Submitted

Commenter's Reason: The rationale for requiring multi-level controls is the same as it was back in 2002 when the "Updates to Title 24 Treatment of Skylights" was commissioned to consider, multi-level photocontrol requirements for skylit daylight spaces. It is hard to find more recent studies comparing on/off controls with multilevel controls as the de factor standard for daylighting controls is multi-level switching or continuous dimming. Both ASHRAE 90.1 and California's Title 24 energy codes have required multi-level switching or continuous dimming daylighting controls for around a decade. With the rapid advance of LED lighting, the balance has shifted to most daylighting controls being continuous dimming. Figure 4 illustrates the fraction of power versus fraction of light curves for the various control types. Of key interest is to compare the control strategy between "ON/OFF" controls and "2 LEVEL + OFF Switching" controls.
The first two columns of life cycle energy cost savings data in Table 6 are for "ON/OFF" controls and "2 LEVEL + OFF Switching" controls. From this table, over the range of skylight to floor ratios (SFRs) from 1.9% to 3.9% the added energy and life cycle cost savings from on/off controls to two level plus off controls is between 25% and 104% for warehouses and greater than 109% for retail occupancies. It should be noted that the continuous dimming savings are greater than what is listed in Table 6, as the current continuous dimming requirements for offices, classrooms, laboratories and library reading rooms are dimming plus off, whereas the analysis results shown in Figure 6 are continuous dimming to 10% light output without an OFF step.

The fixed rate economic analysis was present valued $1.37/kWh over a 15 year period at a 3% real discount rate. This is the same as 11.5 cents per kWh on an annualized basis. In general the life cycle cost savings was in excess of $0.30/sf in warehouses and in excess of $1.00/sf in retail spaces. With lower LPDs the savings would be approximately half of this amount on a per square foot basis. However many of the light sources used to justify lower LPDs are LED and often have dimming with little to none cost premium.

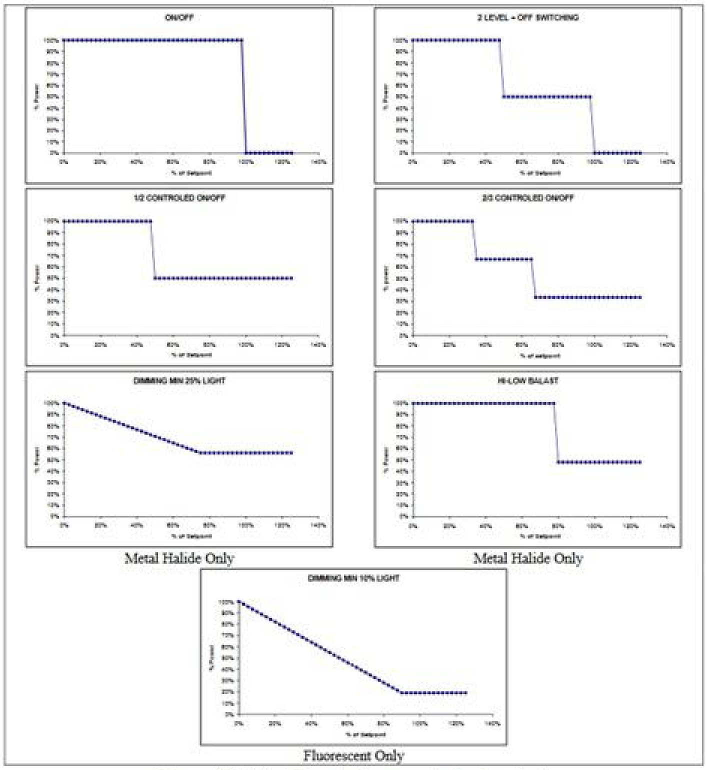


Figure 4: Lighting Power in Response to Photocontrols

However of equal or greater importance is that multi-level plus off switching is less disruptive that on/off switching as the light level changes are smaller. Continuous dimming is even less intrusive with imperceptible light levels changes.

Except for offices, classrooms, laboratories and library reading rooms (which require continuous dimming plus off), the current IECC daylighting controls requirements in Section C405.2.3.1 only require on/off controls. This proposal recommends that the daylighting controls be at least multi-level.

Table 6: Fixed Rate LCC Cost Savings per Square Foot of Daylit Area from Photocontrols

		Warehouse LPD = 0.7										
Climate zone 3		Fluorescent setpoint = 20 fc					Metal Halide setpoint = 13 fc					
SFR	Effective Aperture	On/Off	Two level + off switching	1/2 controlled on/off	2/3 controlled on/off	Dimming min 10% light	On/Off	Two level + off switching	1/2 controlled on/off	2/3 controlled on/off	Dimming min 25% light	hi/lo ballast
1.9%	0.6%	$0.77	$1.25	$0.87	$1.08	$1.45	$1.31	$1.63	$0.97	$1.32	$0.99	$0.79
2.6%	0.8%	$1.23	$1.63	$1.01	$1.31	$1.68	$1.69	$1.96	$1.12	$1.48	$1.08	$0.97
3.2%	1.0%	$1.53	$1.88	$1.11	$1.42	$1.82	$1.91	$2.13	$1.18	$1.58	$1.13	$1.07
3.9%	1.2%	$1.74	$2.04	$1.17	$1.52	$1.92	$2.09	$2.28	$1.23	$1.65	$1.17	$1.15
4.5%	1.4%	$1.90	$2.17	$1.22	$1.59	$2.00	$2.22	$2.39	$1.28	$1.72	$1.20	$1.21
5.2%	1.6%	$2.02	$2.26	$1.25	$1.65	$2.06	$2.31	$2.47	$1.32	$1.75	$1.22	$1.25
5.8%	1.8%	$2.13	$2.35	$1.28	$1.69	$2.11	$2.38	$2.54	$1.35	$1.79	$1.24	$1.28
6.4%	2.0%	$2.22	$2.43	$1.32	$1.73	$2.15	$2.44	$2.59	$1.37	$1.83	$1.26	$1.31
7.1%	2.2%	$2.29	$2.53	$1.36	$1.76	$2.19	$2.50	$2.64	$1.39	$1.85	$1.27	$1.34
7.7%	2.4%	$2.34	$2.53	$1.36	$1.78	$2.21	$2.54	$2.68	$1.40	$1.87	$1.28	$1.37
		Retail LPD = 1.6										
Climate zone 3		Fluorescent setpoint = 65 fc					Metal Halide setpoint = 40 fc					
SFR	Effective Aperture	On/Off	Two level + off switching	1/2 controlled on/off	2/3 controlled on/off	Dimming min 10% light	On/Off	Two level + off switching	1/2 controlled on/off	2/3 controlled on/off	Dimming min 25% light	hi/lo ballast
1.9%	0.6%	$0.00	$0.48	$0.48	$0.88	$1.70	$0.17	$1.56	$1.48	$1.95	$1.70	$0.64
2.6%	0.8%	$0.00	$1.08	$1.08	$1.61	$2.33	$1.54	$2.74	$1.97	$2.53	$2.03	$1.24
3.2%	1.0%	$0.23	$1.57	$1.45	$2.09	$2.86	$2.35	$3.41	$2.24	$2.94	$2.23	$1.60
3.9%	1.2%	$1.10	$2.30	$1.75	$2.42	$3.26	$2.96	$3.91	$2.43	$3.22	$2.37	$1.93
4.5%	1.4%	$1.74	$2.88	$2.01	$2.71	$3.58	$3.50	$4.35	$2.60	$3.43	$2.49	$2.17
5.2%	1.6%	$2.22	$3.29	$2.18	$2.98	$3.82	$3.91	$4.69	$2.73	$3.56	$2.57	$2.33
5.8%	1.8%	$2.67	$3.63	$2.29	$3.17	$4.03	$4.25	$4.94	$2.82	$3.70	$2.64	$2.45
6.4%	2.0%	$3.01	$3.92	$2.42	$3.30	$4.20	$4.48	$5.13	$2.89	$3.81	$2.70	$2.58
7.1%	2.2%	$3.32	$4.17	$2.51	$3.43	$4.35	$4.67	$5.29	$2.95	$3.92	$2.75	$2.68
7.7%	2.4%	$3.66	$4.44	$2.60	$3.51	$4.46	$4.87	$5.44	$3.00	$4.00	$2.79	$2.79

Bibliography: CASE (2002) Codes and Standards Enhancement. Updates to Title 24 Treatment of Skylights.
https://mchughenergy.com/papers/2002-05-17_SKY-LT_PROP_T24.pdf

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
If dimmable lighting is used such is the case with most LED luminaires, the cost impact is zero. Given the expansion of LED lighting, this is the most common outcome. If the light source is not dimmable the incremental cost between a one channel and two channel switching controller is around $0.10/sf whereas the life cycle incremental savings are several times that amount. Thus multilevel controls reduce the life cycle cost of the system.

Public Comment 2:

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted for the following reasons:
-It allows more technical options for daylight responsive controls.

-It is more technically neutral than CE-185, as the requirements in this proposal will allow the use of high-efficiency technologies such as HID lamps (metal halide, etc.) in high-bay and other commercial applications. A minimum code should be technology neutral where possible.

-It provides more choices for building designers and owners.

-It will save energy compared to the current code.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This will increase the requirements for more controls.

Public Comment# 1297

CE198-19

IECC®: C405.2.6.3

Proposed Change as Submitted

Proponents: Connor Barbaree, representing ASHRAE (cbarbaree@ashrae.org)

2018 International Energy Conservation Code

Revise as follows:

C405.2.6.3 Lighting setback. Lighting that is not controlled in accordance with Section C405.2.6.2 shall ~~be~~ comply with the following:

1. Be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent by selectively switching off or dimming luminaires at one of the following times:
   ~~1.~~ 1.1. From not later than midnight to not earlier than 6 a.m.

   ~~2.~~ 1.2. From not later than one hour after business closing to not earlier than one hour before business opening.

   ~~3.~~ 1.3. During any time where activity has not been detected for 15 minutes or more.

2. Luminaires serving outdoor parking areas and having a rated input wattage of greater than 78 W and a mounting height of 24 feet or less above the ground shall be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent during any time where activity has not been detected for 15 minutes or more. No more than 1500 W of lighting power shall be controlled together.

Reason: Parking lot lighting offers more controllability and energy efficiency through the prolific use of solid state light sources. In prior versions of the IECC, the lighting setback control to reduce lighting wattage was limited to just 30% due to legacy lighting source limitations. Solid state lighting sources now allow a greater control range and dimmability of exterior luminaires than in the past. Changing the wattage reduction from 30 to 50% maintains sufficient exterior illumination after business operating hours when occupancy is reduced, yet is able to save an additional 20% in lighting wattage over the prior IECC versions. A 50% lighting setback wattage reduction has been part of other energy codes for a number of years. This change allows the IECC to remain consistent with the practice and efficiency of other codes.
Providing lighting when it is needed, through activity detection, has been long proven as one of the most efficient and effective ways to control lighting. In outdoor environments, as parking lots, detection technology is widely available. Many outdoor luminaires come with options to include detection technology directly integrated in the luminaire. These controls add some cost to the parking lot luminaires, but offer good payback. The amount of occupancy in parking lots ranges by exterior use type. Office building exteriors show 29% occupancy (using the proposed 15 minute time delay) during normally scheduled occupancy of 6pm to midnight. This allows lighting that might normally be at 100% to be reduced to 50% for 71% of the time, when controlled by activity detection. By comparison, an outdoor shopping center experiences a 79% occupancy. Even with this broad range of exterior occupancy rates, there still remains consider opportunity to reduce the lighting level with minimal impact to use.

Bibliography: Nonresidential Outdoor Lighting Controls, Codes and Standards Enhancement Initiative, Measure Number: 2019-NR-LIGHT3F, September 2017
Use of Occupancy Sensors in LED Parking Lot and Garage Applications: Early Experiences, Gateway Demonstrations, U.S. Department of Energy, Prepared by: Pacific Northwest National Laboratories, October 2012

Outdoor Lighting and Controls, Codes and Standards Enhancement Initiative, California Utilities Statewide Codes and Standards Team, October 2011

Cost Impact: The code change proposal will increase the cost of construction
This proposal increases the cost of construction due to the lighting controls needed for this requirement. This proposed change increases energy efficiency by an additional 20% during after hour periods and when there is no occupancy in the occupancy sensor-controlled area and provides payback for the increased cost of construction.

CE198-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: Provides substantial energy savings for outdoor lighting and handles safety issues. This can be a safety aid, as lighting levels increase due to activity and draw attention to areas of activity where it's not planned. The requirement are not to abridge safety, lighting designers are responsible to design accordingly (Vote: 8-7).

Assembly Action: **None**

CE198-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C405.2.6.3

Proponents:
Charles Foster, representing EEI (cfoster20187@yahoo.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C405.2.6.3 Lighting setback. Lighting that is not controlled in accordance with Section C405.2.6.2 shall comply with the following:

1. Be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent by selectively switching off or dimming luminaires at one of the following times:
   1.1 From not later than midnight to not earlier than 6 a.m.

   1.2 From not later than one hour after business closing to not earlier than one hour before business opening.

   1.3. During any time where activity has not been detected for 15 minutes or more.

2. Luminaires serving outdoor parking areas and having a rated input wattage of greater than 78 W and a mounting height of 24 feet or less above the ground shall be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent during any time where activity has not been detected for 15 minutes or more. No more than 1500 W of lighting power shall be controlled together.

   Exception: During rain, snow, or fog weather lighting shall operate at 100% output.

Commenter's Reason: The intent of this proposal is to provide an exception for inclement weather to allow 100% lighting output.
As currently written, during inclement weather, such as heavy rain, fog, or snow, when the visibility of the sensor is limited, the lights will stay dimmed below 50%, creating a higher safety and security risk.

While this may increase energy usage, it will also increase safety and security. In addition, other proposals that have been approved will increase the efficiency of all outdoor lighting systems, which will more than compensate for the minimal increase in energy usage with this exception.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment is perceived that existing controls have the capability of performing as allowed under this proposal, therefore no additional cost would be incurred.

Public Comment# 1583

Public Comment 2:

Proponents:
Barry Greive, Target Corp, representing Target Corp (barry.greive@target.com)

requests Disapprove

Commenter's Reason: There are security concerns with reducing the lighting limits to 50% as well as having them on sensors.
At times when there are no shoppers in a shopping center, there are still lighting needs. Many stores will have cleaning crews visiting the location,

and also employees that will utilize the parking areas, full light is needed for security. If the lights are not 100% functional there could be security issues with not enough light. There are many instances of electronics not functioning in the cold winter weather. This could render the sensors inoperable, and who knows how they will react and the fact that they will probably not react properly when needed. Snow in the winter will also create these to be overridden, and not function as designed. There are also other items that can trip the sensors such as birds and large bugs.

There is also a concern of zoning codes and the lights flickering on and off causing issues for neighboring properties causing nuisance complaints.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1567

Public Comment 3:

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests Disapprove

Commenter's Reason: This should be disapproved for the following reasons:
-It would require parking lot lights to be dimmed while a business is still open.

-It does not have any exceptions for inclement weather (snow, heavy rain, fog), so lights would be dimmed when they are needed at full brightness for safety and security reasons. In those conditions, there is a higher likelihood that they will not sense people, due to limited visibility.

-Sensors can be affected by condensation and/or dirt on the lens, which also reduces visibility (the sensor will have a harder time sensing people and movement).

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval will not change the current code.

Public Comment# 1309

CE199-19

IECC: C405.2.7 (New)

Proposed Change as Submitted

Proponents: Marilyn Williams, representing National Electrical Manufacturers Association (mar_williams@nema.org)

2018 International Energy Conservation Code

Add new text as follows:

C405.2.7 Parking Garage Lighting Control. Lighting for parking garage shall comply with the following:

1. Parking garage lighting shall have automatic time-switch shutoff in accordance with Section C405.2.2.1.
2. Lighting power of each luminaire shall be automatically reduced by not less than 30% when there is no activity detected within a lighting zone for 20 minutes. Lighting zones for this requirement shall be no larger than 3600 ft^2 .
3. Where lighting for eye adaptation is provided at covered vehicle entrances and exits from buildings and parking structures,such lighting shall be separately controlled by a device that automatically reduces lighting power by at least 50% from sunset to sunrise.
4. The power to luminaires within 30 ft of perimeter wall openings or fenestration shall automatically reduce in response to daylight by at least 50%.

Exceptions:

1.Where the opening or fenestration-to-wall-ratio is less than 40% as viewed from the interior and encompassing the vertical distance from the driving surface to the lowest structural element.

2.Where the distance from the opening or fenestration to any exterior daylight blocking obstruction is less than one-half the height from the bottom of the opening or fenestration to the top of the obstruction.

3.Where openings are obstructed by permanent screens or architectural elements restricting daylight entering the interior space.

Reason: Adding this language will:

1. Reduce inconsistency and confusion with the application of lighting controls in parking garages.

2. Align code language and implementation with other energy efficiency codes.

3. Reduce energy use.

4. Resolve compliance in application and inspection.

Currently there is confusion on how to apply the requirements of the 2018 IECC to parking garage applications. Is it to be treated as a interior space, and if so, how are the control requirements applied that has different use needs that building interior spaces? The Daylight Responsive Controls of section C405.2.3 do not provide proper guidance for how to control lighting in a parking garage setting. This proposal provides proper daylight responsive control and exceptions that meet the design needs and operation of parking garages.

There is some relative increase in cost due to adding occupancy sensing control to reduce the lighting level when there is no activity in controlled lighting zones.

Adding a parking garage specific control section, there is improved clarity in parking garage application, increased energy efficiency in lighting operation and better compliance through requirements that meetg the application needs of parking garages.

Cost Impact: The code change proposal will increase the cost of construction
The code change proposal will increase the cost of construction. Proposed language is mostly a clarification and editorial in nature. There is a small increase in construction cost with the added controls for partial automatic off that provide a payback during the long operating hours of a parking garage structure.

CE199-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:

C405.2.7 Parking Garage Lighting Control. Lighting for parking garage s shall comply with the following:

1. Parking garage lighting shall have automatic time-switch shutoff in accordance with Section C405.2.2.1.

2. Lighting power of each luminaire shall be automatically reduced by not less than 30% when there is no activity detected within a lighting zone for 20 minutes. Lighting zones for this requirement shall be no larger than 3600 ft^2.

3. Where lighting for eye adaptation is provided at covered vehicle entrances and exits from buildings and parking structures, such lighting shall be separately controlled by a device that automatically reduces lighting power by at least 50% from sunset to sunrise.

4. The power to luminaires within ~~3~~ 20 ft of perimeter wall openings or fenestration shall automatically reduce in response to daylight by at least 50%.

Exceptions:

Where the opening or fenestration-to-wall-ratio is less than 40% as viewed from the interior and encompassing the vertical distance from the driving surface to the lowest structural element.
Where the distance from the opening or fenestration to any exterior daylight blocking obstruction is less than one-half the height from the bottom of the opening or fenestration to the top of the obstruction.
Where openings are obstructed by permanent screens or architectural elements restricting daylight entering the interior space.

Committee Reason: This improves the code. You can not violate the safety aspects of the code. The modification corrects a dimension to align with original intent of the proposal (Vote: 8-7).

Assembly Action: **None**

CE199-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C405.2.7 (New)

Proponents:
Jack Bailey, representing International Association of Lighting Designers (jbailey@oneluxstudio.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C405.2.7 Parking Garage Lighting Control. Lighting for parking garages shall comply with the following:

1. Parking garage lighting shall have automatic time-switch shutoff in accordance with Section C405.2.2.1.
2. Lighting power of each luminaire shall be automatically reduced by not less than 30% when there is no activity detected within a lighting zone for 20 minutes. Lighting zones for this requirement shall be no larger than 3600 ft^2.

   Exception: Lighting zones provided with less than 1.5 foot-candles of illumination on the floor at the darkest point with all lights on are not required to have automatic light reduction controls.
3. Where lighting for eye adaptation is provided at covered vehicle entrances and exits from buildings and parking structures,such lighting shall be separately controlled by a device that automatically reduces lighting power by at least 50% from sunset to sunrise.
4. The power to luminaires within 20 ft of perimeter wall openings or fenestration shall automatically reduce in response to daylight by at least 50%.

Exceptions:

1. Where the opening or fenestration-to-wall-ratio is less than 40% as viewed from the interior and encompassing the vertical distance from the driving surface to the lowest structural element.

2. Where the distance from the opening or fenestration to any exterior daylight blocking obstruction is less than one-half the height from the bottom of the opening or fenestration to the top of the obstruction.
3. Where openings are obstructed by permanent screens or architectural elements restricting daylight entering the interior space.

Commenter's Reason: Safety.

Wherever I am in a parking garage, and regardless of how I got there, the IBC requires that a minimum of 1 foot-candle be provided on the floor in a continuous pathway connecting me to two exits. It is not permissible to have occupant sensors reduce light levels below this 1 foot-candle minimum in these pathways. There are two valid reasons for this:

1. I need to see my way to the exit, and know before I proceed that the path I take will be free of hazards.

2. Occupant sensors are not tested in smoke, and there is good reason to believe that they will not work in smoke, meaning that lights controlled by occupant sensors would turn on in a fire, could even turn off while the control zone is occupied.

Because of this, we must make sure that the minimum 1 foot-candle is maintained at all times the parking garage is occupied, and that this minimum light level is not compromised by occupant sensor controls. This is essential.

It is also important to remember that most parking garages are designed to 1 foot-candle minimum with all lights on full. In other words, this exception is not needed for the rare parking garage that is underlighted - it is needed for the majority of parking garages.

Finally, we should keep in mind that it is more efficient to design the lighting a parking garage to a minimum of 1 foot-candle than to design it to a higher light level with occupant sensor controls. In this way, the proposed exception actually improves energy efficiency by encouraging designers to design to lower light levels.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The public comment will reduce the cost of construction by limiting the requirement that occupant sensor controls be provided. The code change proposal itself increases the cost of construction with or without the public comment.

Public Comment# 1770

Public Comment 2:

IECC®: C405.2.7 (New)

Proponents:
Jack Bailey, representing International Association of Lighting Designers (jbailey@oneluxstudio.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C405.2.7 Parking Garage Lighting Control. ~~Lighting for parking garages shall comply with the following:~~ Parking garage lighting shall be controlled by an *occupant sensor* complying with Section C405.2.1.1 or a *time-switch control* complying with Section C405.2.2.1. Additional lighting controls shall be provided as follows:

1. ~~Parking garage lighting shall have automatic time-switch shutoff in accordance with Section C405.2.2.1.~~
2. Lighting power of each luminaire shall be automatically reduced by not less than 30% when there is no activity detected within a lighting zone for 20 minutes. Lighting zones for this requirement shall be no larger than 3600 ft^2.
3. Where lighting for eye adaptation is provided at covered vehicle entrances and exits from buildings and parking structures,such lighting shall be separately controlled by a device that automatically reduces lighting power by at least 50% from sunset to sunrise.
4. The power to luminaires within 20 ft of perimeter wall openings or fenestration shall automatically reduce in response to daylight by at least 50%.

Exceptions:

1. Where the opening or fenestration-to-wall-ratio is less than 40% as viewed from the interior and encompassing the vertical distance from the driving surface to the lowest structural element.
2. Where the distance from the opening or fenestration to any exterior daylight blocking obstruction is less than one-half the height from the bottom of the opening or fenestration to the top of the obstruction.
3. Where openings are obstructed by permanent screens or architectural elements restricting daylight entering the interior space.

Commenter's Reason: Parking garages are not exempt from the timeswitch and occupant sensor control requirements currently in the code. However, this is also true of Section C405.2.4.1 (Specific application controls), and we have repeated this requirement in C405.2.4.1 so it probably makes sense to do the same here for consistency.
Nevertheless, it is important that we re-phrase this because as currently written, the proposal would require that both occupant sensors and time-switch controls be provided in all parking garages, and there is no need for this in smaller parking garages less than 3,600 square feet.

Moving this language to C405.2.7 also eliminates the awkward wording in the current proposal ("Lighting for parking garages shall comply with the following." when the following requirements pertain only to lighting controls, not lighting).

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The code change proposal will increase the cost of construction by requiring more extensive use of lighting controls in parking garages.

This code change proposal will reduce the additional cost slightly by eliminating redundant controls requirements for smaller parking garages less than 3,600 square feet.

Public Comment# 1771

Public Comment 3:

IECC®: C405.2.7 (New)

Proponents:
Jack Bailey, representing International Association of Lighting Designers (jbailey@oneluxstudio.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C405.2.7 Parking Garage Lighting Control. Lighting for parking garages shall comply with the following:

1. Parking garage lighting shall have automatic time-switch shutoff in accordance with Section C405.2.2.1.
2. Lighting power of each luminaire shall be automatically reduced by not less than 30% when there is no activity detected within a lighting zone for 20 minutes. Lighting zones for this requirement shall be no larger than 3600 ft^2.
3. Where lighting for eye adaptation is provided at covered vehicle entrances and exits from buildings and parking structures,such lighting shall be separately controlled by a device that automatically reduces lighting power by at least 50% from sunset to sunrise.
4. The power to luminaires within 20 ft of perimeter wall openings ~~or fenestration~~ shall automatically reduce in response to daylight by at least 50%.

Exceptions:

1. Where the opening ~~or fenestration~~ to-wall-ratio is less than 40% as viewed from the interior and encompassing the vertical distance from the driving surface to the lowest structural element.
2. Where the distance from the opening ~~or fenestration~~ to any exterior daylight blocking obstruction is less than one-half the height from the bottom of the opening ~~or fenestration~~ to the top of the obstruction.
3. Where openings are obstructed by permanent screens or architectural elements restricting daylight entering the interior space.

Commenter's Reason: The daylight responsive controls requirements in the code are already applicable to parking garages. However, daylight responsive controls are only required adjacent to <u>fenestration</u>, which is rarely provided in parking garages.
So first of all it is unnecessary to add the word <u>fenestration</u> here, because when a parking garage has fenestration it is already required to have daylight responsive controls adjacent to the fenestration. And second, by adding the work <u>fenestration</u> here, we create a conflicting set of

requirements in parking garages with fenestration, where Section C405.2.3 has one set of requirements, and this section would have a different set of requirements.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The code change proposal would increase the cost of construction by requiring the installation of additional lighting controls within parking garages.

This public comment would not alter construction costs in any meaningful way.

Public Comment# 1772

Public Comment 4:

IECC®: C405.2.7 (New)

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C405.2.7 Parking Garage Lighting Control. Lighting for parking garages shall comply with the following:

1. Parking garage exterior lighting shall have automatic time-switch control ~~shutoff~~ in accordance with Section ~~C405.2.2.1~~ C405.2.6.4
2. Lighting power of each luminaire shall be automatically reduced by not less than 30 percent when there is no activity detected within a lighting zone for 60 ~~20~~ minutes. Lighting zones for this requirement shall be no larger than 3600 square feet.

   ~~Where lighting for eye adaptation is provided at covered vehicle entrances and exits from buildings and parking structures,such lighting shall be separately controlled by a device that automatically reduces lighting power by at least 50% from sunset to sunrise.~~
3. The power to luminaires within 20 feet of perimeter wall openings or fenestration shall automatically reduce in response to daylight by at least 50 percent.

Exceptions:

1. Where the opening or fenestration-to-wall-ratio is less than 40 percent as viewed from the interior and encompassing the vertical distance from the driving surface to the lowest structural element.
2. Where the distance from the opening or fenestration to any exterior daylight blocking obstruction is less than one-half the height from the bottom of the opening or fenestration to the top of the obstruction.
3. Where openings are obstructed by permanent screens or architectural elements restricting daylight entering the interior space.

Commenter's Reason: While I do not agree with the energy code infringing on components I would consider life safety and egress, and no amount of energy saved is worth the decrease of my safety or anyone else's safety. The proposal as it stands needs to be addressed and corrected if it does actually make it through for voter consideration.
#1 addresses that this is for the exterior lighting of parking garages. I do not believe that the interior lighting of an enclosed parking garage would be on a timer to be shut off. The referenced section was changed to the time switch controls for exterior lighting. The correct wording was provided for the title of the section referenced. The testimony provided for this proposal spoke about the light form the exterior of the parking garage filtering into the surrounding buildings, so it makes sense to reference the exterior lighting control section.

#2 changes the time from 20 minutes to 60 minutes. Again this is a safety issue for everyone. The time frame of 20 minutes is not long enough time to address any issues that can arise. Remember this is a parking garage where vehicles break down, don't start, have a flat tire, locking your keys in the car, or a plethora of other issues. You are at the mercy of assistance from someone else to assist you. More than likely you will wait in your car, if that is a possibility. After 20 minutes the occupancy sensor would kick in. 20 minutes is not long enough time for a tow truck, or car service or friend/family member to pick you up. This is not an office or a room where the light reducing really has no consciences.

#3 is deleted because this requirement contradicts the exception found in C405.2.6. The original proposal did not delete this exception from the mentioned section, and we do not knowing create contradictions within the code.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

will cost more

Public Comment# 1868

Public Comment 5:

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests Disapprove

Commenter's Reason: I do not agree with the energy code infringing on components I would consider safety, public health and general welfare of the public. No amount of energy saved is worth the decrease of my safety or anyone else's safety.
The testimony provided on this proposal spoke about exterior lighting infiltrating the buildings near the parking garages. I believe addressing the amount of exterior lighting should be addressed and not create an unsafe situation. There are many issues with this proposal as it is currently written.

Requirement #1 states for parking garages requires the lighting to be on automatic shutoff and then references the time-switch control section. An enclosed garage where daylighting is not penetrating should not be on a timer to shut off. This contradicts the requirement of a minimum 1 footcandle at the walking surface for the means of egress found in Section 1008.2 of the IBC.

Requirement #2 -The time frame of 20 minutes is not long enough time to address any issues that can arise in a parking garage where vehicles break down, don't start, have a flat tire, locking your keys in the car, or a plethora of other issues. You are at the mercy of assistance from someone else to assist you. More than likely you will wait in your car, if that is a possibility. After 20 minutes the occupancy sensor would kick in. 20 minutes is not long enough time for a tow truck, or car service or friend/family member to pick you up. This is not an office or a room where reducing the lighting has no consciences.

If you add the two requirements listed as 1 and 2 the lighting of a parking garage would contain both time-switch control and an occupancy sensor. In Sections C405.2.2 it states if the area is not provided with an occupancy sensor it has a time-switch, but no where does it require both controls for interior lighting within the code currently. Why would a condition, that in my opinion fall under the exception of Section C405.2 and Section C405.2.1.1 of the IECC require more lighting controls than a room used as an office.

The requirement #3 contradicts the exception found in C405.2.6. We do not knowingly create conflicts within the code, and this does.

Let's discuss what the potential consciences are of this proposal. The reality is this is a very unsafe situation. I do not want to be stuck in a parking garage that has a potential of myself being raped, robbed, or other possibilities, and I know that I am not alone in this. This proposal diminishes my safety and security. This is not just a female issue, but it is a reality we have to face on a daily basis. Would you want your 18 year old daughter whose beater car breaks down and is stuck in a parking garage where these conditions exist? No respectable parent would want to place their child knowingly in a dangerous situation. I have personally had incidents in parking garages, and I can't imagine how it may have ended if they were required to comply with this proposal. I know other women who have had similar and worse situations than my own. I have spoken against occupancy sensors in stairwells and parking garages for cycles as they keep coming up because I know the unsafe situations they can be, and why would you want to decrease the safety of key elements as such. I will end my reason statement as I started this reason statement. No amount of energy saved is worth the decrease of my safety or anyone else's safety.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1914

CE209-19

IECC: C405.4 (New), ASABE Chapter 6

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing New Buildings Institute (ericM@newbuildings.org)

2018 International Energy Conservation Code

Add new text as follows:

C405.4 Lighting for plant growth and maintenance. Not less than 95 percent of the permanently installed luminaires used for plant growth and maintenance shall have a photon efficiency of not less than 1.6 μmol/J rated in accordance with ANSI/ASABE S640.

ASABE

Add new standard(s) as follows:

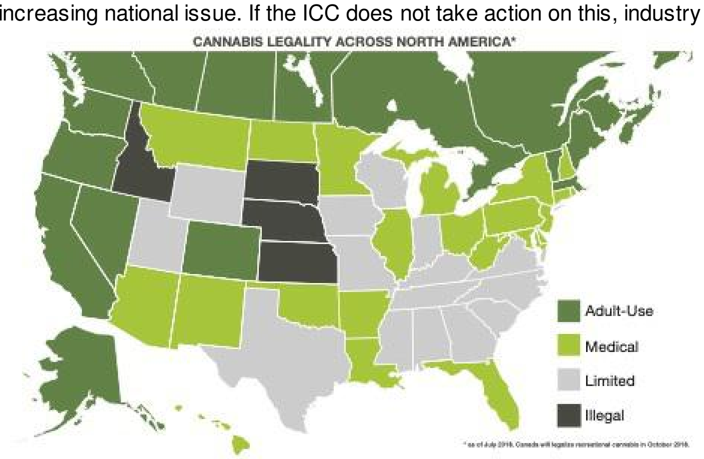
ASABE

ASABE
2950 Niles Road
St. Joseph MI 49085
US

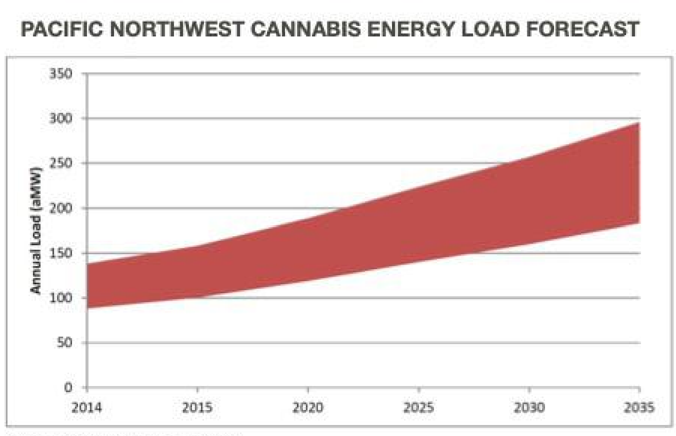
ASABE
2950 Niles Road
St. Joseph MI 49085
US

S640-2017: Quantities and Units of Electromagnetic Radiation for Plants (Photosynthetic Organisms)

Reason: Indoor agriculture energy usage is projected to grow substantially over the next several years, driven in large part (but not entirely) by the legalization of medical and recreational marijuana. As more and more states legalize medical and recreational marajuana, this will become an increasing national issue. If the ICC does not take action on this, industry is likely to see a patchwork of different and even conflicting local solutions.



The Northwest Power and Conservation Council projects that indoor marijuana growing operations alone will add as much as 300 average megawatts by 2030. That is equivalent to 1.5% of total regional electricity demand. Indoor agriculture operations not related to marijuana are expanding too. Indoor horticulture facilities can have EUIs that exceed even data centers.



ENERGY INTENSITY COMPARISONS

	Typical Site EUI* kBtu/sf	kWh/sf (of flowering canopy)	grams/kWh (of final product in flower form)
Outdoor (Sungrown)**	n/a	0	16
Greenhouse (Light Deprivation)**	84	33	8
Indoor (Efficient)**	~600	234	1+
Indoor (Inefficient)**	~1300	500+	1-
Office Building***	67	n/a	n/a
Hospital***	197	n/a	n/a
Data Center***	~600	n/a	n/a

*Assumes 75% of grow facility floor space is used for flowering canopy
**Data source: Self-Reported producer data from the Resource Innovation Institute Cannabis PowerScore
***Data source: US Energy Star Portfolio Manager

The price of LEDs has fallen dramatically in the past few years and local food movements in cities are driving increased demand for fresh high-quality produce that is grown close to the point of consumption. More restaurants are interested in sourcing ingredients directly from the producer, and in dense urban areas a growing number of new indoor agriculture operations have begun to meet this demand. This potent combination of policy, technology, and market factors is driving a dramatic expansion in indoor agriculture. As written, the 2018 IECC leaves lighting in this growing energy load completely exempt from efficiency requirements.

This proposal removes the loophole by requiring lighting used for plant growth or maintenance to either meet an efficiency metric . The efficiency metric of 1.6 µmol/J (micromoles per Joule) was developed in collaboration with the American Society of Agricultural and Biological Engineers and was developed specifically for lighting used for plant growth. It measures the number of photons emitted from the fixture per Joule of energy consumed. Lighting Power Density was developed as a metric to evaluate the light usable for visual tasks relative to the power consumed. Likewise, this metric was developed specifically to measure the light usable for plant growth relative to the power consumed. This metric is codified as an ANSI standard (ANSI/ASABE S640 – Quantities and Units of Electromagnetic Radiation for Plants (Photosynthetic Organisms))and is already seeing wide adoption in the industry with over 84 products available that meet this requirement when surveyed in 2016. More information on the metric can be found in the ANSI Standard: ANSI/ASABE S640.

Using a typical High Pressure Sodium lamps (a common growing light) as the baseline, this requirement will result in 78% savings. That is a substantially lower lighting load and a reduction in the cooling load.

Cost Impact: The code change proposal will increase the cost of construction
The proposal could marginally add to the cost of construction. The cost of horticultural lighting fixtures is actually driven to a large extent by reflectors and ventilation needs (horticultural lighting is positioned very close to the plants and venting the heat is essential) and not just lighting technology. Therefore, fixture cost can very dramatically, from $25/fixture to almost $1000/fixture for High Pressure Sodium fixtures and from $75/fixture to well over $1000/fixture for LED. And advancements and expanding market share of LED lighting has narrowed the impact of lighting technology. Therefore, lighting that meets this requirement can be obtained for less than lighting that does not. The only projects that will see an increase in cost are those using the absolute cheapest lighting that does not meet the requirement.

CE209-19

Public Hearing Results

Committee Action: As Modified

Committee Modification:

C405.4 Lighting for plant growth and maintenance <u>(Mandatory)</u>. Not less than 95 percent of the permanently installed luminaires used for plant growth and maintenance shall have a photon efficiency of not less than 1.6 µmol/J ~~rated~~ <u>as defined</u> in accordance with ANSI/ASABE S640.

Committee Reason: This change provides jurisdictions the opportunity to enforce lighting. The modifications add the word mandatory, clarifying intent it is mandatory and non tradeable and corrects a more appropriate term for reference standard. (Vote: 14-1).

Assembly Action: None

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

CE209-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests Disapprove

Commenter's Reason: This should be disapproved for the following reasons:
-The requirement shown is a "photon efficiency" for the process of growing plants and crops. A higher photon efficiency does not mean higher lighting energy efficiency.

-The energy used by lighting depends on the type of structure and lighting technology. Based on a 2017 DOE report, the lighting energy usage. A supplemented greenhouse will have different lighting energy usage compared to non-stacked indoor farm and as compared to a vertical farm. For facilities using LED lighting, the lighting energy usage density ranged from 7.3 to 41.8 Watts/square foot. For facilities with HID lighting (high pressure sodium or metal halide), the lighting energy usage density ranged from 10.4 to 60.8 Watts/square foot, and for facilities with fluorescent lighting, the lighting energy usage density ranged from 22.8 to 60.0 Watts/square foot.

-It is not clear if this requirement is applicable to all plants/crops that could be grown in these types of facilities, or just a few (e.g., Basil/herbs, cabbage, cannabis, carrots, cucumbers, flowers, grapes, green peas, chickpeas, lentils, leafy greens, lettuce, onions, peppers, squash, strawberries, blueberries, tomatoes, etc.).

-According to a May 2018 report by the Lighting Research Center for greenhouse applications:

"The LRC found that LED horticultural luminaires cannot replace HPS luminaires on a one-for-one basis while still maintaining the original PPFD. Approximately three times as many LED horticultural luminaires would be needed to provide the same PPFD as a typical HPS horticultural luminaire layout, on average.

The results show that intensity distribution plays an important role, illustrated by the fact that two of the tested LED luminaires had higher luminaire efficacy than the HPS luminaires but still had a higher total power demand in the greenhouse application.

The LRC found an increase in shading from LED luminaires compared with HPS luminaires due to the size of the luminaires and the fact that more are needed to provide the same PPFD in a greenhouse. The shading from LED luminaires reduces daylight in a greenhouse by 13—55% compared with a 5% reduction in daylight from HPS luminaires, thus more electric energy could be needed for lighting with the LED systems, depending upon the available daylight."

Bibliography: *Energy Savings Potential of SSL in Horticultural Applications*, US Department of Energy, DOE/EE-1723, December 2017 available at: https://www.energy.gov/sites/prod/files/2017/12/f46/ssl_horticulture_dec2017.pdf
LED and HID Horticultural Luminaire Testing Report, Lighting Research Center, Rensselaer Polytechnic Institute, May 3, 2018, available at https://www.lrc.rpi.edu/programs/energy/pdf/HorticulturalLightingReport-Final.pdf

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
There is no change to code if this is disapproved.

Public Comment# 1315

CE213-19

IECC®: C405.8.2, C405.8.2.1

Proposed Change as Submitted

Proponents: Kevin Brinkman, representing National Elevator Industry, Inc. (klbrinkman@neii.org)

2018 International Energy Conservation Code

Revise as follows:

C405.8.2 Escalators and moving walks. Escalators and moving walks shall comply with ASME A17.1/CSA B44 ~~and~~ Where a traffic analysis indicates that an escalator or moving walk application will have sufficient periods with no riders while it is operating, it shall have automatic controls ~~configured to~~ that reduce speed ~~to the minimum~~ as permitted ~~speed~~ in accordance with ASME A17.1/CSA B44 or applicable local code ~~when not conveying passengers.~~ .

> **Exception:** A variable voltage drive system that reduces operating voltage in response to light loading conditions is an alternative to the reduced speed function.

C405.8.2.1 ~~Regenerative drive.~~ Power Recovery. ~~An escalator designed either for one-way down operation only or for reversible operation shall have a variable frequency regenerative drive that supplies electrical energy to the building electrical system when the escalator is loaded~~ Where a traffic analysis indicates that an escalator application will have sufficient periods in the down direction with passengers whose combined weight exceeds 750 pounds (340 ~~kg).~~ kg), the escalator shall be designed to recover, on average, more power than is consumed by the power recovery feature of its motor controller system.

Reason: The universal application of technology designed for energy efficiency improvement imposed by the current requirement may actually increase energy consumption in many applications. The proposed revision would require a traffic analysis to determine whether the technology would actually be beneficial or detrimental. The proposal also used more prescriptive language for the power recovery to allow designers and manufacturers to select the most energy efficient technology for the application.
C405.8.2: Depending on the escalator or moving walk application, varying speeds may actually increase energy usage. Each time the escalator or moving walk returns to the normal operating speed from its reduced speed condition, more energy is consumed to create the acceleration needed. In applications where the amount of time that there are no riders is very short, the energy consumed during the acceleration stage may actually exceed what is saved during the reduced speed segments. The traffic analysis can be used to calculate the anticipated savings, if any, to determine whether the technology should be applied and the return on investment.

C405.8.2.1: It should be noted that most, if not all, escalators are designed to be reversible, so the provision in the current edition would be applied to all escalators, including those that always run in the up direction. Depending on the escalator application, there may be only marginal gains in applying one technical solution over another and therefore no single technical solution should be prescribed for all escalators as stated in the current standard. The proposed language uses more prescriptive language for the power recovery to allow designers and manufacturers to select the most energy efficient technology for the application and ensure that if applied it actually recovers more power on average than the added feature would consume. [Note: some examples may include direct induction motor regeneration, variable frequency regeneration motor controller, or various combinations of the two.]

To further illustrate the deficiencies in the current language and support the need for an analysis to determine the best option for energy usage, three hypothetical scenarios are provided below with three configurations of motor controller-motor energy recovery arrangements. In each configuration, power recovery (regen power) back to the supply system can only be realized when the escalator is running in the down direction with a sufficient load to overcome friction. (See sample motor controller configuration diagrams under Technical Backup).

Electrical DATA

Rise: 18' (approx. 6m)

Power: 15Hp/11kW

Power factor (Pf) 0.75

Voltage: 480VAC

Configuration 1 is an electro-mechanical motor controller with an AC induction motor that can feed direct power back to the power supply system when the escalator is running in the down direction with sufficient load.

Configuration 2 is an electronic motor controller with no regeneration capability but can reduce escalator speed when there are no riders on it, and uses the AC motor to feed direct power back to the power supply system when the escalator is running in the down direction with sufficient load.

Configuration 3 is an electronic motor controller with regeneration capability back to the power supply system when the escalator is running in the down direction with sufficient load driving an AC induction motor.

A) Approximate additional energy consumption (kW/hr.) by the controller for the four types of motor controls considered (electro-mechanical is baseline):

1. Electro-mechanical motor controller with AC induction motor ~ 0 kW

2. Electronic motor controller (VVVF) without regen and with AC induction motor ~ 0.285 kW

3. Electronic motor controller (VVVF Pf1 regen type) with AC induction motor ~ 0.430 kW

B) Approximate energy saved (kW/hr.) at reduced speed for the three types of motor controls considered:

1. Electro-mechanical motor controller with AC induction motor ~ 0 kW (reduced speed not possible)

2. Electronic motor controller (VVVF) without regen and with AC induction motor ~ 1.5 kW

3. Electronic motor controller (VVVF Pf1 regen type) with AC induction motor ~ 1,5 kW

C) Approximate energy recovered (kW/hr) by the escalator for the three types of motor controls considered:

1. Electro-mechanical motor controller with AC induction motor ~ 3 kW

2. Electronic motor controller (VVVF) without regen and with AC induction motor ~ 3 kW

3. Electronic motor controller (VVVF Pf1 regen type) with AC induction motor ~ 4 kW

Summary: From the three application scenarios below, it will be seen that the energy savings from each configuration very much depends upon the application and use of the escalator:

- The single dedicated down airport escalator in Scenario 1 with the VVVF Pf1 regenerative motor controller of Configuration 3 provides the best energy efficiency. This configuration is specified by the current standard.
- The single up escalator with a peak hour down direction in scenario 2 is better suited with the VVVF motor controller in Configuration 2 that can reduce the speed of the escalator when no riders are present but uses the AC motor to feed direct power back to the power supply system when the escalator is moving in the down direction with sufficient load.
- The heavily used bi-directional shopping mall escalators in Scenario 3 will consume more energy with the added speed reduction and power recovery features of Configuration 2 and 3 than they would by simply allowing the AC induction motor of Configuration 1 to recover direct energy from the induction motor whenever possible.

The NEII proposed code modifications address the application sensitivity in achieving energy recovery and savings by making the application of the conveyance a factor in selecting the best suited energy saving configuration.

Application Scenario 1

An airport is open 18 hours per day with a dedicated down escalator to baggage claim. When flights arrive, it is loaded with more than 75% capacity for 5 minutes for each flight and zero load the remainder of the time. One hundred and twenty arriving flights per day use this baggage claim escalator.

Escalators load during the 18 operating hours:

1. 0% load for 8 hours (=Total time where reduced speed can be applied)

2. > 0%, < 75% load for 0 hours

3. 75% load or more for 10 hours

Motor Controller (Operating 18 hours/day)	A) Controller power ~kW consumption	B) Reduced speed ~kW saved	C) Regen ~kW recovered	Energy saved Power ~kW

Direction	Up	Down	Up	Down	Up	Down	Total
1. Electro-mechanical with AC induction motor that provides regen	0	0	0	0	0	30	30
2. Electronic controller with AC induction motor that provides power recuperation capability	0	5.1	0	12	0	30	38.90
3. Electronic controller (Pf1 regen type) with AC induction motor	0	7.74	0	12	0	40	**44.26**

Application Scenario 2

A subway station open 22 hour per day has one escalator for each platform. Typically, the escalator runs in the up direction most of the time and in the down direction during peak rush hour. Scenario for reduced power consumption and regen power is as follows:

Escalators load during the 22 operating hours (20hrs up and 2hrs down):

1. 0% load for 10 hours up direction (Total time where reduced speed can be applied)

2. > 0%, < 75% load for 10 hours up direction

3. 75% load or more for 2 hours down direction

Motor Controller (Operating 22 hours/day)	**A) Controller power ~kW consumption**		**B) Reduced speed ~kW saved**		**C) Regen ~kW recovered**		**Energy saved Power ~kW**
Direction	Up	Down	Up	Down	Up	Down	Total
1. Electro-mechanical with AC induction motor that provides regen	0	0	0	0	0	6	6
2. Electronic controller with AC induction motor that provides power recuperation capability	5.7	0.57	15	0	0	6	**14.73**
3. Electronic controller (Pf1 regen type) with AC induction motor	8.6	0.86	15	0	0	8	13.5

Application Scenario 3

A busy outdoor mall is open 12 hours per day has two escalators. Typically, one of the escalators will be running up and the other in the down direction. Both escalators can run down and each may be used for that direction from time to time. Scenario for reduced power consumption and regen power is as follows:

Escalators load during the 12 operating hours:

1. 0% load for 0 hours (Total time where reduced speed can be applied)

2. > 0%, < 75% load for 12 hours

3. 75% load or more for 0 hours

Motor Controller (Operating 12 hours/day)	**A) Controller power (~kW) consumption**		**2) Reduced speed (0hrs) ~kW saved**		**3) Regen (0hr) ~kW recovered**		**Energy saved Power ~kW**
Direction	Up	Down	Up	Down	Up	Down	Total
1. Electro-mechanical with AC induction motor	0	0	0	0	0	0	0
2. Electronic controller with AC induction motor that provides power recuperation capability	3.4	3.4	0	0	0	0	(6.8)
3. Electronic controller (Pf1 regen type) with AC induction motor	5.16	5.16	0	0	0	0	(10.32)

Technical backup.

Energy is utilized by escalators for the following:

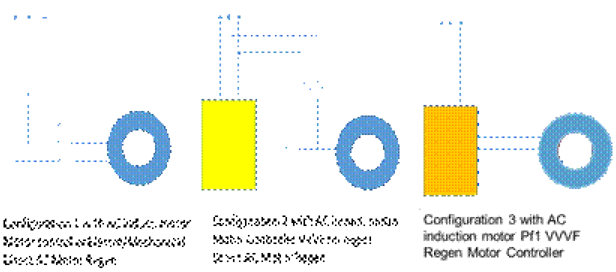
1. to overcome friction,
2. transport the load, and
3. inertia (starting) (insignificant for configuration 1 minimum for the others)

Because of the angle of inclination, transport of the escalator load is the dominate energy consumption area of the system to move a load up the inclination. However, the converse is true that when the load is being transported in the down direction, energy can be produced by the overhauling of the drive motor from the downward moving load and returned to the power system.

In general, an AC induction motor used to drive an escalator will produce power when it is in overhauling in the down direction with sufficient passenger loading to overcome the friction in the system. AC induction motors may be applied with simple electro-mechanical or fully electronic motor controllers and still provide this capability. Other variations of motor types, such as permanent magnet motors and variable voltage variable frequency motor control are also possible, and may also provide an energy saving reduced speed feature in the application. However, the electronics required for the various technologies to provide these motor control functions also consumes energy and must be weighed against the possible energy saving under the application and use of the escalator.

It should also be pointed out that in certain applications, escalators and moving walks with a speed reduction feature are confronted with flows of traffic that can cause the escalator or moving walk to continually switch between full to reduced speed and back to full speed. With a high enough frequency, this switching between slow to full speed will consume more energy than saved by the feature because of the need to accelerate the mass to full speed each time.

Example configurations (basic diagrams)



Cost Impact: The code change proposal will decrease the cost of construction
The code change proposal will decrease the cost of construction because it would allow alternate designs to achieve energy conservation.

CE213-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There are no specific standards for when the escalator needs to slow down, this could be a roll-back. Proponent is encouraged to separate this into two code changes, there is too much reliance on undefined traffic analysis (Vote: 13-2)

Assembly Action: **None**

CE213-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C405.8.2

Proponents:
Kevin Brinkman, representing National Elevator Industry, Inc. (klbrinkman@neii.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C405.8.2 Escalators and moving walks. Escalators and moving walks shall comply with ASME A17.1/CSA B44. ~~Where a traffic analysis indicates that an escalator or moving walk application will have sufficient periods with no riders while operating, it~~ and shall have automatic controls that reduce speed as permitted in accordance with ASME A17.1/CSA B44 ~~or~~ and applicable local code.

> **Exception:** A variable voltage drive system that reduces operating voltage in response to light loading conditions is an alternative to the reduced speed function.

Commenter's Reason: Proposed modification would result in minor changes to clarify the base requirement. These clarifications would reduce potential redundancy with ASME A17.1/CSA B44 which specifies strict safety requirements for the reduction of speed on escalators and moving walks. Also, the modifications clarify language to prevent conflict with local codes that prohibit a variation of speed or have not adopted the applicable editions of A17.1/CSA B44 that specify the relevant safety requirements. The modified proposal also breaks down the proposal into multiple changes as recommended by the committee.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This public comment is only a clarification of the proposed language and clarifications do not impact the cost of construction. The net effect of the proposal and public comment will be a decrease in the cost of construction for the reasons stated in the proposal.

Public Comment# 1736

Public Comment 2:

IECC®: C405.8.2

Proponents:
Kevin Brinkman, representing National Elevator Industry, Inc. (klbrinkman@neii.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C405.8.2 Escalators and moving walks. Escalators and moving walks shall comply with ASME A17.1/CSA B44. Where a traffic analysis indicates that an escalator or moving walk application will have sufficient periods with no riders while it is operating, it shall have automatic controls that reduce speed as permitted in accordance with ASME A17.1/CSA B44 or applicable local code.

> **Exception:** ~~A variable voltage drive system that reduces operating voltage in response to light loading conditions is an alternative to the reduced speed function.~~ Reduction in speed is not required where the application of the escalator or moving walk will have passengers more than 50 percent of the time during powered operation.

Commenter's Reason: Escalators and moving walks are typically powered down during building closing hours. However, while in operation passenger usage conditions for certain applications of the escalator or moving walk may permit only very short periods for the reduction of speed due to the frequency of passenger loading and unloading. In these applications energy reduction during reduced speed may not offset the required energy of the added automatic controls due to the short durations of reduced speed and the energy required for reaccelerating the escalator and moving walk back to full running speed after each speed reduction period ends. The modified language is also structured to be more technology neutral and breaks down the proposal into multiple changes as recommended by the committee.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
The proposed change will reduce the cost of construction because it will not require the additional cost and energy consumption of speed varying controls when the application would not be able to produce sufficient cost savings to offset the expense.

Public Comment# 1739

Public Comment 3:

IECC®: C405.8.2.1

Proponents:
Kevin Brinkman, representing National Elevator Industry, Inc. (klbrinkman@neii.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C405.8.2.1 **Energy Recovery.** ~~**Regenerative drive.**~~ ~~An escalator~~ Escalators shall be designed to recover electrical energy when resisting overspeed in the down direction. ~~either for one-way down operation only or for reversible operation shall have a variable frequency regenerative drive that supplies electrical energy to the building electrical system when the escalator is loaded with passengers whose combined weight exceeds 750 pounds (340 kg).~~

Commenter's Reason: This public comment requests approval of the proposed modifications to C405.8.2.1 independent of the other changes in the original proposal based on the committee recommendation to split this into multiple changes. Overall the modification and the change still requires energy saving technology, but allows the building owner, designers and manufacturers more flexibility to ensure that the resulting application actually saves energy.
All escalators are, by the nature of their motor drives, designed to recover electrical power in the down direction when there is enough passenger load to overcome the friction of the escalator system and imbalance of the escalator step masses that will cause the escalator motor to resist over speeding of the escalator. There is no significant marginal energy recovery benefit by specifying any one type of energy recovery solution for escalators. In some applications specifying one technology solution for energy recovery can be counterproductive to that objective since the means to recover the energy also requires power that must be considered among all possible solutions. A single specified solution also hinders innovation in escalator motor drive design.

The stated 750-pound requirement is arbitrary since, as noted above, the inherent friction of an escalator system, including rise, handrail design, and other factors, may need more or may need less than 750lbs of passenger load to cause the escalator motor to resist escalator overspeed in the down direction and recover energy.

To further illustrate the deficiencies in the current language and support the need for an analysis to determine the best option for energy usage, three application scenarios were provided with the original proposal that include three available configurations of motor energy recovery arrangements. In each configuration, power recovery (regen power) to the supply system can only be realized when the escalator is running in the down direction with a sufficient load to overcome friction and energy losses.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This proposal would reduce the cost of construction because it would offer builder owners, designers, and manufacturers more flexibility in the selection of escalators for a given application.

Public Comment# 1741

CE215-19

IECC: C405.10 (New), C405.10.1 (New), C405.10.2 (New), TABLE C405.10.2 (New), C405.10.2 (New), C405.10.4 (New), C405.10.5(New)

Proposed Change as Submitted

Proponents: Marilyn Williams, representing National Electrical Manufacturers Association (mar_williams@nema.org)

2018 International Energy Conservation Code

Add new text as follows:

C405.10 **Energy Monitoring (Mandatory)** New buildings with a gross conditioned floor area of 25,000 square feet or larger shall be equipped to measure, monitor, record and report energy consumption data in compliance with Section C406.10.1 through C406.10.5.

> **Exception:** Individual tenant spaces are not required to comply with this section provided the space has its own utility services and meters and has less than 5,000 square feet of conditioned floor area.

C405.10.1 **Electrical energy metering.** For electrical energy, including all electrical energy supplied to the building and its associated site, including but not limited to site lighting, parking, recreational facilities, and other areas that serve the building and its occupants, meters or other measurement devices shall be provided to collect energy consumption data for each end-use category required by Section C405.10.2.

C405.10.2 **End-use metering categories.** Meters or other approved measurement devices shall be provided to collect energy use data for each end-use category indicated in Table 405.10.2. Where multiple meters are used to measure any end-use category, the data acquisition system shall total all of the energy used by that category. Not more than 5 percent of the measured load for each of the end-use categories indicated in Table 405.10.2 shall be permitted to be from a load that is not within that category.

Exceptions:

1. HVAC and water heating equipment serving only an individual dwelling unit shall not require end-use metering.
2. End-use metering shall not be required for fire pumps, stairwell pressurization fans or any system that operates only during testing or emergency.
3. End-use metering shall not be required for an individual tenant space having a floor area not greater than 2,500 square feet where a dedicated source meter complying with Section C405.10.3 is provided.

TABLE C405.10.2
ENERGY USE CATEGORIES

LOAD CATEGORY	**DESCRIPTION OF ENERGY USE**
Total HVAC System	Heating, cooling and ventilation including, but not limited to fans, pumps, boilers, chillers, and water heating. Energy used by 120 volt equipment, or by 208/120 volt equipment that is located in a building where the main service is 480/277 volt power, is permitted to be excluded from Total HVAC system energy use.
Interior Lighting	Lighting systems located withing the building.
Exterior Lighting	Lighting systems located on the building site but not within the building.
Plug Loads	Devices, appliances and equipment connected to convenience receptacle outlets.
Process Loads	Any single load that is not included in a HVAC, lighting or plug load category and that exceeds 5 percent of the peak connected load of the whole building including, but not limited to data centers, manufacturing equipment and commercial kitchens.
Building Operations and other miscellaneous loads	The remaining loads not included elsewhere in this table including, but not limited to, vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains, ornamental fireplaces, swimming pools, in-ground spas, and snow-melt systems.

C405.10.3 Meters. Meters or other measurement devices required by this section shall be configured to automatically communicate energy consumption data to the data acquisition system required by Section C405.10.4. Source meters shall be allowed to be any digital-type meter. Lighting, HVAC, or other building systems that can monitor their energy consumption shall be permitted instead of meters. Current sensors shall be permitted, provided that they have a tested accuracy of plus or minus 2 percent. Required metering systems and equipment shall have the capability to provide at least hourly data that is fully integrated into the data acquisition system and graphical energy report in accordance with Sections C405.10.4 and C405.10.5.

C405.10.4 Data acquisition system A data acquisition system shall have the capability to store the data from the required meters and other sensing devices for minimum of 36 months. The data acquisition system shall have the capability to store real-time energy consumption data and provide hourly, daily, monthly, and yearly logged data for each end-use category required by Section C405.10.2.

C405.10.5 Graphical energy report A permanent and readily accessible reporting mechanism shall be provided in the building that is accessible by building operation and management personnel. The reporting mechanism shall have the capability to graphically provide the energy consumption for each end-use category required by Section C405.10.2 at least every hour, day, month, and year for the previous 36 months.

Reason: The investment made for the infrastructure of a building to comply with the IECC is significant. The assumption that is currently made upon commissioning a facility is that energy efficiency measures will not degrade, or go out of calibration, over time and their energy consumption will not increase as time passes from the time they were commissioned. Such as assumption is completely inaccurate and any payback assumed for energy efficient infrastructure investments will be lengthened, thereby reducing the ROI and increasing the payback period. The only means to retain the energy performance of a building is to continously monitor energy consumption levels of various energy consuming systems and compare them to previous levele. Monitorin sub-systems provides key indications when changes have been made or systems are not operating to specification, which increases energy consumption. Examples include, but are not limited to:

1. Increase energy consumption in HVAC system loads will point to failures in motors, drive systems, bearings, etc.

2. Degrading building envelope.

3. Configuration changes to the building that may drive increased energy consumption.

4. Increase of energy consumption from lighting loads may indicate changes in arrangement of the office space that resulted in reduced lighting driving the installation of more lighting above permitted energy code levels, failure of occupant sensors, inappropriate lighting schedules, lamps that need to be replaced or cleaned, etc.

5. Monitoring plug loads will indicate when computer equipment is left on during non-working hours and use of space heaters that compromise the efficiency of the facility due to set points on the HVAC system.

The requirements in this proposal save energy by continually monitoring and reporting actionable energy consumption data to building owners and operators. For large buildings, this data is further broken out by the major sub-systems (HVAC, lighting, process loads, and plus loads). There are well documented studies that demonstrates the energy savings from metering and monitoring systems. The 2013 version of ASHRAE Std. 90.1 and several state energy codes have recognized the benefits and require energy monitoring to support a continual high level of performance from the energy efficienct investment.

Cost Impact: The code change proposal will not increase or decrease the cost of construction

The code change proposal “will” increase the cost of construction because it will require additional hardware, software and labor during installation. Providing specific cost would violate antitrust laws, however the following link to a report provided by the GSA demonstrates an example of cost and savings: https://www.gsa.gov/cdnstatic/Energy_Submetering_Finance_Paper_Knetwork_2012_11_269%28508%29.pdf

CE215-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: As Modified

Committee Modification:
C405.10 Energy Monitoring (Mandatory). New buildings with a gross conditioned floor area of 25,000 square feet or larger shall be equipped to measure, monitor, record and report energy consumption data in compliance with Section ~~C406.10.1~~ C405.10.1 through ~~C406.10.5~~ C405.10.5

> **Exception:** R-2 occupancies and Individual tenant spaces are not required to comply with this section provided the space has its own utility services and meters and has less than 5,000 square feet of conditioned floor area.

Committee Reason: Monitoring is important, building owners and operators need to know what energy is being used, the change supports the cities benchmarking requirements. A public comment would be advised lining up dwelling unit language. The modifications clarify exemptions and correct errors in citations (Vote: 10-5).

Assembly Action: None

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as ‘mandatory’ will instead have their respective section numbers added to the new non-tradeable requirement tables.

CE215-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C405.10 (New)

Proponents:
Charles Foster, representing EEI (cfoster20187@yahoo.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C405.10 Energy Monitoring (Mandatory) New buildings with a gross conditioned floor area of 250,000 square feet or larger shall be equipped to measure, monitor, record and report energy consumption data in compliance with SectionC405.10.1 through C405.10.5.

> **Exception:** R-2 occupancies and Individual tenant spaces are not required to comply with this section provided the space has its own utility services and meters and has less than 50,000 square feet of conditioned floor area.

Commenter's Reason: Smaller commercial buildings should not be required to submeter, since they are much less likely to have on-site technical staff that can respond to short-term or long-term increases in energy usage discovered by the submeters.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
To the extent this modification would reduce the number of buildings subject to submetering provisions, it would reduce the cost of construction.

Public Comment# 1584

Public Comment 2:

IECC®: C405.10.5 (New)

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C405.10.5 Graphical energy report A permanent and readily accessible reporting mechanism shall be provided in the building that is accessible by building operation and management personnel, building owner, and the tenant of each space. The reporting mechanism shall have the capability to graphically provide the energy consumption for each end-use category required by Section C405.10.2 at least every hour, day, month, and year for the previous 36 months.

Commenter's Reason: This public comment made was to address who receives the reports for the energy use of the building or space. The intent is to monitor the energy usage to be cognitive of how much and how the energy is used within the building or space, but the original proposal left out key players in the mix. If the tenants of the space or owners of the building are not provided with this information they are not able to address any concerns of how one may be wasting energy. Knowledge is power, and this knowledge needs to be provided where it can be useful and used appropriately. If one does not know how much energy is being used one can not fix any wasting measures.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This public comment is a clarification as to where/who information needs to be/go. Clarifications do not impact the cost of construction. However, the proposal does impact the cost of constructions as requires installation of a lot of electrical monitoring equipment to buildings and that will increase the cost of construction.

Public Comment# 2041

Public Comment 3:

IECC®: C405.10 (New), C405.10.1 (New), C405.10.2 (New), TABLE C405.10.2 (New), C405.10.3 (New), C405.10.4 (New), C405.10.5 (New)

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C405.10 Energy Monitoring (Mandatory) New buildings with a gross conditioned floor area of 25,000 square feet or larger shall be equipped to measure, monitor, record and report electric and fossil fuel energy consumption data in compliance with Section C405.10.1 through C405.10.5.

> **Exception:** R-2 occupancies and Individual tenant spaces are not required to comply with this section provided the space has its own utility services and electric meters , steam meters, and fossil fuel meters and has less than 5,000 square feet of conditioned floor area.

C405.10.1 Electrical and Fossil Fuel and Steam energy metering. For electrical and fossil fuel and steam energy, including all ~~electrical~~ energy supplied to the building and its associated site, including but not limited to site lighting that is fueled or powered through the energy service for the building, parking, recreational facilities, and other areas that serve the building and its occupants, electric and fossil fuel and steam meters or other measurement devices shall be provided to collect energy consumption data for each end-use category required by Section C405.10.2.

C405.10.2 End-use metering categories. Electric and fossil fuel and steam ~~M~~ meters or other approved measurement devices shall be provided to collect energy use data for each end-use category indicated in Table 405.10.2. Where multiple meters are used to measure any end-use category, the data acquisition system shall total all of the electric and fossil fuel and steam energy used by that category. Not more than 5 percent of the measured load for each of the end-use categories indicated in Table 405.10.2 shall be permitted to be from a load that is not within that category.

Exceptions:

1. HVAC and water heating equipment serving only an individual dwelling unit shall not require end-use metering.

2. End-use metering shall not be required for fire pumps, stairwell pressurization fans or any <u>other</u> system that operates only during testing or emergency.
3. End-use metering shall not be required for an individual tenant space having a floor area not greater than 2,500 square feet where a dedicated source meter complying with Section C405.10.3 is provided.

TABLE C405.10.2
ENERGY USE CATEGORIES

LOAD CATEGORY	DESCRIPTION OF ENERGY USE
Total HVAC System	Heating, cooling and ventilation including, but not limited to fans, pumps, furnaces, boilers, chillers, and water heating. Energy used by 120 volt equipment, or by 208/120 volt equipment that is located in a building where the main service is 480/277 volt power, is permitted to be excluded from Total HVAC system energy use.
Interior Lighting	Lighting systems located withing the building.
Exterior Lighting	Electric or fossil fuel ~~Lighting~~ systems located on the building site but not within the building that are fueled or powered through the energy service for the building.
Plug / Pipe Loads	Electric or fossil fuel or steam ~~Devices,~~ appliances and equipment connected to convenience receptacle outlets or fossil fuel supply piping or steam piping.
Process Loads	Any single load that is not included in a HVAC, lighting or plug load category and that exceeds 5 percent of the peak connected load of the whole building including, but not limited to data centers, laundry equipment, manufacturing equipment and commercial kitchens.
Building Operations and other miscellaneous loads	The remaining electric and fossil fuel and steam loads not included elsewhere in this table including, but not limited to, vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains, ornamental gas fireplaces, swimming pools, pool heaters, in-ground spas, and snow-melt systems.

C405.10.3 Meters. Electric and fossil fuel and steam ~~M~~ meters or other measurement devices required by this section shall be configured to automatically communicate energy consumption data to the data acquisition system required by Section C405.10.4. Source meters shall be allowed to be any digital-type electric or fossil fuel or steam meter. Lighting, HVAC, or other building systems that can monitor their energy consumption shall be permitted instead of meters. ~~Current~~ Other electric and fossil fuel or steam sensors shall be permitted, provided that they have a tested accuracy of plus or minus 2 percent. Required electric and fossil fuel and steam metering systems and equipment shall have the capability to provide at least hourly data that is fully integrated into the data acquisition system and graphical energy report in accordance with Sections C405.10.4 and C405.10.5.

C405.10.4 Data acquisition system A data acquisition system shall have the capability to store the data from the required electric and fossil fuel and steam meters and other sensing devices for minimum of 36 months. The data acquisition system shall have the capability to store real-time electric and fossil fuel and steam energy consumption data and provide hourly, daily, monthly, and yearly logged data for each end-use category required by Section C405.10.2.

C405.10.5 Graphical energy report A permanent and readily accessible reporting mechanism shall be provided in the building that is accessible by building operation and management personnel. The reporting mechanism shall have the capability to graphically provide the electric and fossil fuel and steam energy consumption for each end-use category required by Section C405.10.2 at least every hour, day, month, and year for the previous 36 months.

Commenter's Reason: As currently written, this code change would only require submetering of electric end-uses, while ignoring fossil fuel and steam end-uses. For buildings in northern climates with multiple fossil-fuel end uses, the majority of energy used and energy costs will be from fossil fuels (and/or steam), not electricity. So, designers and owners will have incentive to install fossil-fuel or steam equipment to lower their submetering costs.
This modification will increase energy savings by ensuring that all forms of energy are submetered, not just electricity. This is fuel neutral, as it requires all forms of energy, not just one, to be submetered. This will ensure that savings can be obtained for all forms of energy that are being used at the building or building site.

There are other editorial improvements to the proposal, and language for exterior lighting has been submitted that is consistent with language that is currently in the IECC (in C405.4.2) and approved for other proposals (such as CE 211). This will prevent any problems with lighting that is provided to the building site by 3rd parties (such as cities, counties, or utilities).

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Adding more submetering for all forms of energy used will increase the cost of construction.

Public Comment# 1346

Public Comment 4:

Proponents:

Barry Greive, Target Corp, representing Target Corp (barry.greive@target.com)

requests Disapprove

Commenter's Reason: While monitoring energy usage is in the best interest of the owner, mandating it in this detail is not. Many owners monitor certain loads but to the extent the proposal requires is not beneficial. The cost to add the equipment only benefits the manufacturer and installers. This proposal also requires a reporting mechanism, on simple buildings, this is not a good use of resources. Designers know how to limit energy usage by good design, once all this expensive equipment is installed it is not mandated that an owner or tenant do anything with the information. This is a mandate with no need to act on anything.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1589

CE216-19

IECC: C405.10 (New)

Proposed Change as Submitted

Proponents: Marilyn Williams, representing National Electrical Manufacturers Association

2018 International Building Code

Add new text as follows:

C405.10 Automatic Receptacle Control The following shall be automatically controlled:

1.At least 50% of all 125 V, 15 and 20-amp receptacles installed in enclosed offices, conference rooms, rooms used primarily for copy or print functions, breakrooms, classrooms, and individual workstations, including those installed in modular partitions and module office workstation systems.
2.At least 25% of branch circuit feeders installed for modular furniture not shown on the construction documents.
3.Either split controlled receptacles shall be provided, with the top receptacle controlled, or a controlled receptacle shall be located within 12 inches of each uncontrolled receptacle.

This control shall function on:

1.A scheduled basis using a time-of-day operated control device that turns receptacle power off at specific programmed times and can be programmed separately for each day of the week. The control device shall be configured to provide an independent schedule for each portion of the building of not more than 5000 ft^2 and not more than one floor. The occupant shall be able to manually override an area for not more than two hours. Any individual override switch shall control the receptacles of not more than 5000 ft.
2.An occupant sensor control that shall turn receptacles off within 20 minutes of all occupants leaving a space; or
3.An automated signal from another control or alarm system that shall turn receptacles off within 20 minutes after determining that the area is unoccupied.

All controlled receptacles shall be permanently marked in accordance with NFPA 70 and be uniformly distributed throughout the space. Plug-in devices shall not comply.

Exceptions: Receptacles for the following shall not require an automatic control device:

1. Receptacles specifically designated for equipment requiring continuous operation (24/day, 365 days/year).
2. Spaces where an automatic control would endanger the safety or security of the room or building occupants.
3. Within a single modular office workstation, non-controlled receptacles are permitted to be located more than 12 inches, but not more than 72 inches from the controlled receptacles serving that workstation.

Reason: This proposal will:
1. Increase building energy efficiency

2. Offer a well-studied, cost effective efficiency measure

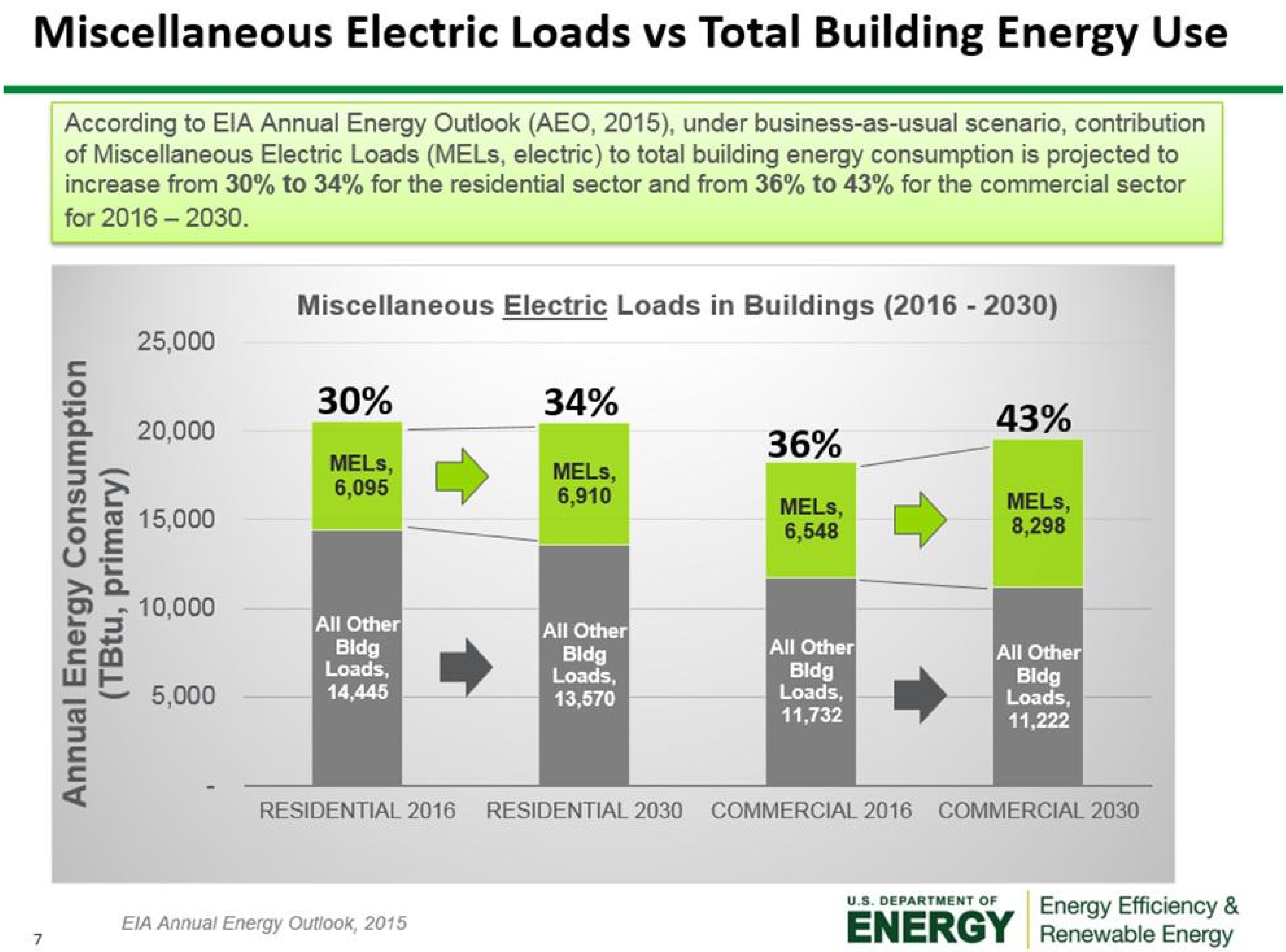
3. Maintain building occupant's safe usability

4. Keep enforceability simple

5. Align with other energy efficiency codes, increasing design compliance.

Although commercial buildings continue to decrease their energy use through more efficient lighting, mechanical, and domestic water systems, the Miscellaneous Electrical Loads (MELs) energy segment continues to rise. More and more electrical power consuming devices are being plugged into building electrical systems. Some, such as fans, space heaters, printers, monitors, plug in lamps are left on, when spaces are unoccupied. Other devices may be left plugged in and continue to draw power even when inactive or in standby modes. This wastes energy and is counter to the energy efficiency aim of the IECC.

Some jurisdictions which adopt the IECC for their commercial buildings, like Florida and Washington, have amended the IECC to include automatic receptacle control, thereby addressing the growing energy consumption concern of these loads. For more than eight years, other energy efficiency codes have included automatic receptacle control provisions to reduce the wasted energy. Yet, the IECC lags behind offering no viable solution to the growing receptacle and miscellaneous loads on commercial building electrical systems. The Annual Energy Outlook of 2015 from the US EIA, indicate that these load categories will grow from 36% of a commercial buildings energy use, to 43% over the next 15 years.



This provision simply assures receptacle loads that are not needed when building occupants leave high receptacle load use areas, are automatically turned off, saving the energy that would otherwise be wasted. It requires that controlled receptacles clearly be marked as required by NFPA 70, to eliminate user confusion of proper use, and provides good practice exceptions where controlling receptacles would endanger safety and security, or areas of continuous operation.

Expressed safety concerns where extensive use of extension cords and plug strips would be used are unfounded. There are no documented studies validating this problem exists. The proposed language requires either a split duplex receptacle with a controlled or uncontrolled receptacle in the same device, or an uncontrolled receptacle be located no more than 12 inches from a controlled receptacle. This provides occupants in an automatic receptacle-controlled space, clear access to both label marked controlled receptacles and uncontrolled receptacles.

Although there are no requirements for receptacle density in commercial buildings, a design professional will ensure there is an appropriate distribution of receptacles to effectively accomplish the mission of the building. There's no evidence that the distribution of receptacle outlets and controlling some of them has any adverse impact on the utility of this requirement.

Enforceability of this provision is straight forward for building departments and their inspectors. Construction drawings indicate which receptacles are controlled and which are uncontrolled. Onsite inspection will clearly show complying labelled receptacles and operation is easily varied with the shut-off controls already in place with the lighting system.

There have been a considerable number of studies over the years that share the viability and cost effectiveness of automatic receptacle control. Some noted here.

1. One study demonstrated effectiveness (e.g. Zhang2012) with simply payback on this type of equipment between 1.5 and 9 years for small and large offices. This considers the most comprehensive information on office plug load types, installation densities, usage patterns, and power states based on field surveys and monitoring (Kawamoto 2000, 2001; Moorefield, Frazer & Bendt 2011; Roberson 2002, 2004; Roth 2002, 2004; Sanchez 2007; Webber 2001, 2005).

2. A CASE initiative study for CA Title 24-2013 found that smaller office buildings (10,000 sqft) had an annual electrical savings of 4,900 kwh/year and a demand savings of 1.97 kW. Based on installed costs and utilization of lighting control system elements already installed. The simple payback was 4.2 years. For larger office buildings (175,000 sqft) the annual electrical savings were 107,000 kwh/year and a demand savings of 23.6 kW for a simple payback of 2.4 years.

3. A GSA Green Proving Ground Program study conducted in 8 buildings with monitored receptacle control through market available plug strips found "Results underscored the effectiveness of schedule-based functionality, which reduce plug loads at workstations by 26%, even though advanced computer power management was already in place, and nearly 50% in printer room and kitchens." In the study buildings, receptacle loads averaged 21% of building energy use and monitored more than 295 devices over three different test periods to validate the findings. It found payback through timer scheduled control of kitchens of 0.7 years, printer rooms of 1.1 years and miscellaneous devices in 4.1 years. At workstations, the payback was 7.8 years.

4. A study done on "Office Space Plug Load Profiles and Energy Savings Interventions" at the University of Idaho and presented at the ACEEE summer Study in 2012 found that average savings of 0.60 kWh/SF Yr. with plug strip control interventions. This study provided guidance for utility programs to assist with development of plug load efficiency measures and was based on a more detailed report, "Plug Load Profiles" (Acker, B. et. al. 2012).

5. The DOE Better Buildings program issued a December 2015 "Decision Guides for Plug and Process Loads Controls" to help educate and guide decision processes for effective receptacle-based load control. It highlights that "Plug and Process Loads" account for 33% of the total energy consumed by commercial buildings. It sites seven decision strategies including that of Integrated plug load controls with other building systems as one of the largest for energy savings across most building types for whole-building retrofit and new construction categories.

6. A study performed “Advancing the Last Frontier – Reduction of Commercial Plug Loads” presented at the ACEEE summer study of 2016, indicated field study results demonstrating savings of 19% when deploying plug in control strategies in office workstation environments.

Cost Impact: The code change proposal will increase the cost of construction
Costs estimated to be $0.26/ft[2] for small office implementation and $0.19/ft[2] for large office. Payback estimated at 4.2 years for small office buildings (10,000sqft) and 2.4 years for large office buildings (100,000sqft). Source: 2013 California Building Energy Efficiency Standards CASE report.

CE216-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: As Modified

Committee Modification:
C405.10 Automatic Receptacle Control (Mandatory). The following shall have ~~be~~ automatically receptacle controls ~~led~~ complying with Section C405.10.1:

1. At least 50% of all 125 V, 15 and 20-amp receptacles installed in enclosed offices, conference rooms, rooms used primarily for copy or print functions, breakrooms, classrooms, and individual workstations, including those installed in modular partitions and module office workstation systems.
2. At least 25% of branch circuit feeders installed for modular furniture not shown on the construction documents.
3. ~~Either split controlled receptacles shall be provided, with the top receptacle controlled, or a controlled receptacle shall be located within 12 inches of each uncontrolled receptacle.~~

~~This control shall function on~~ **C405.10.1 Automatic receptacle control function.** Automatic receptacle controls shall comply with the following:

1. Either split controlled receptacles shall be provided, with the top receptacle controlled, or a controlled receptacle shall be located within 12 inches of each uncontrolled receptacle.
2. Shall be controlled by one of the following methods:
   2.1. A scheduled basis using a time-of-day operated control device that turns receptacle power off at specific programmed times and can be programmed separately for each day of the week. The control device shall be configured to provide an independent schedule for each portion of the building of not more than 5000 ft2 and not more than one floor. The occupant shall be able to manually override an area for not more than two hours. Any individual override switch shall control the receptacles of not more than 5000 ft.
   2.2. An occupant sensor control that shall turn receptacles off within 20 minutes of all occupants leaving a space.; or
   2.3. An automated signal from another control or alarm system that shall turn receptacles off within 20 minutes after determining that the area is unoccupied.
   3. All controlled receptacles shall be permanently marked in accordance with NFPA 70 and be uniformly distributed throughout the space.
   4. Plug-in devices shall not comply.

Exceptions: Automatic ~~R~~ receptacle~~s~~ controls are not required for the following~~ shall not require an automatic control device~~:

1. Receptacles specifically designated for equipment requiring continuous operation (24/day, 365 days/year).
2. Spaces where an automatic control would endanger the safety or security of the room or building occupants.
3. Within a single modular office workstation, non-controlled receptacles are permitted to be located more than 12 inches, but not more than 72 inches from the controlled receptacles serving that workstation.

Committee Reason: This is a nice solution and adds efficacy to another building system. the modification clarifies the original language in ICC format (Vote: 10-5).

Assembly Action: **None**

Staff Analysis: If CE42-19 Part I is successful, sections being individually approved to be labeled as ‘mandatory’ will instead have their respective section numbers added to the new non-tradeable requirement tables.

CE216-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Barry Greive, Target Corp, representing Target Corp (barry.greive@target.com)

requests Disapprove

Commenter's Reason: This proposal is a solution looking for a problem. This will cause all kinds of problems in an office setting. In many offices you cannot shut off the printers, especially large plotters. Many offices are also 24 hour facilities, and this proposal is counter productive. In the office where I work, there are entire floors that are touchdown work stations, they can be used by a variety of people and are used all day and night. Many offices are not your normal 8 to 5 schedule like years ago. In our office our phone is also based on the internet and if the receptacle it is plugged into the phone would shut down, this is not good for business. At the first sign of issues these devices will be overridden which meant it was a waste of money to add all the controls.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1837

Public Comment 2:

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests Disapprove

Commenter's Reason: Mandating that all projects that fall into the categories listed in this proposal utilized control receptacles does not work for all projects. There is a place for this type of requirement, and it should be a choice in the additional efficiency package. This is something that projects must think about to verify that the equipment that will be placed in these types of projects can function on a controlled receptacle situation. It doesn't do any good if what we have is an over abundant number of receptacles installed to compensate for the control receptacles, or what you have is the daisy chain effect of extension chord to power strip to extension chord to power strip.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1538

CE217-19 Part I

IECC: C202, C405.10 (New), C405.10.1 (New), TABLE C405.10.1 (New), C405.10.2 (New)

Proposed Change as Submitted

Proponents: Matt Frommer, Southwest Energy Efficiency Project, representing Southwest Energy Efficiency Project (mfrommer@swenergy.org); Eric Makela, New Buildings Institute, representing New Buildings Institute (ericM@newbuildings.org); jim edelson, representing New Buildings Institute (jim@newbuildings.org); Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org); Francesca Wahl (fwahl@tesla.com); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Add new definition as follows:

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the Electric Vehicle.

EV CAPABLE SPACE. Electrical panel capacity and space to support a minimum 40-ampere, 208/240-volt branch circuit for each EV parking space, and the installation of raceways, both underground and surface mounted, to support the *EVSE*.

EV READY SPACE. A designated parking space which is provided with one 40-ampere, 208/240-volt dedicated branch circuit for EVSE servicing *Electric Vehicles*. The circuit shall terminate in a suitable termination point such as a receptacle, junction box, or an *EVSE*, and be located in close proximity to the proposed location of the EV parking spaces.

Add new text as follows:

C405.10. Electric Vehicle (EV) charging for new construction. New construction shall facilitate future installation and use of *Electric Vehicle Supply Equipment (EVSE)* in accordance with the NFPA 70.

C405.10.1. New commercial buildings. *EV Ready Spaces* and *EV Capable Spaces* shall be provided in accordance with Table C405.10.1. Where the calculation of percent served results in a fractional parking space, it shall be shall rounded up to the next whole number. The service panel or sub panel circuit directory shall identify the spaces reserved to support EV charging as “EV Capable” or “EV Ready”. The raceway location shall be permanently and visibly marked as “EV Capable”.

TABLE C405.10.1.
***EV READY SPACE* AND *EV CAPABLE SPACE* REQUIREMENTS**

Total Number of Parking Spaces	Minimum number of *EV Ready Spaces*	Minimum number of *EV Capable Spaces*
1	1	-
2 – 10	2	-
11 – 15	2	3
16 – 19	2	4
21 - 25	2	5
26+	2	20% of total parking spaces

C405.10.2. Identification. Construction documents shall indicate the raceway termination point and proposed location of future EV spaces and EV chargers. Construction documents shall also provide information on amperage of future *EVSE*, raceway methods, wiring schematics and electrical load calculations to verify that the electrical panel service capacity and electrical system, including any on-site distribution transformers, have sufficient capacity to simultaneously charge all EVs at all required EV spaces at the full rated amperage of the *EVSE*.

Reason: In the United States, electric vehicle (EV) sales increased by 80 percent from 2017 to 2018 (1). According to a November 2018 forecast from the Edison Electric Institute, the number of EVs on U.S. roads is projected to grow from 1 million vehicles at the end of 2018, to 18.7 million by 2030. To recharge these new EVs, the U.S. will need 9.6 million charge ports, a substantial portion of which will be installed in workplace and commercial buildings (2).

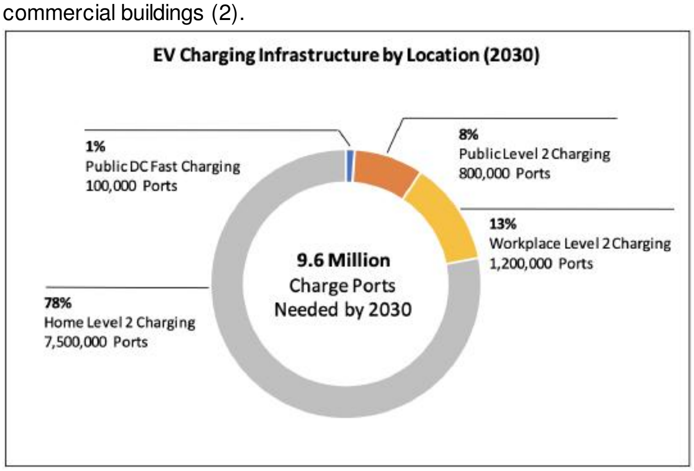


Figure 1. EV Charging Infrastructure in 2030 Based on EEI/IEI Forecast.

EVs provide significant economic benefits for consumers through fuel and maintenance cost savings, and have been identified as a key climate strategy to reduce GHG emissions from the U.S. transportation sector. The interest in EVs has grown alongside greater EV model availability and increased vehicle range. Every major auto manufacturer in the world has announced a plan to electrify a significant portion of their vehicle fleets over the next 3-5 years. Ford recently announced an $11 billion investment to reach their goal of 40 EV models by 2022 (3). The goal for GM: 20 EV models by 2023 (4); for VW: 27 EV models by 2022 (5); for Toyota: 10 BEVs by the early 2020's (6); and similar goals for Volvo, Daimler, Nissan, BMW, and Fiat-Chrysler.

However, the lack of access to EV charging stations continues to be a critical barrier to EV adoption. In particular, there are significant logistical barriers for commercial building tenants to upgrade existing electrical infrastructure and install new EV charging stations.

A lack of pre-existing EV charging infrastructure, such as electrical panel capacity, raceways, and pre-wiring, can make the installation of a new charging station cost-prohibitive for a potential EV-owner. The installation of an EV charging station is made three to four times less expensive when the infrastructure is installed during the initial construction phase as opposed to retrofitting existing buildings to accommodate the new electrical equipment.

New commercial buildings are constructed to last for decades, and so it is critical that EV charging infrastructure is incorporated at the pre-construction stage to ensure that new buildings can accommodate the charging needs of future EV-owners.

Bibliography:

1. "Monthly Plug-In EV Sales Scorecard." Inside EVs: Monthly U.S. Plug-in EV Sales Report Card. Accessed January 2019. https://insideevs.com/monthly-plug-in-sales-scorecard/.
2. Edison Electric Institute. *Electric Vehicle Sales Forecast and the Charging Infrastructure Required Through 2030.* Report. November 2018.

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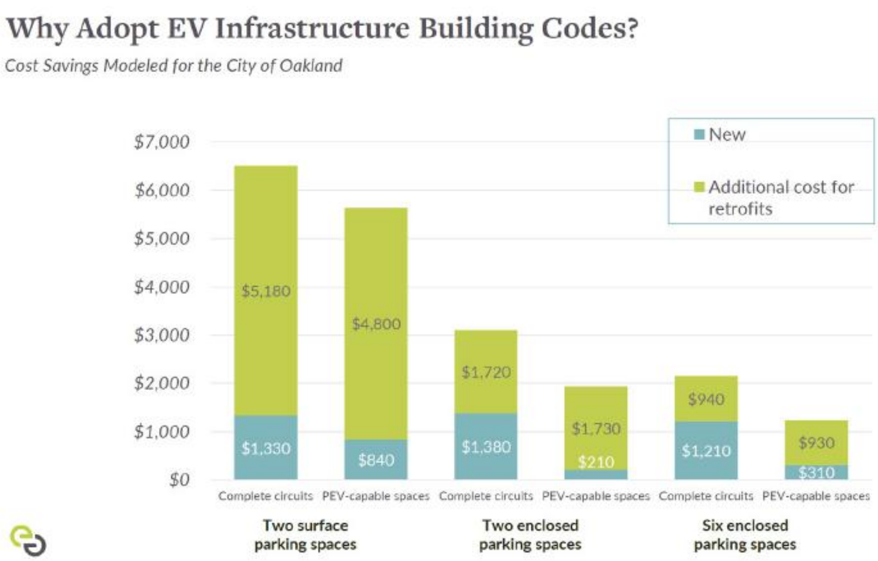
5. Evarts, Eric C. "VW Plans 27 Electric Cars by 2022 on New Platform." Green Car Reports. September 19, 2018. Accessed January 2019. https://www.greencarreports.com/news/1118857_vw-plans-27-electric-cars-by-2022-on-new-platform.
6. Kageyama, Yuri. "Toyota Planning 10 Purely Electric Vehicles by 2020s." USA Today. December 18, 2017. Accessed January 2019. https://www.usatoday.com/story/money/cars/2017/12/18/toyota-planning-10-purely-electric-vehicles-2020-s/960486001/.
7. Pike, Ed. *EV Infrastructure Building Codes*.Report. June 2018. Accessed January 2019. http://roadmapforth.org/program/presentations18/EdPike.pdf.
8. *ELECTRIC VEHICLE (EV) CHARGING INFRASTRUCTURE: MULTIFAMILY BUILDING STANDARDS.* Report. April 2018. Accessed January 2019. https://arb.ca.gov/cc/greenbuildings/pdf/tcac2018.pdf.
9. "NFPA 70®." NFPA Reports - Fires in the United States. Accessed January 2019. https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70.

Cost Impact: The code change proposal will increase the cost of construction
The code change proposal will increase the cost of initial construction, but provide long-term savings for EV owners through the avoided retrofit costs of installing EV charging infrastructure.

The chart below compares the cost of installing the necessary electrical infrastructure to support EV-Ready spaces (complete circuit) and an EV-Capable spaces (PEV-capable) at the time of new construction versus a building retrofit. In one example, the cost to retrofit an existing building with two EV-Capable spaces is $5,640, and $4,800 or 85 percent of that cost would be avoided if EV-Capable infrastructure was included during the initial construction of the parking lot. These additional retrofit costs typically include labor expenses for demolition, treching and boring, balancing the circuits, and new permitting costs.



In April, 2018, the California Air Resources Board published a cost analysis for a proposed code change to increase the required percentage of EV-Capable spaces. (8)

"Avoided Retrofit Costs: Significant retrofit costs can be avoided by installing EV charging infrastructure in new construction. CARB staff reviewed multiple sources to obtain average retrofit costs of installing infrastructure to support Level 2 charging stations in existing buildings. An estimated $7,000 per parking space can be avoided with multiple installations of Level 2 charging stations. An estimated $8,000 per parking space can be avoided when an individual Level 2 charging station is installed. These retrofit costs do not include the cost of the electrical vehicle supply equipment (EVSE). Retrofit costs are focused on parking lot trenching, adding electrical service and/or panel upgrades. The 10 percent requirement would result in the installation of an additional 38,000 to 47,000 parking spaces with EV charging infrastructure beyond the current 3 percent requirement. If the proposed 10% requirement is not adopted, CARB staff assumed that every one of these parking spaces would need the basic EV charging infrastructure (raceway and panel capacity) to become EV Capable and support future installation of Level 2 charging stations. CARB staff estimates that the avoided retrofit costs range from $272 million to $386 million between 2020 and 2025."

CE217-19 Part I

Public Hearing Results

Committee Action: **As Modified**

Committee Modification: Electric Vehicle. An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, and electric motorcycles, primarily powered by an electric motor that draws current from a building electrical service, EVSE, a rechargeable storage battery, a fuel cell, a photovoltaic array, or another source of electric current.
EV READY SPACE. A designated parking space which is provided with one ~~40~~ 50-ampere, 208/240-volt dedicated branch circuit for a future dedicated Level 2 EVSE servicing*Electric Vehicles*. The circuit shall terminate in a ~~suitable termination~~ NEMA 6-50 or NEMA 14-50 receptacle or a suitable electrical connector rated for 208/240 or greater service. The circuit shall have no other outlets. The service panel shall include an over-current protective device and provide sufficient capacity and space to accommodate the circuit and over-current protective device ~~point such as a receptacle, junction box, or an *EVSE*,~~ and be located in close proximity to the proposed location of the EV parking spaces.

C405.10 Electric Vehicle (EV) charging for new construction (Mandatory). New construction shall facilitate future installation and use of *Electric Vehicle Supply Equipment (EVSE)*in accordance with the NFPA 70.

C405.10.2. Identification. Construction documents shall indicate the raceway termination point and proposed location of future EV spaces and EVSEs ~~chargers~~. Construction documents shall also provide information on amperage of future *EVSE*, raceway methods, wiring schematics and electrical load calculations to verify that the electrical panel service capacity and electrical system, including any on-site distribution transformers, have sufficient capacity to simultaneously charge all EVs at all required EV spaces at the full rated amperage of the *EVSE*.

C405.10.1. New ~~commercial~~ buildings. EV Ready Spaces and EV Capable Spaces shall be provided in accordance with Table C405.10.1. Where the calculation of percent served results in a fractional parking space, it shall be shall rounded up to the next whole number. The service panel or sub panel circuit directory shall identify the spaces reserved to support EV charging as “EV Capable” or “EV Ready”. The raceway location shall be permanently and visibly marked as “EV Capable”.

Committee Reason: This is a health and safety issue so people do not run power cords out their windows to power vehicles. The cost assessment was very modest. The modification clarified application (Vote: 12-3).

Assembly Action: **None**

CE217-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC®: C405.10 (New)

Proponents:
Craig Conner, representing self (craig.conner@mac.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Energy Conservation Code

C405.10 **Electric vehicle charging spaces.** In new construction Group E, M, R-1 and R-2 buildings with 5*0* or more passenger vehicle parking spaces shall provide two EV Ready 50-ampere, 208/240-volt branch circuits per 50 passenger vehicle parking spaces. The number of spaces required shall be rounded up to the nearest even number.

The branch circuit shall be identified as “EV READY” in the service panel or subpanel directory, and the termination location shall be marked as “EV READY”. The circuit shall terminate in a NEMA receptacle or a Society of Automotive Engineers (SAE) standard J1772 electrical connector.

Exceptions:

1. Parking spaces and garage spaces intended exclusively for storage of vehicles for retail sale or vehicle service.
2. This requirement will be considered met if all spaces which are not EV Ready are separated from the meter by a public right-of-way.

Commenter's Reason: The general goal of CE2117 Part 1 make sense. However, there are multiple issues of CE217 Part 1

- 20% of the parking spaces for EVs is way too many. There are not nearly enough electric vehicles now or projected in the near term to justify 20% of the parking spaces.

- This applies to all use groups, even those unlikely to have many EVs.

- Wording is confusing. For example, having both “EV Ready and "EV Capable” could be confusing

- If there is only 1 or 2 spaces the table says all parking must be EV.

This comment

- lowers the percentage of EV ready parking spaces to 4% (2 per 50 is 4%).

- has no requirement for buildings with less than 50 parking spaces.

- specifies an even number of EV ready parking spaces because many commercial charging units are made for 2 cars per stations. The (future) charging station sets between two parking spaces with charging lines to both parking spaces.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This change will add costs.

Adding new EV capacity for charging during construction costs much less than retrofitting, as retrofitting often requires retrenching, rewiring or upgrades to electric panels.

Public Comment# 2161

Public Comment 2:

IECC®: APPENDIX CEV (New), CEV100 (New), 202 (New), CEV 101.1 (New), CEV 101.2 (New), TABLE CEV 101.2 (New), CEV 101.3. (New)

Proponents:
Margo Thompson, Newport Ventures, representing National Multifamily Housing Council (mthompson@newportventures.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

APPENDIX CEV
Electric Vehicle Charging Capability for New Construction

CEV100 Definitions The following words and terms shall, for the purposes of this appendix, having the meansings shown herein. Refer to Chapter 2 of this code for general definitions.

ELECTRIC VEHICLE. An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, and electric motorcycles, primarily powered by an electric motor that draws current from a building electrical service, EVSE, a rechargeable storage battery, a fuel cell, a photovoltaic array, or another source of electric current.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the Electric Vehicle.

EV CAPABLE SPACE. Electrical panel capacity and space to support a minimum 50-ampere, 208/240-volt branch circuit for each EV parking space, and the installation of raceways, both underground and surface mounted, to support the *EVSE*.

EV READY SPACE. A designated parking space which is provided with one 50-ampere, 208/240-volt dedicated branch circuit for a future dedicated Level 2 EVSE servicing *Electric Vehicles*. The circuit shall terminate in a NEMA 6-50 or NEMA 14-50 receptacle or a suitable electrical connector rated for 208/240 or greater service. The circuit shall have no other outlets. The service panel shall include an over-current protective device and provide sufficient capacity and space to accommodate the circuit and over-current protective device and be located in close proximity to the proposed location of the EV parking spaces.

~~C405.10.~~ CEV 101.1 Electric Vehicle (EV) charging for new construction (Mandatory). New construction shall facilitate future installation and use of *Electric Vehicle Supply Equipment (EVSE)* in accordance with the NFPA 70.

~~C405.10.1.~~ CEV 101.2 New buildings. *EV Ready Spaces* and *EV Capable Spaces* shall be provided in accordance with Table ~~C405.10.1~~. CEV 101.2. Where the calculation of percent served results in a fractional parking space, it shall be shall rounded up to the next whole number. The service panel or sub panel circuit directory shall identify the spaces reserved to support EV charging as "EV Capable" or "EV Ready". The raceway location shall be permanently and visibly marked as "EV Capable".

TABLE ~~C405.10.1.~~ CEV 101.2
EV READY SPACE AND EV CAPABLE SPACE REQUIREMENTS

Total Number of Parking Spaces	Minimum number of EV Ready Spaces	Minimum number of *EV Capable Spaces*
1	1	-
2 – 10	2	-
11 – 15	2	3
16 – 19	2	4
21 - 25	2	5
26+	2	20% of total parking spaces

~~C405.10.2.~~ **CEV 101.3. Identification.** Construction documents shall indicate the raceway termination point and proposed location of future EV spaces and EVSEs. Construction documents shall also provide information on amperage of future *EVSE*, raceway methods, wiring schematics and electrical load calculations to verify that the electrical panel service capacity and electrical system, including any on-site distribution transformers, have sufficient capacity to simultaneously charge all EVs at all required EV spaces at the full rated amperage of the *EVSE*.

Commenter's Reason: Reason: A report by the International Council on Clean Transportation found that there is wide variation in the prevalence of electric vehicles (EVs) on the road across the country. While there are large numbers of electric vehicles on the east and west coasts of the U.S., the vast majority of the country is not even close to a 2% market penetration of EVs. Requirements for EV charging capability and dedicated parking spaces should be left up to local jurisdictions, for instance, local planning and zoning boards which can tailor the requirements to the existing and anticipated conditions in their locale. Local factors vary significantly and include potential policies supporting EVs or emission reductions; utility integration issues which may or may not favor added EV charging, etc. While 20% EV capable parking spaces might be the right number in one city or town, it may be too few or too many for another. By moving these new provisions to an Appendix - rather than as part of the body of the Energy Code - a template is provided for jurisdictions to use and modify in a manner that they deem appropriate for their locale. It is important to support and encourage increased use of electric vehicles in order to reduce carbon emissions, but it must be done in a manner that suits local conditions rather than an across-the-board, one-size-fits-all mandate.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposal As Submitted would increase the cost of construction - especially since adding 20% *EV Capable* parking spaces may not even be warranted. A typical multifamily building may have 500 parking spaces. The proposal would require 100 *EV capable* electric circuits and 4,000 amps minimum extra capacity in the panel box. Furthermore, space allotted for *EV capable* parking must be greater than that for standard parking spaces in order to allow for the charging post. A cost analysis performed by the National Multifamily Housing Council found that creating **four** *EV capable* charging stations would cost approximately $5,000.

By moving the proposed language to an Appendix, this Public Comment does not increase or decrease the cost of construction. It allows local jurisdictions to develop policies related to Electric Vehicles that are practical and cost effective for their constituents.

Public Comment# 1553

Public Comment 3:

Proponents:
Barry Greive, Target Corp, representing Target Corp (barry.greive@target.com)

requests Disapprove

Commenter's Reason: This proposal is way to restrictive, the numbers are not rational. For small businesses the numbers would be in additional to accessible spaces. If an owner had room for 11 parking spaces in front of their building, 2 would need to be EV ready, 3 would need to be EV capable and 1 would need to be accessible. In some states the EV parking space also needs to be accessible. This leaves the owner with 8 spaces for everyone else to park, for the time until the other spaces are mandated, at that time there will be almost no parking left for non EV users, this is far to restrictive.
In a large building or shopping center, if the parking lot has 500 parking spaces which is mandated by local zoning codes. The parking lot would need 9 accessible parking spaces, 2 EV ready spaces and 100 EV capable spaces. While for a large parking field 2 EV ready spaces is much more reasonable, the 100 EV capable spaces is a huge waste of resources.

The proponent needs to come back with more reasonable numbers that work for all situations.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1836

Public Comment 4:

Proponents:
Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

requests Disapprove

Commenter's Reason: A requirement to install electric vehicle charging stations should not be set in place in a minimum code. The intent of the IECC is "This code shall regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building". Installing electric vehicle charging stations does not deal with the building or conserving energy within the building. This type of proposal is better suited for a green code and not a minimum base code. This does not allow for innovation of new technology for other forms of transportation. This is a market driven application and should not be mandated.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The original code change will increase the cost of construction but the public comment if accepted will have no effect on the cost of construction because there will be no change to the code.

Public Comment# 1470

Public Comment 5:

Proponents:
Ted Williams, representing American Gas Association (twilliams@aga.org)

requests Disapprove

Commenter's Reason: Promotion on electric vehicle charging infrastructure for vehicle market benefits is outside the scope and purpose of the IECC. The proposal does not address building energy conservation, which is the scope and purpose of IECC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 2097

CE217-19 Part II

IECC: R202 (IRC N1101.6), R404.2 (IRC N1104.2) (New), R404.2.1 (IRC N1104.2.1) (New), R404.2.2 (IRC N1104.2.2) (New), Table R404.2.2 (IRC N1104.2.2) (New), R404.2.3 (IRC N1104.2.3) (New)

Proposed Change as Submitted

Proponents: Matt Frommer, Southwest Energy Efficiency Project, representing Southwest Energy Efficiency Project (mfrommer@swenergy.org); Eric Makela, New Buildings Institute, representing New Buildings Institute (ericM@newbuildings.org); jim edelson, representing New Buildings Institute (jim@newbuildings.org); Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Francesca Wahl (fwahl@tesla.com)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6)
GENERAL DEFINITIONS

Add new definition as follows:

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the Electric Vehicle.

EV CAPABLE SPACE. Electrical panel capacity and space to support a minimum 40-ampere, 208/240-volt branch circuit for each EV parking space, and the installation of raceways, both underground and surface mounted, to support the *EVSE*.

EV READY SPACE. A designated parking space which is provided with one 40-ampere, 208/240-volt dedicated branch circuit for *EVSE* servicing Electric Vehicles. The circuit shall terminate in a suitable termination point such as a receptacle, junction box, or an *EVSE*, and be located in close proximity to the proposed location of the EV parking spaces.

Add new text as follows:

R404.2 (IRC N1104.2) Electric Vehicle (EV) charging for new construction. New construction shall facilitate future installation and use of *Electric Vehicle Supply Equipment (EVSE)* in accordance with the *National Electrical Code (NFPA 70).*

R404.2.1 (IRC N1104.2.1) One- to two-family dwellings and townhouses. For each dwelling unit, provide at least one *EV Ready Space*. The branch circuit shall be identified as “EV Ready” in the service panel or subpanel directory, and the termination location shall be marked as “EV Ready”.

Exception: *EV Ready Spaces* are not required where no parking spaces are provided.

R404.2.2 (IRC N1104.2.2) Multifamily dwellings (three or more units). *EV Ready Spaces* and *EV Capable Spaces* shall be provided in accordance with Table R404.2.2. Where the calculation of percent served results in a fractional parking space, it shall round up to the next whole number. The service panel or subpanel circuit directory shall identify the spaces reserved to support EV charging as “EV Capable” or “EV Ready”. The raceway location shall be permanently and visibly marked as “EV Capable”.

Table R404.2.2 (IRC N1104.2.2)
***EV Ready Space* and *EV Capable Space* requirements.**

Total Number of Parking Spaces	**Minimum number of *EV Ready Spaces***	**Minimum number of *EV Capable Spaces***
1	1	-
2 – 10	2	-
11 – 15	2	3
16 – 19	2	4
21 - 25	2	5
26+	2	20% of total parking spaces

R404.2.3 (IRC N1104.2.3) Identification. Construction documents shall indicate the raceway termination point and proposed location of future EV spaces and EV chargers. Construction documents shall also provide information on amperage of future *EVSE*, raceway methods, wiring schematics and electrical load calculations to verify that the electrical panel service capacity and electrical system, including any on-site distribution transformers, have sufficient capacity to simultaneously charge all EVs at all required EV spaces at the full rated amperage of the *EVSE*.

Reason: In the United States, electric vehicle (EV) sales increased by 80 percent from 2017 to 2018 (1). According to a November 2018 forecast from the Edison Electric Institute, the number of EVs on U.S. roads is projected to grow from 1 million vehicles at the end of 2018, to 18.7 million by 2030. To recharge these new EVs, the U.S. will need 9.6 million charge ports, a substantial portion of which will be installed in workplace and commercial buildings (2).

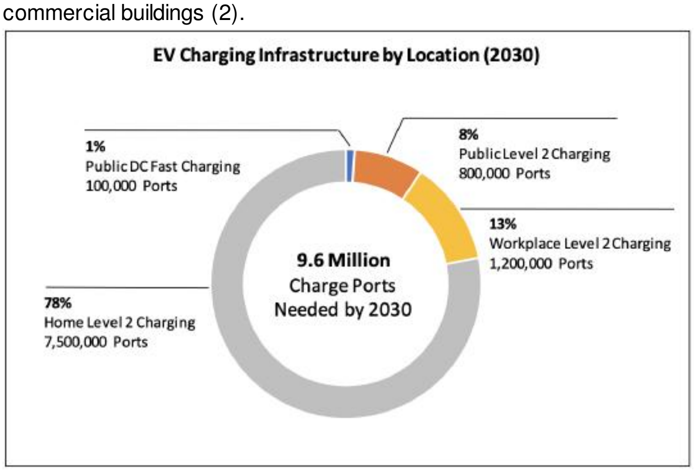


Figure 1. EV Charging Infrastructure in 2030 Based on EEI/IEI Forecast.

EVs provide significant economic benefits for consumers through fuel and maintenance cost savings, and have been identified as a key climate strategy to reduce GHG emissions from the U.S. transportation sector. The interest in EVs has grown alongside greater EV model availability and increased vehicle range. Every major auto manufacturer in the world has announced a plan to electrify a significant portion of their vehicle fleets over the next 3-5 years. Ford recently announced an $11 billion investment to reach their goal of 40 EV models by 2022 (3). The goal for GM: 20 EV models by 2023 (4); for VW: 27 EV models by 2022 (5); for Toyota: 10 BEVs by the early 2020's (6); and similar goals for Volvo, Daimler, Nissan, BMW, and Fiat-Chrysler.

However, the lack of access to EV charging stations continues to be a critical barrier to EV adoption. In particular, there are significant logistical barriers for commercial building tenants to upgrade existing electrical infrastructure and install new EV charging stations.

A lack of pre-existing EV charging infrastructure, such as electrical panel capacity, raceways, and pre-wiring, can make the installation of a new charging station cost-prohibitive for a potential EV-owner. The installation of an EV charging station is made three to four times less expensive when the infrastructure is installed during the initial construction phase as opposed to retrofitting existing buildings to accommodate the new electrical equipment.

New commercial buildings are constructed to last for decades, and so it is critical that EV charging infrastructure is incorporated at the pre-construction stage to ensure that new buildings can accommodate the charging needs of future EV-owners.

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1. "Monthly Plug-In EV Sales Scorecard." Inside EVs: Monthly U.S. Plug-in EV Sales Report Card. Accessed January 2019. https://insideevs.com/monthly-plug-in-sales-scorecard/.
2. Edison Electric Institute. *Electric Vehicle Sales Forecast and the Charging Infrastructure Required Through 2030.* Report. November 2018.

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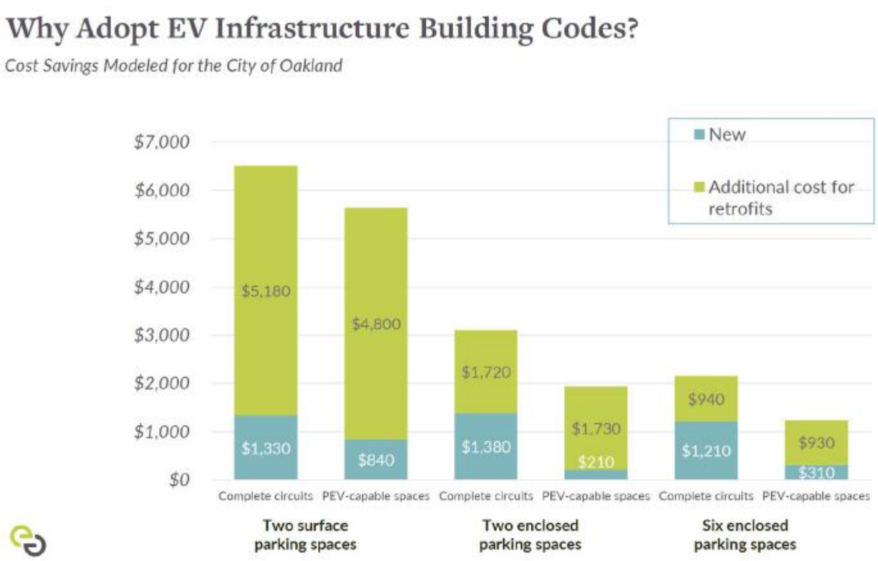
9. "NFPA 70®." NFPA Reports - Fires in the United States. Accessed January 2019. https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70.

Cost Impact: The code change proposal will increase the cost of construction
The code change proposal will increase the cost of initial construction, but provide long-term savings for EV owners through the avoided retrofit costs of installing EV charging infrastructure.

The chart below compares the cost of installing the necessary electrical infrastructure to support EV-Ready spaces (complete circuit) and an EV-Capable spaces (PEV-capable) at the time of new construction versus a building retrofit. In one example, the cost to retrofit an existing building with two EV-Capable spaces is $5,640, and $4,800 or 85 percent of that cost would be avoided if EV-Capable infrastructure was included during the initial construction of the parking lot. These additional retrofit costs typically include labor expenses for demolition, treching and boring, balancing the circuits, and new permitting costs.



In April, 2018, the California Air Resources Board published a cost analysis for a proposed code change to increase the required percentage of EV-Capable spaces. (8)

"Avoided Retrofit Costs: Significant retrofit costs can be avoided by installing EV charging infrastructure in new construction. CARB staff reviewed multiple sources to obtain average retrofit costs of installing infrastructure to support Level 2 charging stations in existing buildings. An estimated $7,000 per parking space can be avoided with multiple installations of Level 2 charging stations. An estimated $8,000 per parking space can be avoided when an individual Level 2 charging station is installed. These retrofit costs do not include the cost of the electrical vehicle supply equipment (EVSE). Retrofit costs are focused on parking lot trenching, adding electrical service and/or panel upgrades. The 10 percent requirement would result in the installation of an additional 38,000 to 47,000 parking spaces with EV charging infrastructure beyond the current 3 percent requirement. If the proposed 10% requirement is not adopted, CARB staff assumed that every one of these parking spaces would need the basic EV charging infrastructure (raceway and panel capacity) to become EV Capable and support future installation of Level 2 charging stations. CARB staff estimates that the avoided retrofit costs range from $272 million to $386 million between 2020 and 2025."

CE217-19 Part II

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: It may be commendable but there is no demonstration of energy savings or relationship to building energy efficiency. It does not belong in energy codes (Vote: 8-3).

Assembly Action: **None**

CE217-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC®: 202 (New), R404.2.1 (IRC N1104.2.1) (New)

Proponents:
Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Matthew Frommer, representing Southwest Energy Efficiency Project (mfrommer@swenergy.org); Eric Makela, representing New Buildings Institute (ericm@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

ELECTRIC VEHICLE (EV). An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, and electric motorcycles, primarily powered by an electric motor that draws current from a building electrical service, electric vehicle supply equipment, a rechargeable storage battery, a fuel cell, a photovoltaic array, or another source of electric current.

EV CAPABLE SPACE. ~~Electrical panel capacity and space to support a minimum 40-ampere, 208/240-volt branch circuit for each EV parking space, and the installation of raceways, both underground and surface mounted, to support the *EVSE*.~~ A designated parking space which is provided with a listed raceway capable of accommodating a 40-ampere minimum 208/240-volt dedicated branch circuit for each future EV Ready parking space. Raceways shall not be less than trade size 1 (nominal 1-inch inside diameter). Raceways shall originate at the main service or subpanel and shall terminate into a listed cabinet, box, or enclosure in close proximity to the proposed location of the EV Capable parking spaces. Raceways are required to be continuous at enclosed, inaccessible or concealed areas and spaces. The service panel and/or subpanel shall provide capacity to install a 40-ampere minimum 208/240-volt dedicated branch circuit and space(s) reserved to permit installation of a branch circuit overprotection device.

EV READY SPACE. A designated parking space which is provided with one minimum 40-ampere, 208/240-volt dedicated branch circuit for *EVSE* servicing Electric Vehicles. The circuit shall terminate in a suitable termination point such as a receptacle, junction box, or an *EVSE*, and be located in close proximity to the proposed location of the EV Ready parking spaces.

R404.2.1 (IRC N1104.2.1) One- to two-family dwellings and townhouses. For each dwelling unit, provide at least one *EV Ready Space*. The branch circuit shall be identified as "EV Ready" in the service panel or subpanel directory, and the termination location shall be marked as "EV Ready".

~~**Exception**~~ **Exceptions:**

1. *EV Ready Spaces* are not required where no parking spaces are provided.
2. This section does not apply to parking spaces used exclusively for trucks or delivery vehicles.

Commenter's Reason:
This public comment adds a definition, improves the requirement specification for EV Capable parking spaces, and clarifies that parking spaces used for trucks and delivery vehicles would not be affected. The public comment also addresses the positive effect the proposal would have on total household energy spending.

In the United States, electric vehicle (EV) sales increased by 80 percent from 2017 to 2018 (1). According to a November 2018 forecast from the Edison Electric Institute, the number of EVs on U.S. roads is projected to grow from 1 million vehicles at the end of 2018, to 18.7 million by 2030. To recharge these new EVs, the U.S. will need 9.6 million charge ports, a substantial portion of which will be installed in single and multi-family residential buildings (2).

EVs provide significant economic benefits for consumers through fuel and maintenance cost savings, and have been identified as a key climate strategy to reduce GHG emissions from the U.S. transportation sector. The interest in EVs has grown alongside greater EV model availability and increased vehicle range. Every major auto manufacturer in the world has announced a plan to electrify a significant portion of their vehicle fleets over the next 3-5 years. Ford recently announced an $11 billion investment to reach their goal of 40 EV models by 2022 (3). The goal for GM: 20 EV models by 2023 (4); for VW: 27 EV models by 2022 (5); for Toyota: 10 BEVs by the early 2020's (6); and similar goals for Volvo, Daimler, Nissan, BMW, and Fiat-Chrysler.

A lack of pre-existing EV charging infrastructure, such as electrical panel capacity, raceways, and pre-wiring, can make the installation of a new charging station cost-prohibitive for a potential EV-owner. The installation of an EV charging station is made three to four times less expensive when the infrastructure is installed during the initial construction phase as opposed to retrofitting existing buildings to accommodate the new electrical equipment. New residential buildings are constructed to last for decades, and so it is critical that EV charging infrastructure is incorporated at the preconstruction stage to ensure that new buildings can accommodate the charging needs of future EV-owners.

Increased adoption of EVs will have a positive effect on overall U.S. household energy spending and carbon emissions. In terms of energy savings, EV fuel economy is, on average, more than three times more efficient than conventional gasoline-fueled counterparts. Even when compared over the full lifecycle of fuel production and use, the average EV consumes less than half the energy per vehicle mile traveled. (10) (11) NRDC and EPRI found that if 50 percent of personal vehicle miles traveled were powered by electricity in 2050, the U.S. would realize annual emissions reductions of 550 million metric tons of carbon dioxide. (12) The code change in place by the time adoption rates are expected to accelerate would facilitate adoption of EVs and therefore lead to more efficient energy consumption and lower household carbon emissions.

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Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The code change proposal will increase the cost of initial construction, but provide long-term savings for EV owners through the avoided retrofit costs of installing EV charging infrastructure.

One- and two- family dwellings: Additional costs include the price and labor associated with the installation of one 40-ampere, 208/240-volt dedicated branch circuit and a circuit terminating in a receptacle, junction box, or EVSE. The proposed code will allow current and future EV-owners to avoid the cost of electrical equipment upgrades, demolition, and permitting for future retrofits.

Multi-family residential (3 or more units): In one example, the cost estimate to retrofit an existing building with two EV-Capable spaces is $5,640, and $4,800 or 85 percent of that cost would be avoided if EV-Capable infrastructure was included during the initial construction of the parking lot. These additional retrofit costs typically include labor expenses for demolition, treching and boring, balancing the circuits, and new permitting costs.

In April 2018, the California Air Resources Board published a cost analysis for a proposed code change to increase the required percentage of EVCapable spaces. (8) "Avoided Retrofit Costs: Significant retrofit costs can be avoided by installing EV charging infrastructure in new construction. CARB staff reviewed multiple sources to obtain average retrofit costs of installing infrastructure to support Level 2 charging stations in existing buildings. An estimated $7,000 per parking space can be avoided with multiple installations of Level 2 charging stations. An estimated $8,000 per parking space can be avoided when an individual Level 2 charging station is installed. These retrofit costs do not include the cost of the electrical vehicle supply equipment (EVSE). Retrofit costs are focused on parking lot trenching, adding electrical service and/or panel upgrades. The 10 percent requirement would result in the installation of an additional 38,000 to 47,000 parking spaces with EV charging infrastructure beyond the current 3 percent requirement. If the proposed 10% requirement is not adopted, CARB staff assumed that every one of these parking spaces would need the basic EV charging infrastructure (raceway and panel capacity) to become EV Capable and support future installation of Level 2 charging stations. CARB staff estimates that the avoided retrofit costs range from $272 million to $386 million between 2020 and 2025."

Public Comment# 1603

Public Comment 2:

IECC®: 202 (New), Table R404.2.2 (IRC N1104.2.2) (New)

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

EV CAPABLE SPACE. Electrical panel capacity and space to support a minimum ~~40~~ 50-ampere, 208/240-volt branch circuit for each EV parking space, and the installation of raceways, both underground and surface mounted, to support the *EVSE*.

EV READY SPACE. A designated parking space which is provided with one ~~40~~ 50-ampere, 208/240-volt dedicated branch circuit for a future dedicated Level 2 *EVSE* servicing Electric Vehicles. The circuit shall terminate in a NEMA 6-50 or NEMA 14-50 receptacle or suitable electrical connector rated for 208/240 Volt or greater service. The circuit shall have no other outlets ~~suitable termination point such as a receptacle, junction box, or an *EVSE*,~~ and be located in close proximity to the proposed location of the EV parking spaces.

Table R404.2.2 (IRC N1104.2.2)
***EV Ready Space* and *EV Capable Space* requirements.**

Total Number of Parking Spaces	**Minimum number of *EV Ready Spaces***	**Minimum number of *EV Capable Spaces***
1	1	-
2 – 10	~~2~~ 1	-
11 – 15	~~2~~ 1	~~3~~ 2
16 – 19	~~2~~ 1	~~4~~ 2
21 - 25	~~2~~ 1	~~5~~ 3
26+	2	~~20~~ 10% of total parking spaces

Commenter's Reason: This modification will improve the proposed definitions and have language that is consistent with the language approved for CE 217, Part I.
This modification will also reduce the costs of this proposal compared to the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The installation of EV charging infrastructure will increase construction costs, but reduce transportation energy costs for vehicle owners.

Public Comment# 1350

Public Comment 3:

Proponents:
Tim Ryan, International Association of Building Officials, representing IABO

requests Disapprove

Commenter's Reason: The International Association of Building Officials is opposed to this proposed change as it goes beyond the scope and intent of the ICC Codes, including the IECC. This provision does not support energy efficiency of buildings but conserves energy while providing convenience to owners of electric vehicles. The primary supporting testimony from proponents of this change was based on the expectation of increased car sales; that certain major cities have adopted similar provisions for their respective jurisdictions; and to address forward thinking. The testimony indicates that these types of requirements tend to be more market driven and are political issues which should be addressed by local and state governance bodies and not by model building codes. Such requirements are more appropriate within land usage and zoning regulations. While the proponents recognized several major jurisdictions that have adopted such provisions, it should be recognized that not all jurisdictions agree with such provisions and have considered this issue a private business issue. Therefore, IABO is recommending disapproval of CE217-19 part II

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1832

CE218-19

IECC: C406, C406.1, TABLE C406.1(1) (New), TABLE C406.1(12) (New), TABLE C406.1(3) (New), TABLE C406.1(4) (New), TABLE C406.1(5) (New), C406.1.1, C406.2, C406.2.1 (New), C406.2.2 (New), C406.2.3 (New), C406.2.4 (New), C406.5, C406.5.1 (New), C406.5.2 (New), C406.7 (New), C406.7, C406.7.1, C406.7.3 (New), C406.7.4 (New)

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing Northwest Energy Codes Group (ericM@newbuildings.org)

2018 International Energy Conservation Code

Revise as follows:

SECTION C406
ADDITIONAL EFFICIENCY REQUIREMENTS ~~PACKAGE OPTIONS~~

C406.1 ~~Requirements.~~ Additional energy efficiency credit requirements. ~~Buildings shall comply~~ New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Alternatively, credits shall be calculated in accordance with the relevant subsection of C406. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9

Add new text as follows:

TABLE C406.1(1)
Additional Energy Efficiency Credits for Group B Occupancy

Sub-section / Climate Zone:	**1A**	**1B**	**2A**	**2B**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6 A**	**6 B**	**7**	**8**
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	1	1	NA	1
C406 .2.2: 5% Cooling Eff Imprv.	6	6	5	5	4	4	3	3	3	2	2	2	1	2	2	2	1
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	2	1	1	2	2	NA	1
C406 .2.4: 10 % Cooling Eff Imprv.	11	12	10	9	7	7	6	5	6	4	4	5	3	4	3	3	3
C406 .3: Reduced Light Power	9	8	9	9	9	9	10	8	9	9	7	8	8	6	7	7	6
C406 .4: Enh. Digital Light Ctrl	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1
C406 .5.1: On-site Renewable Egy.	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
C406 .6 : Dedicated OA Sys (DOAS)	4	4	4	4	4	3	2	5	3	2	5	3	2	7	4	5	3
C406 .7.2: Recovered/Renew SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .7.3: Eff fossil fuel SWH [b]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .7.4: Heat Pump SWH [b]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .8: Enhanced Envelope Perf	1	4	2	4	4	3	NA	7	4	5	10	7	6	11	10	14	16
C406 .9: Reduced Air Infiltration	2	1	1	2	4	1	NA	8	2	3	11	4	1	15	8	11	6

TABLE C406.1(2)
Additional Energy Efficiency Credits for Group R and I Occupancies

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	NA	NA	1	NA	1	1	1	1	2	1	2	2
C406 .2.2: 5% Cooling Eff Imprv.	3	3	2	2	1	1	1	1	1	NA	1	1	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	NA	1	NA	NA	1	1	1	2	2	1	3	2	3	4
C406 .2.4: 10 % Cooling Eff Imprv.	5	5	4	3	2	3	1	2	2	1	1	1	1	1	1	1	1
C406 .3: Reduced Light Power	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2
C406 .4: Enh. Digital Light Ctrl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .5.1: On-site Renewable Egy.	8	8	8	8	7	8	8	7	7	7	7	7	7	7	7	7	7
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	4	2	NA	6	3	4	8	5	5	10	7	11	12
C406 .7.2: Recovered/Renew SWH	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406 .7.3: Eff fossil fuel SWH	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406 .7.4: Heat Pump SWH	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406 .8: Enhanced Envelope Perf	3	6	3	5	4	4	1	4	3	3	4	5	3	5	4	6	6
C406 .9: Reduced Air Infiltration	6	5	3	11	6	4	NA	7	3	3	9	5	1	13	6	8	3

TABLE C406.1(3)
Additional Energy Efficiency Credits for Group E Occupancies

Sub-section / Climate Zone:	**1A**	**1B**	**2A**	**2B**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6 A**	**6 B**	**7**	**8**
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	4
C406 .2.2: 5% Cooling Eff Imprv.	4	4	3	3	2	2	2	2	1	1	1	1	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	3	4	3	4	3	4	3	5	7
C406 .2.4: 10 % Cooling Eff Imprv.	7	8	7	6	5	4	3	4	3	1	2	2	1	2	2	2	1
C406 .3: Reduced Light Power	8	8	8	9	8	9	9	8	9	9	8	9	8	7	8	7	7
C406 .4: Enh. Digital Light Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406 .5.1: On-site Renewable Egy.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5
C406 .6 : Dedicated OA Sys (DOAS)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .7.2: Recovered/Renew SWH [a]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C406 .7.3: Eff fossil fuel SWH [a]	NA	1	1	1	1	1	1	2	2	3	2	3	2	3	3	3	5
C406 .7.4: Heat Pump SWH [a]	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	1	1	NA	1	1	1	1
C406 .8: Enhanced Envelope Perf	3	7	3	4	2	4	1	1	3	1	2	3	NA	4	3	6	9
C406 .9: Reduced Air Infiltration	1	1	1	2	NA	NA	NA	NA	NA	NA	1	NA	NA	4	1	4	3

a. For schools with showers or full service kitchens

TABLE C406.1(4)
Additional Energy Efficiency Credits for Group M Occupancy

Sub-section / Climate Zone:	**1A**	**1B**	**2A**	**2B**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6 A**	**6 B**	**7**	**8**
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	NA	1	1	2	2	2	2	3	2	3	4
C406 .2.2: 5% Cooling Eff Imprv.	5	6	4	4	3	3	1	2	2	1	1	2	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	2	4	3	4	5	5	3	6	8
C406 .2.4: 10 % Cooling Eff Imprv.	9	12	9	8	6	6	3	4	4	1	2	3	NA	2	2	2	1
C406 .3: Reduced Light Power	13	13	15	14	16	14	17	15	15	14	12	14	14	16	16	14	12
C406 .4: Enh. Digital Light Ctrl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .5.1: On-site Renewable Egy.	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	6
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	3	3	1	3	2	2	2	3	2	4	3	4	4
C406 .7.2: Recovered/Renew SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .7.3: Eff fossil fuel SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .7.4: Heat Pump SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .8: Enhanced Envelope Perf	4	6	3	4	3	3	1	6	4	4	4	5	4	6	5	8	9
C406 .9: Reduced Air Infiltration	1	1	1	2	1	1	NA	3	1	1	3	2	1	7	3	6	3

TABLE C406.1(5)
Additional Energy Efficiency Credits for Other[a] Occupancies

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	3
C406 .2.2: 5% Cooling Eff Imprv.	5	5	4	4	3	3	2	2	2	1	1	2	1	1	1	1	1
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	2	3	3	3	3	4	3	5	5
C406 .2.4: 10 % Cooling Eff Imprv.	8	9	8	7	5	5	3	4	4	2	2	3	2	2	2	2	2
C406 .3: Reduced Light Power	8	8	9	9	9	9	10	8	9	9	7	8	8	8	8	8	7
C406 .4: Enh. Digital Light Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406 .5.1: On-site Renewable Egy.	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	7
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	4	3	2	5	3	3	5	4	3	7	5	7	6
C406 .7.2: Recovered/Renew SWH[b]	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406 .7.3: Eff fossil fuel SWH [b]	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406 .7.4: Heat Pump SWH [b]	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406 .8: Enhanced Envelope Perf	3	6	3	4	3	4	1	5	4	3	5	5	4	7	6	9	10
C406 .9: Reduced Air Infiltration	3	2	2	4	4	2	NA	6	2	2	6	4	1	10	5	7	4

a. Other occupancy groups include all Groups except for Groups B, R, I, E, and M
b. For occupancy groups listed in C406.7.1

Revise as follows:

C406.1.1 Tenant spaces. Tenant spaces shall comply with sufficient options from Tables C406.1(1) through C406.1(5) to achieve a minimum number of 5 credits, where credits are selected from Section C406.2, C406.3, C406.4, C406.6 or C406.7. ~~Alternatively, tenant spaces shall comply with Section C406.5 where the entire building is in compliance.~~ Where the entire building complies using credits from Section C406.5, C406.8 or C406.9, tenant spaces within the building shall be deemed to comply with this section.

Exception: Previously occupied tenant spaces that comply with this code in accordance with Section C501.

C406.2 More efficient HVAC equipment performance. Equipment shall exceed the minimum efficiency requirements listed in Tables C403.3.2(1) through C403.3.2(~~7) by 10 percent, in addition to the requirements of Section C403. Where multiple performance requirements are provided, the equipment shall exceed all requirements by 10 percent.~~ 9) and *Variable refrigerant flow systems* ~~shall exceed~~ listed in the energy efficiency provisions of ~~ANSI/~~ ASHRAE/IESNA 90.1 ~~by 10 percent.~~ in accordance with Sections C406.2.1, C406.2, C406.2.3 or C406.4. Equipment shall also meet applicable requirements of Section C403. Energy efficiency credits for heating shall be selected from C406.2.1 or C406.2.3 and energy efficiency credits for cooling shall be selected from C406.2.2 or C406.2.4. Selected credits shall include a heating or cooling energy efficiency credit or both. Equipment not listed in Tables C403.3.2(1) through C403.3.2(~~7)~~ 9) and *Variable refrigerant flow systems* not listed in the energy efficiency provisions of ASHRAE/IESNA 90.1 shall be limited to 10 percent of the total building system capacity for heating equipment where selecting Section C406.2.1 or C406.2.3 and cooling equipment where selecting Section C406.2.2 or C406.2.4.

Add new text as follows:

C406.2.1 Five percent heating efficiency improvement. Equipment shall exceed the minimum heating efficiency requirements by 5 percent.

C406.2.2 Five percent cooling efficiency improvement Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 5 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

C406.2.3 Ten percent heating efficiency improvement Equipment shall exceed the minimum heating efficiency requirements by 10 percent.

C406.2.4 Ten percent cooling efficiency improvement. Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 10 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

Revise as follows:

C406.5 On-site renewable energy. Buildings shall comply with Section C406.5.1 or C406.5.2. ~~The total minimum ratings of on-site renewable energy systems shall be one of the following:~~

1. ~~Not less than 1.71 Btu/h per square foot (5.4 W/m²) or 0.50 watts per square foot (5.4 W/m²) of conditioned floor area.~~
2. ~~Not less than 3 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.~~

Add new text as follows:

C406.5.1 **Basic renewable credit.** The total minimum ratings of on-site renewable energy systems not including systems used for credits under Sections C406.7.2, shall be one of the following:

1. Not less than 0.86 Btu/h per square foot (2.7 W/m^2) or 0.25 watts per square foot (2.7 W/m^2) of conditioned floor area.
2. Not less than 2 percent of the annual energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.

C406.5.2 **Enhanced Renewable Credits.** Where the total minimum ratings of on-site renewable energy systems exceeds the rating in C406 .5.1(1), additional energy efficiency credits shall be determined based on Equation 4-13, rounded to the nearest whole number.

$AEEC_{RRa} = AEEC_{2.5} \times RRa / RR_1$ (Equation 4-13)

Where:

$AEEC_{RRa}$ = C406 .5.2 additional energy efficiency credits

RRa = actual total minimum ratings of *on-site renewable energy* systems in Btu/h, watts per square foot or W/m^2)

RR1 = minimum ratings of *on-site renewable energy* systems required by C406 .5.1(1) in Btu/h, watts per square foot or W/m^2)

$AEEC_{2.5}$ = C406 .5.1 credits from Tables C406 .1(1) through C406 .1(5)

C406.7 **Reduced energy use in service water heating.** Buildings shall comply with Section C406.7.1 and Section C406.7.2, C406.7.3 or C406.7.4.

Revise as follows:

~~C406.7~~ C406.7.1 **~~Reduced energy use in service water heating.~~ Building Type** ~~Buildings shall be of the following types to use this compliance method~~ To qualify for this credit, the building shall contain one of the following use groups and the additional energy efficiency credit shall be prorated by conditioned floor area of the portion of the building comprised of the following use groups:

1. *Group R*-1: Boarding houses, hotels or motels.
2. Group I-2: Hospitals, psychiatric hospitals and nursing homes.
3. Group A-2: Restaurants and banquet halls or buildings containing food preparation areas.
4. Group F: Laundries.
5. *Group R*-2.
6. Group A-3: Health clubs and spas.
7. Group E: Schools with full-service kitchens or locker rooms with showers
8. Buildings showing a service hot water load of 10 percent or more of total building energy loads, as shown with an energy analysis as described in Section C407.

~~C406.7.1~~ C406.7.2 **~~Load fraction.~~ Recovered or renewable water heating** The building service water-heating system shall have one or more of the following that are sized to provide not less than ~~60~~ 30 percent of the building's annual hot water requirements, or sized to provide ~~100~~ 70 percent of the building's annual hot water requirements if the building ~~shall otherwise~~ is required to comply with Section C403.9.5:

1. Waste heat recovery from service hot water, heat-recovery chillers, building equipment, or process equipment.
2. *On-site renewable energy* water-heating systems.

Add new text as follows:

C406.7.3 **Efficient fossil fuel water heater.** The combined input-capacity-weighted-average equipment rating of all fossil fuel water heating equipment in the building shall be not less than 95% Et or 0 .95 EF. This option shall receive only half the listed credits for buildings required to comply with C404.2.1.

C406.7.4 **Heat pump water heater** Where electric resistance water heaters are allowed, all service hot water system heating requirements shall be met using heat pump technology with a combined input-capacity-weighted-average EF of 3.0 . Air-source heat pump water heaters shall not draw conditioned air from within the building, except exhaust air that would otherwise be exhausted to the exterior.

Reason: The C406 Option Packages was introduced into the IECC in 2012 as part of the prescriptive method to achieve an additional 4% energy savings over the prescriptive requirements of the code. The original proposal included three additional options (reduced lighting power density, increased HVAC efficiency and renewables). The 2018 IECC now has eight options to select from. In 2018, PNNL performed an analysis to determine the energy savings potential for each of the eight options and found significant savings differences.

How does the proposed measure compare to what 's required in current codes?

The current additional efficiency package options are all considered equal in the 2018 IECC, and any one item must be selected to comply with the extra efficiency provision. However, there is a great deal of variation in the energy savings, as shown in Figure 1.

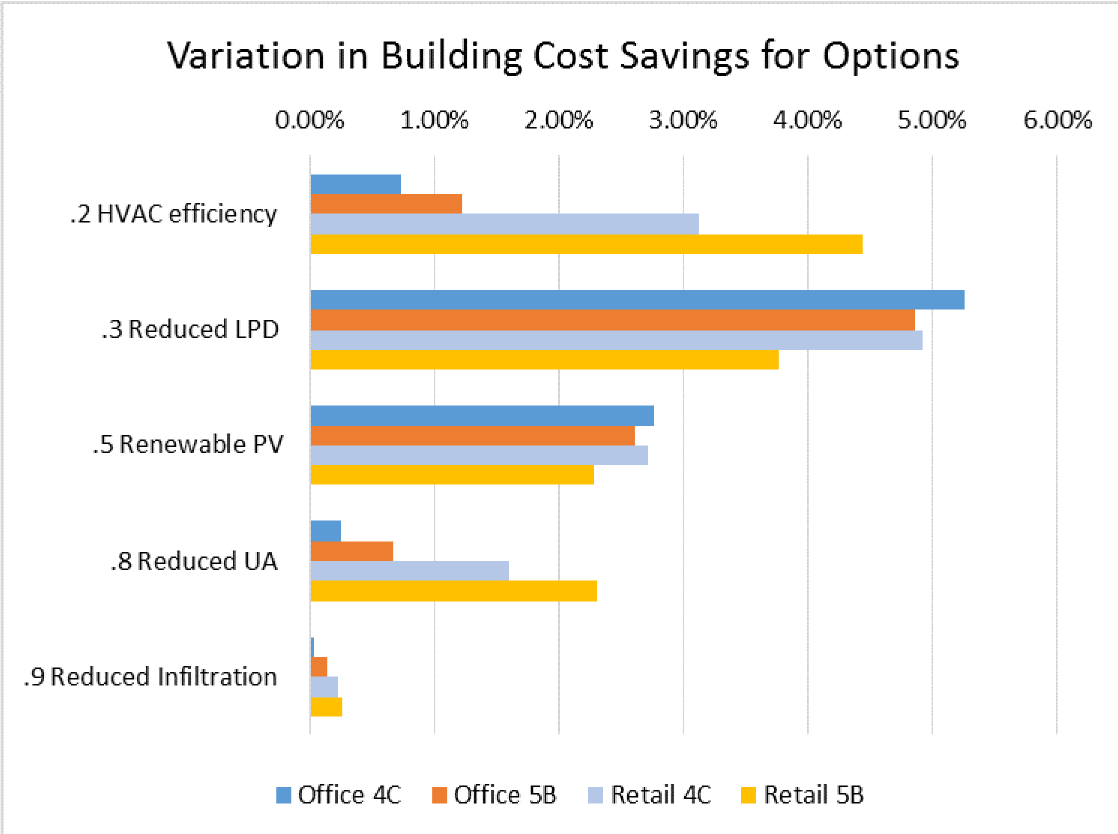

Figure 1

To address this issue PNNL developed a credits based option that provides equity across the efficiency measure options. The analysis is presented in their technical brief "Relative Credits for Extra Efficiency Measures" available at:

https://www.osti.gov/servlets/purl/1490280

https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-28370rev.1.pdf

Technical Analysis

The technical analysis was conducted as follows:

Prototype models are used in the analysis. Their development, and associated climate locations, are described in detail in the quantitative determination[1] and are available for download.[2] Four building prototypes were used to capture the difference between building types:

- Medium office
- Primary School
- Mid-rise Apartment
- Stand Alone Retail

EnergyPlus™ was used to evaluate each measure in the four prototypes in all U.S. climate zones, except in cases where there is not a strong interaction with building HVAC systems, where standard engineering calculations were used. This applies to service hot water and renewable energy. Dedicated outdoor air systems (DOAS) savings were estimated rather than modeled, as discussed in the “Relative Credits for Extra Efficiency Measures.”

Using average annual commercial energy prices, cost savings for each measure are calculated as a percentage of building total annual energy cost.

The cost percentages are converted to credit points, with the goal of not being exactly equivalent, but to provide approximate relative equivalency between measures. One point is assigned for each 0 .25% of building energy cost savings.

Extra efficiency measures save energy by reducing energy use directly or reducing the heating or cooling loads in the building, resulting in lower HVAC energy use. The measure would require different items to be added to construction, depending on the combination of credits selected. The requirements for each measure are discussed under the individual items.

Why is an energy efficiency credit assignment method superior to other approaches?

The extra efficiency credit approach allows for designer and builder flexibility. While it is slightly more complicated to select multiple items and add up points, in many cases credit would be given for measures that are often included in buildings. Furthermore, using points rather than “just pick one” puts the options on more of a level consideration and better accounts for the impact of climate.

The climate zone impact is fairly broad, especially for cooling efficiency and building envelope measures. The spread is also broad for lighting reduction and plug load controls, as the reduced heat load must be made up by the heating system in colder climates, while in warmer climates there is added savings in the cooling system. Assigning the points relative to building energy cost savings and climate zone will reward savings measures appropriate to the location of the building, and more fairly across measures.

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[1] Halverson M, M Rosenberg, W Wang, J Zhang, V Mendon, R Athalye, Y Xie, R Hart, and S Goel. 2014. *ANSI/ASHRAE/IES Standard 90.1-2013 Determination: Quantitative Analysis*. Pacific Northwest National Laboratory, Richland, WA. https://www.energycodes.gov/sites/default/files/documents/901-2013_finalCommercialDeterminationQuantitativeAnalysis_TSD.pdf.
[2] Download from http://www.energycodes.gov/development/commercial/90.1_models.

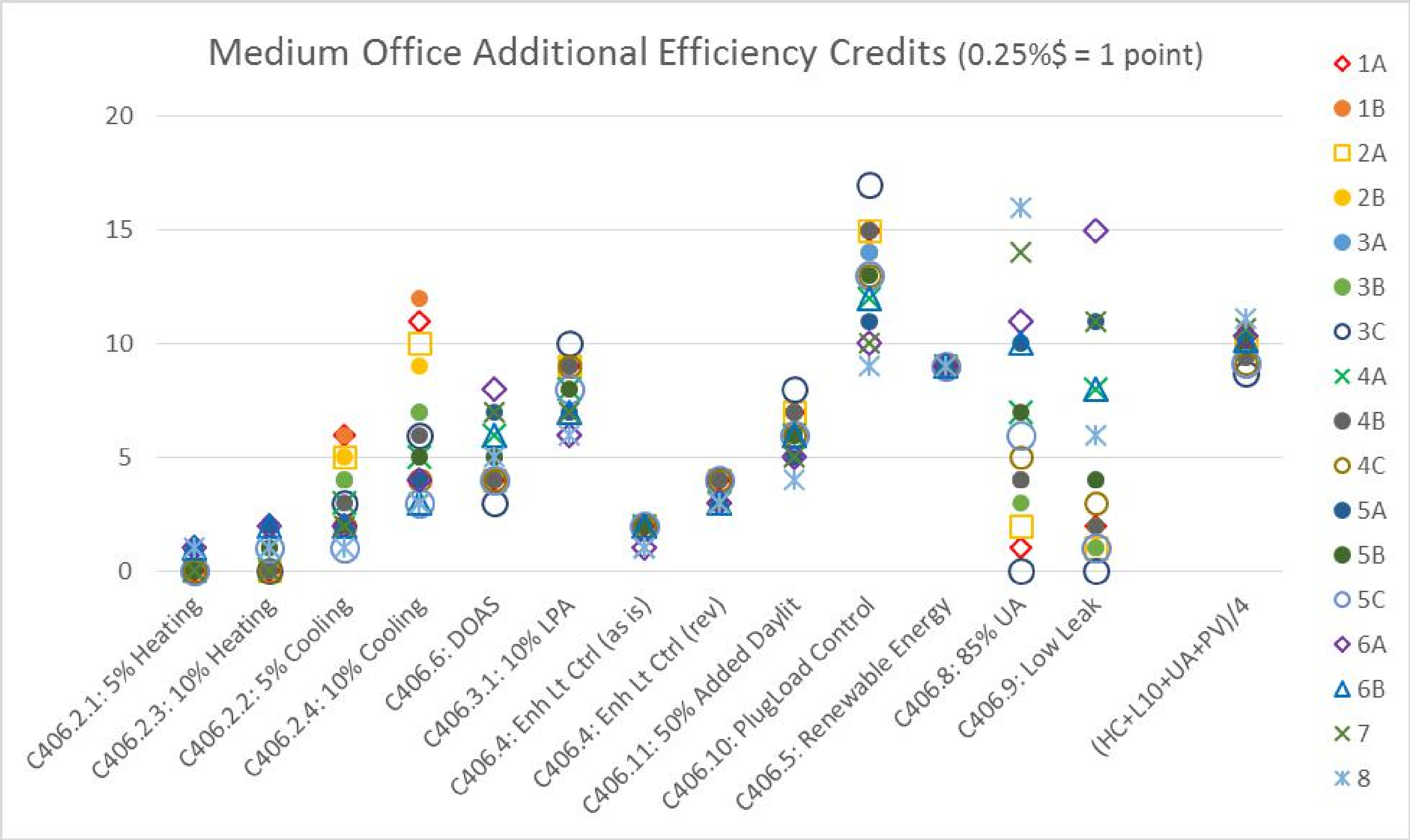

Figure 2

The points resulting from averaging four typical C406 measures (10 % HVAC, 10 % LPA, Renewable and 85% UA) are shown as the last item on the right side of Figure 2. These four average around 10 points across climate zones, while lighting power allowance—a popular option selection—averages around 8 points across climate zones. Selecting 10 points or 2.5% savings of building energy cost as the target of a point-based system makes sense as being slightly ahead or roughly equal to the approach followed in the 2018 IECC.

What strategies are considered to minimize compliance burdens?

To achieve savings from a combination of multiple measures under the 2018 IECC, the only recourse is to follow the performance path that requires a building model. Having a simple table of points for measures in different building types and climate zones bypasses the need for full performance modeling, which can be expensive relative to savings for smaller buildings. The end result is a performance-based approach that can be applied with the simplicity of a prescriptive approach.

Are there existing codes and standards that take a similar approach?

The outlined approach is based on the structure currently employed in the IECC for commercial buildings. It just shifts from a “pick one” approach to one that selects adequate measures from the options to meet a required point level. It is also similar to packages of measures that have been utilized in both residential and commercial energy codes, particularly in the Pacific Northwest. The Washington code has successfully used such a structure to balance energy performance, design flexibility, and evolving technologies.

The existing measures were modified to better fit within the credits option and to provide more flexibility.

More efficient HVAC heating performance (C406 .2) There has been industry feedback that it is difficult to comply with the 10 % increase in efficiency for the More Efficient HVAC Option because both the heating and cooling equipment must comply. The credits option allows either heating or cooling or both to comply. This measure would be modified to provide separate credits for the following:

– Medium efficiency HVAC heating performance (C406 .2.1) is a 5% improvement in efficiency over the existing minimum requirement.

– Medium efficiency HVAC cooling performance (C406 .2.2) is a 5% improvement in efficiency over the existing minimum requirement.

– High Efficiency HVAC heating performance (C406 .2.3) is a 10 % improvement in efficiency over the existing minimum requirement.

– High Efficiency HVAC cooling performance (C406 .2.4) is a 10 % improvement in efficiency over the existing minimum requirement

Note: If equipment efficiency tables for VRF or other items are added by another proposal, then remove the reference to the ASHRAE 90.1 tables and adjust the table number reference range to include all HVAC equipment tables.

– **C 40 6.5 On-sit e renewable energy.** The onsite renewable energy credit has been modified to allow for additional credit from increased system size over the base level requirement for this credit.

– **C 40 6.7.1 Reduced energy use in service water heating.** The water heating option allows for credit for high effi ciency gas and electric water heaters in addition to heat recovery.

Note: Tables C406.1(1) through C406.1(5) include entries for climate zones 1A through 8. Should climate zones 0A and 0B be added to the IECC, use values for 1A in 0A aand values for 1B in 0B.

Bibliography:

Hart R and B Liu. 2015. *Methodology for Evaluating Cost-effectiveness of Commercial Energy Code Changes.* PNNL-23923, Rev1, Pacific Northwest National Laboratory for U.S. Department of Energy; Energy Efficiency & Renewable Energy. https://www.energycodes.gov/development/commercial/methodology.

Hart R and J Zhang. 2018. *Cost-effectiveness Analysis of Hi-rise Residential Building Air Leakage Testing.* https://www.energycodes.gov/sites/default/files/documents/TBD.pdf.

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Cost Impact: The code change proposal will not increase or decrease the cost of construction
The current proposal does not require more investment, but rather expands existing options permitted under the 2018 IECC. The intention is to assess relative savings equity amongst current options, and identify additional options to increase flexibility and more effectively utilize new technologies and construction practices. There is not expected to be an increased cost, as several of the evaluated options are included in current code. In some cases, costs may be reduced, as the outlined approach provides partial credit for selected items as well as credit for items that may have previously been included in the building design without credit. Costs, and cost effectiveness, are not evaluated for individual measures due to the vast number of potential combinations amongst building types, climates, and selected options. Actual costs will vary based on the items selected by the building designer—architects, engineers, and other involved trades—based on the needs and goals of the individual project.

CE218-19

Public Hearing Results

Errata: This proposal includes no errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: As Modified

Committee Modification:

C406.1 Additional energy efficiency credit requirements. New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. ~~Alternatively, credits shall be calculated in accordance with the relevant subsection of C406~~. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

Table C406.1(4) Additional Energy Efficiency Credits for Group M Occupancies

Portions of table not shown remain unchanged.

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
~~C406.4: Digital Lt Ctrl~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~	~~NA~~

C406.4: Digital Lt Ctrl	3	3	4	3	4	3	4	4	4	3	3	3	3	4	4	3	3

Committee Reason: This does a good job of weighting value across climate zones and is long overdue. This creates a new middle path for those that do not have a design team giving them a smart approach without expensive modeling. Provide a UA benefit in an appropriate location. This is a balancing of an unbalanced set of requirements for energy efficiency. The modifications move a sentence within charging language and brings in credit for a well liked requirement (Vote: 13-2).

Assembly Action: **None**

CE218-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C406.1 (New), C406.7.3 (New), C406.7.4 (New)

Proponents:
Eric Makela, representing New Buildings Institute (ericm@newbuildings.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C406.1

Table C406.1(2) Additional Energy Efficiency Credits for Group R and I Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% Heating	NA	NA	NA	NA	1	NA	NA	1	NA	1	1	1	1	2	1	2	2
C406.2.2: 5% Cooling	3	3	2	2	1	1	1	1	1	NA	1	1	NA	1	1	1	NA
C406.2.3: 10% Heating	NA	NA	NA	NA	1	NA	NA	1	1	1	2	2	1	3	2	3	4
C406.2.4: 10% Cooling	5	5	4	3	2	3	1	2	2	1	1	1	1	1	1	1	1
C406.3.1: 10% LPA	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2
C406.4: Digital Lt Ctrl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.5: Renewable	8	8	8	8	7	8	8	7	7	7	7	7	7	7	7	7	7
C406.6: DOAS	3	4	3	3	4	2	NA	6	3	4	8	5	5	10	7	11	12
C406.7.~~1~~ 2: SWH HR	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406.7.~~2~~ 3: SWH NG eff	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406.7.~~3~~ 4: SWH HP	~~6~~ 11	~~5~~ 10	~~5~~ 11	~~5~~ 11	~~5~~ 11	~~5~~ 11	~~5~~ 13	~~5~~ 12	~~5~~ 12	~~5~~ 13	~~5~~ 11	~~5~~ 11	~~5~~ 13	~~5~~ 11	~~5~~ 11	~~5~~ 11	~~5~~ 10
C406.8: 85% UA	3	6	3	5	4	4	1	4	3	3	4	5	3	5	4	6	6
C406.9: Low Leak	6	5	3	11	6	4	NA	7	3	3	9	5	1	13	6	8	3

C406.1
Table C406.1(3) Additional Energy Efficiency Credits for Group E Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% Heating	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	4
C406.2.2: 5% Cooling	4	4	3	3	2	2	2	2	1	1	1	1	NA	1	1	1	NA
C406.2.3: 10% Heating	NA	NA	NA	1	1	1	1	2	3	4	3	4	3	4	3	5	7
C406.2.4: 10% Cooling	7	8	7	6	5	4	3	4	3	1	2	2	1	2	2	2	1
C406.3.1: 10% LPA	8	8	8	9	8	9	9	8	9	9	8	9	8	7	8	7	7
C406.4: Digital Lt Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406.5: Renewable	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5
C406.6: DOAS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.~~1~~ 2: SWH HR*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C406.7.~~2~~ 3: SWH NG eff*	NA	1	1	1	1	1	1	2	2	3	2	3	2	3	3	3	5
C406.7.~~3~~ 4: SWH HPWH*	~~NA~~ 2	~~NA~~ 2	~~NA~~ 2	~~NA~~ 2	~~NA~~ 2	~~NA~~ 2	~~NA~~ 2	1	~~NA~~ 1	~~NA~~ 1	1	1	~~NA~~ 1	1	1	1	1
C406.8: 85% UA	3	7	3	4	2	4	1	1	3	1	2	3	NA	4	3	6	9
C406.9: Low Leak	1	1	1	2	NA	NA	NA	NA	NA	NA	1	NA	NA	4	1	4	3

* for schools with full service kitchens or showers

C406.1
Table C406.1(5) Additional Energy Efficiency Credits for Other* Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% Heating	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	3
C406.2.2: 5% Cooling	5	5	4	4	3	3	2	2	2	1	1	2	1	1	1	1	1
C406.2.3: 10% Heating	NA	NA	NA	1	1	1	1	2	2	3	3	3	3	4	3	5	5
C406.2.4: 10% Cooling	8	9	8	7	5	5	3	4	4	2	2	3	2	2	2	2	2
C406.3.1: 10% LPA	8	8	9	9	9	9	10	8	9	9	7	8	8	8	8	8	7
C406.4: Digital Lt Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406.5: Renewable	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	7
C406.6: DOAS	3	4	3	3	4	3	2	5	3	3	5	4	3	7	5	7	6
C406.7.~~1~~ 2: SWH HR**	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406.7.~~2~~ 3: SWH FF eff**	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406.7.~~3~~ 4: SWH HPWH**	~~6~~ 11	~~5~~ 10	~~5~~ 11	~~5~~ 11	~~5~~ 11	~~5~~ 11	~~5~~ 13	~~5~~ 12	~~5~~ 12	~~5~~ 13	~~5~~ 11	~~5~~ 11	~~5~~ 13	~~5~~ 11	~~5~~ 11	~~5~~ 11	~~5~~ 10
C406.8: 85% UA	3	6	3	4	3	4	1	5	4	3	5	5	4	7	6	9	10
C406.9: Low Leak Env	3	2	2	4	4	2	NA	6	2	2	6	4	1	10	5	7	4

* Other occupancy groups include all Groups except for Groups B, R, I, E, and M.

** for occupancy groups listed in C406.7.1

C406.7.3 Efficient fossil fuel water heater. The combined input-capacity-weighted-average equipment rating of all fossil fuel water heating equipment in the building shall be not less than 95% Et or 0.95 EF and shall meet 75 percent of the water heating capacity. This option shall receive only half the listed credits for buildings required to comply with C404.2.1.

C406.7.4 Heat pump water heater. Where electric resistance water heaters are allowed, ~~all~~ 75 percent of service hot water system heating ~~requirements~~ capacity shall be met using heat pump technology with a combined input-capacity-weighted-average EF of 3.0. ~~Air-source heat pump water heaters shall not draw conditioned air from within the building, except exhaust air that would otherwise be exhausted to the exterior.~~

Commenter's Reason: In the initial analysis, a gas baseline was used relative to installing a heat pump water heater system. In many cases, especially in apartments, individual electric resistance heaters are the typical baseline. A review of the CBECS data base and AHRI water heater shipment data finds that electric and gas water heaters are about evenly split in current market share. To account for this, the analysis baseline was shifted to 50% electric resistance water heaters and 50% standard gas water heaters. This resulted in an increase in credits allowed for the heat pump water heaters.
The restriction on using conditioned space air is also removed as this has been shown to not be of concern in commercial spaces with large internal heat gains or in residential settings based on actual testing in the PNNL lab homes.

For both C406.7.3 and C406.7.4 the high efficiency heating requirement is required to be 75% of service water heating capacity, as some requirements are better met with other options, such as dishwasher booster heaters, point of use or limited use water heaters like those serving a janitorial sink or public restroom.

In addition, numeric references to the appropriate heat pump water heater sections are corrected.

Bibliography: https://labhomes.pnnl.gov/documents/HPWH_SpaceConditioning_Report_PNNL_23526_FINAL.pdf
https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-22642.pdf

https://labhomes.pnnl.gov/documents/HPWH_BAreview_PNNL-SA-95180.pdf

https://aceee.org/files/proceedings/2014/data/papers/1-1203.pdf

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The current proposal does not require more investment, but rather expands existing options permitted under the 2018 IECC. The intention is to assess relative savings equity amongst current options, and identify additional options to increase flexibility and more effectively utilize new technologies and construction practices. There is not expected to be an increased cost, as several of the evaluated options are included in current code. In some cases, costs may be reduced, as the outlined approach provides partial credit for selected items as well as credit for items that may have previously been included in the building design without credit. Costs, and cost effectiveness, are not evaluated for individual measures due to the vast number of potential combinations

amongst building types, climates, and selected options. Actual costs will vary based on the items selected by the building designer—architects, engineers, and other involved trades—based on the needs and goals of the individual project.

Public Comment# 1998

Public Comment 2:

IECC®: C406.1 (New)

Proponents:
Eric Makela, representing New Buildings Institute (ericm@newbuildings.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C406.1 Additional energy efficiency credit requirements. New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9

Exceptions:

1. Buildings in Utility and Miscellaneous Group U
2. Buildings in Storage Group S, Factory Group F, High-Hazard Group H, Low-energy buildings as defined in C402.1.1, and Equipment buildings as defined in C402.1.2, that achieve a total of 7 credits.
3. Buildings in Residential and Institutional Groups R and I in climate zones 3C, 4B, 4C, 5C that achieve a total of 7 credits

Commenter's Reason: This Public Comment addresses concerns raised by committee members and others by adding exceptions to Section 406.1 to address low energy use buildings and multi-family, hotel and institutional buildings.
The first exception eliminates additional efficiency requirements for the miscellaneous group that have low energy use and little opportunity for additional energy savings.

The second and third exceptions reduce the additional efficiency credits required from 10 to 7 for two situations:

- Warehouses, industrial buildings, equipment, and low energy buildings. These buildings could now easily meet the 7 point credit requirement with only a 10% lighting power reduction, which is readily available with high-efficacy lighting fixtures.

- Apartment, hotel, and institutional buildings in climate zones where credits available are limited. As with most other buildings, a combination of measures would be required, but this would level the playing field across climate zones for meeting the credit requirement.

For the group R & I buildings, the exceptions mean that of five paths identified with two to three items, the exceptions in this PC would qualify all climate zones for those paths, except for climate zone 3C in California that has four paths. There are an additional four paths with four out of eight items that would qualify outside of 3C. *Note that if the separate public comment increasing points for heat pump water heaters passes, fewer items may be required when heat pump water heaters are included.* Examples of complying combinations with two to three options include:

- Natural Gas condenser water heating plus 10% cooling efficiency improvement
- Renewable energy plus DOAS ventilation with energy recovery
- Heat pump water heating; 10% cooling efficiency improvement; lighting efficacy
- Building envelope improvement; leak reduction; DOAS ventilation
- Heat pump water heating; 15% common area light reduction; lighting efficacy

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
The Public Comment exempts certain buildings that were currently included in the original CE218 proposal (Utility and Miscellaneous Group U) and also requires fewer credits for buildings lower energy use buildings. The public comment also requires multifamily to select fewer credits (7 instead of 10) in specific climate zones that will reduce the overall cot of compliance with CE218..

Public Comment# 2006

Public Comment 3:

IECC®: Table C406.1(1) (New), Table C406.1(2) (New), Table C406.1(3) (New), Table C406.1(4) (New), Table C406.1(5) (New), C406.5.1 (New)

Proponents:
Eric Makela, representing New Buildings Institute (ericm@newbuildings.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

Table C406.1(1)
Additional Energy Efficiency Credits for Group B Occupants

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% Heating	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	1	1	NA	1
C406.2.2: 5% Cooling	6	6	5	5	4	4	3	3	3	2	2	2	1	2	2	2	1
C406.2.3: 10% Heating	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	2	1	1	2	2	NA	1
C406.2.4: 10% Cooling	11	12	10	9	7	7	6	5	6	4	4	5	3	4	3	3	3
C406.3.1: 10% LPA	9	8	9	9	9	9	10	8	9	9	7	8	8	6	7	7	6
C406.4:Digital Lt Ctrl	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1
C406.5: Renewable	~~9~~ 6	~~9~~ 5	~~9~~ 6	~~9~~ 7	~~9~~ 6	~~9~~ 7	~~9~~ 7	~~9~~ 5	~~9~~ 7	~~9~~ 5	~~9~~ 5	~~9~~ 6	~~9~~ 5	~~9~~ 4	~~9~~ 5	~~9~~ 4	~~9~~ 3
C406.6: DOAS	4	4	4	4	4	3	2	5	3	2	5	3	2	7	4	5	3
C406.7.1: SWH HR	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.2: SWH NG eff	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.3: SWH HP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.8: 85% UA	1	4	2	4	4	3	NA	7	4	5	10	7	6	11	10	14	16
C406.9: Low Leak	2	1	1	2	4	1	NA	8	2	3	11	4	1	15	8	11	6

Table C406.1(2)
Additional Energy Efficiency Credits for Group R and I Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% Heating	NA	NA	NA	NA	1	NA	NA	1	NA	1	1	1	1	2	1	2	2
C406.2.2: 5% Cooling	3	3	2	2	1	1	1	1	1	NA	1	1	NA	1	1	1	NA
C406.2.3: 10% Heating	NA	NA	NA	NA	1	NA	NA	1	1	1	2	2	1	3	2	3	4
C406.2.4: 10% Cooling	5	5	4	3	2	3	1	2	2	1	1	1	1	1	1	1	1
C406.3.1: 10% LPA	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2
C406.4: Digital Lt Ctrl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.5: Renewable	~~8~~ 5	~~8~~ 5	~~8~~ 5	~~8~~ 5	~~7~~ 5	~~8~~ 6	~~8~~ 6	~~7~~ 4	~~7~~ 5	~~7~~ 4	~~7~~ 4	~~7~~ 4	~~7~~ 4	~~7~~ 3	~~7~~ 4	~~7~~ 3	~~7~~ 2
C406.6: DOAS	3	4	3	3	4	2	NA	6	3	4	8	5	5	10	7	11	12
C406.7.1: SWH HR	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406.7.2: SWH NG eff	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406.7.3: SWH HP	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406.8: 85% UA	3	6	3	5	4	4	1	4	3	3	4	5	3	5	4	6	6
C406.9: Low Leak	6	5	3	11	6	4	NA	7	3	3	9	5	1	13	6	8	3

Table C406.1(3)
Additional Energy Efficiency Credits for Group E Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% Heating	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	4
C406.2.2: 5% Cooling	4	4	3	3	2	2	2	2	1	1	1	1	NA	1	1	1	NA
C406.2.3: 10% Heating	NA	NA	NA	1	1	1	1	2	3	4	3	4	3	4	3	5	7
C406.2.4: 10% Cooling	7	8	7	6	5	4	3	4	3	1	2	2	1	2	2	2	1
C406.3.1: 10% LPA	8	8	8	9	8	9	9	8	9	9	8	9	8	7	8	7	7
C406.4: Digital Lt Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406.5: Renewable	~~6~~ 4	~~6~~ 4	~~6~~ 4	~~6~~ 5	~~6~~ 4	~~6~~ 5	~~6~~ 5	~~6~~ 4	~~6~~ 5	~~6~~ 4	~~6~~ 4	~~6~~ 4	~~6~~ 4	~~6~~ 4	~~6~~ 4	~~5~~ 3	~~5~~ 2
C406.6: DOAS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.1: SWH HR*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C406.7.2: SWH NG eff*	NA	1	1	1	1	1	1	2	2	3	2	3	2	3	3	3	5
C406.7.3: SWH HPWH*	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	1	1	NA	1	1	1	1
C406.8: 85% UA	3	7	3	4	2	4	1	1	3	1	2	3	NA	4	3	6	9
C406.9: Low Leak	1	1	1	2	NA	NA	NA	NA	NA	NA	1	NA	NA	4	1	4	3

* for schools with full service kitchens or showers

Table C406.1(4)
Additional Energy Efficiency Credits for Group M Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% Heating	NA	NA	NA	NA	1	1	NA	1	1	2	2	2	2	3	2	3	4
C406.2.2: 5% Cooling	5	6	4	4	3	3	1	2	2	1	1	2	NA	1	1	1	NA
C406.2.3: 10% Heating	NA	NA	NA	1	1	1	1	2	2	4	3	4	5	5	3	6	8
C406.2.4: 10% Cooling	9	12	9	8	6	6	3	4	4	1	2	3	NA	2	2	2	1
C406.3.1: 10% LPA	13	13	15	14	16	14	17	15	15	14	12	14	14	16	16	14	12
C406.4: Digital Lt Ctrl	3	3	4	3	4	3	4	4	4	3	3	3	3	4	4	3	3
C406.5: Renewable	~~8~~ 6	~~8~~ 5	~~8~~ 6	~~8~~ 6	~~8~~ 6	~~8~~ 6	~~8~~ 7	~~8~~ 5	~~8~~ 6	~~7~~ 4	~~7~~ 5	~~7~~ 5	~~7~~ 5	~~7~~ 4	~~7~~ 5	~~7~~ 4	~~6~~ 3
C406.6: DOAS	3	4	3	3	3	3	1	3	2	2	2	3	2	4	3	4	4
C406.7.1: SWH HR	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.2: SWH NG eff	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.3: SWH HP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.8: 85% UA	4	6	3	4	3	3	1	6	4	4	4	5	4	6	5	8	9
C406.9: Low Leak Env	1	1	1	2	1	1	NA	3	1	1	3	2	1	7	3	6	3

Table C406.1(5)
Additional Energy Efficiency Credits for Other* Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.2.1: 5% Heating	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	3
C406.2.2: 5% Cooling	5	5	4	4	3	3	2	2	2	1	1	2	1	1	1	1	1
C406.2.3: 10% Heating	NA	NA	NA	1	1	1	1	2	2	3	3	3	3	4	3	5	5
C406.2.4: 10% Cooling	8	9	8	7	5	5	3	4	4	2	2	3	2	2	2	2	2
C406.3.1: 10% LPA	8	8	9	9	9	9	10	8	9	9	7	8	8	8	8	8	7
C406.4: Digital Lt Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406.5: Renewable	~~8~~ 6	~~8~~ 6	~~8~~ 6	~~8~~ 7	~~8~~ 6	~~8~~ 7	~~8~~ 7	~~8~~ 5	~~8~~ 6	~~7~~ 5	~~7~~ 5	~~7~~ 6	~~7~~ 5	~~7~~ 5	~~7~~ 5	~~7~~ 5	~~7~~ 4
C406.6: DOAS	3	4	3	3	4	3	2	5	3	3	5	4	3	7	5	7	6
C406.7.1: SWH HR**	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406.7.2: SWH FF eff**	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406.7.3: SWH HPWH**	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406.8: 85% UA	3	6	3	4	3	4	1	5	4	3	5	5	4	7	6	9	10
C406.9: Low Leak Env	3	2	2	4	4	2	NA	6	2	2	6	4	1	10	5	7	4

* Other occupancy groups include all Groups except for Groups B, R, I, E, and M.

** for occupancy groups listed in C406.7.1

C406.5.1 Basic renewable credit. The total minimum ratings of on-site renewable energy systems not including systems used for credits under Sections C406.7.2, shall be one of the following:

1. Not less than ~~0.86~~ 0.34 Btu/h per square foot (~~2.7~~ 1.1 W/m^2) or ~~0.25~~ 0.10 watts per square foot (~~2.7~~ 1.1 W/m^2) of conditioned floor area.
2. Not less than ~~3~~ 1.5 percent of the total building annual energy used ~~within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.~~

Commenter's Reason: In the original CE 218 proposal, the renewable energy credit was based on a percentage of regulated building energy use approach. On review, a few items were found that are improved in this public comment:

- The credits are based on the installed watts per square foot approach, as the savings can be lower. This provides conservative credits without complex adjustments for alternatives.
- The credits vary more with climate zone, as they would in the watts per square foot approach, due to variations in total building energy cost and variations in solar input by climate zone.
- The minimum criteria for this credit was lowered to 0.1 W/square foot installed renewable output, as that allowed for a mix and match with other selections in the credits list. This also makes it easier for high-rise apartments to use the renewable option with photovoltaics.
- The enhanced renewable credits was retained to allow the 0.1 W/square foot to be increased where more renewable credits are desired or to meet the full C406 requirement with just renewable energy.
- To simplify the alternate calculation, the basis is now whole building use, rather than just regulated loads, and the percentage was adjusted to roughly match the watts per square foot approach. Note that there has been a big reduction in regulated loads since this item was introduced more than 12 years ago.

In addition, the terminology and formula symbols were clarified and made more consistent in section C406.5.2, without changing the intent or meaning of C406.5.2.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment reduces the requirement for the renewable credit but also reduces the number of points associated with the credit for has no net affect on the cost of construction.

Public Comment# 2013

Public Comment 4:

IECC®: C406.2.2 (New), C406.2.4 (New)

Proponents:
Jonathan McHugh, representing McHugh Energy Consultants Inc. (jon@mchughenergy.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C406.2.2 Five percent cooling efficiency improvement Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 5 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV. Variable refrigerant flow (VRF) systems with cooling capacities ≥ 65,000 Btu/h, shall exceed the minimum EER requirements by 5 percent.

C406.2.4 Ten percent cooling efficiency improvement. Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 10 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV. Variable refrigerant flow (VRF) systems with cooling capacities ≥ 65,000 Btu/h, shall exceed the minimum EER requirements by 10 percent.

Commenter's Reason: Thank you for the opportunity to submit comments on Proposal CE218-19. CE-218-19 in its current form is an important, well-conceived improvement to the code, and I urge the committee to adopt it regardless as to whether the small modification proposed here is accepted. CE218-19 is an energy equivalent points based system that provides superior guidance for increasing the energy efficiency of buildings. Without adoption of CE218-19, the IECC would provide equal credit for different measures with significantly different energy impacts.
There is a concern about the use of the IEER metric for variable refrigerant flow (VRF) systems. For most other products, the test procedure to determine the annual energy use metric has been in use for a long time, but the VRF procedure was just created in 2010 and there was no opportunity to observe its use in practice prior to its adoption by DOE. The IEER minimum values adopted by ASHRAE 90.1 and DOE in 2013 were close to the results expected for packaged equipment. However, experience has shown that the test method for VRF requires much improvement and the IEER values in the ASHRAE 90.1 tables are well below most of the VRF products on the market. We recommend the use of EER values for assigning the point credits for higher efficiency VRF systems in CE218-19. Note for small VRF systems (< 65,000 Btu/hr) the only efficiency rating for cooling is SEER. As a result EER is required as the metric of comparison of cooling efficiency only when EER is listed for the particular size and configuration of equipment.

DOE VRF Rulemaking

In 2018 DOE initiated a rulemaking to review the test procedure for VRF, with the intention to move from using EER as the metric to IEER. The DOE chose to form an ASRAC working group, consisting of representatives from industry, energy advocacy organizations and DOE. The ASCRAC has not completed its work, but it has determined that the procedure for measuring IEER in the current version of AHRI 1230 requires significant revision. Joint testing conducted by industry, energy advocates, and DOE shows a large discrepancy between the efficiency measured with the control overrides allowed in the current test procedure vs. that found when the controls used in normal operation are applied. These results were presented to the VRF ASRAC Working Group by the VRF ASRAC Testing Joint Subcommittee:

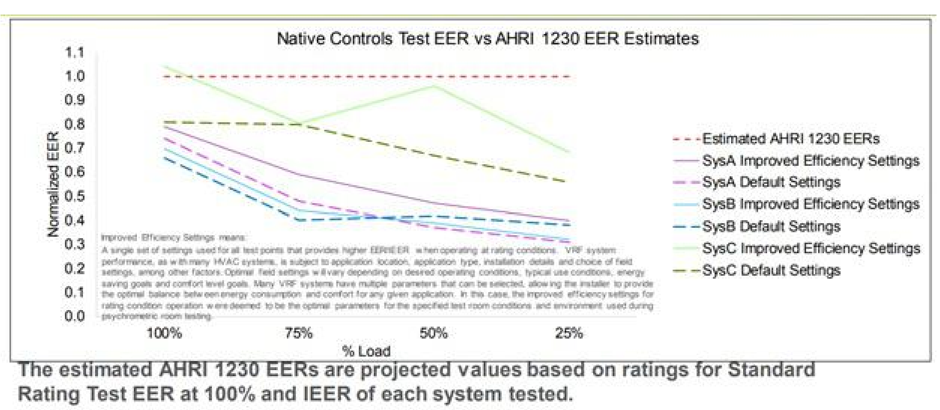


Figure 1: EER at each test point using native controls vs. the overridden controls allowed in AHRI 1230. The red line represents the EER for each test point normalized to 1 for each manufacturer. The other lines represent the percentage of that EER when tested with native controls. For example, the point EER for System A with default settings is only 50% of the point EER reported at 75% load.

Another graph from the same presentation showed the change in IEER that would result if native controls testing were applied instead of the current test procedure. The new IEER’s would be at best, 73% of the currently reported value and at worst, 40% of that value. The use of the manufacture’s “improved efficiency” settings only yielded a small improvement:

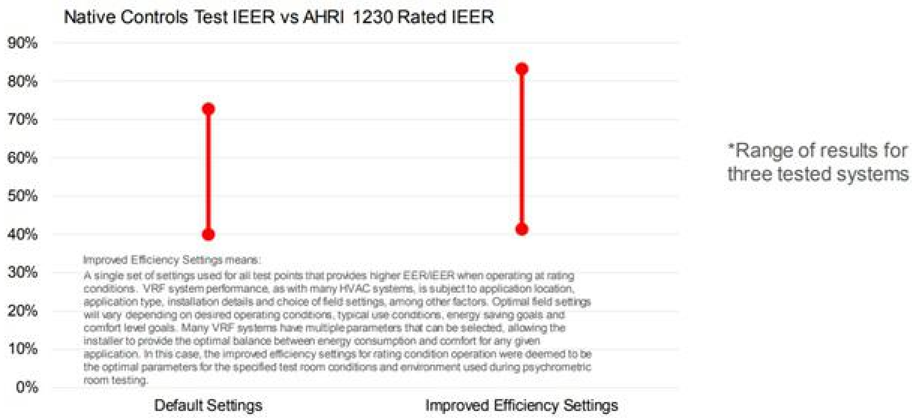


Figure 2: The relative values of IEER calculated from the native controls testing compared to IEER listed in the AHRI database.

The results from the joint committee testing shown here are not meant to imply that the final test procedure proposed by the VRF ASRAC Working Group will change reported VRF IEER's by the same magnitudes. The working group has not yet released a proposed method of test. But it is clear that the test procedure currently used to calculate IEER yields exaggerated results.

Consider using EER for VRF

Based on the DOE work and the results of testing by the California Investor Owned Utilities, the California Energy Commission has chosen to use EER as the basis of evaluating the energy performance of VRFs systems in their 2019 Alternative Compliance Method. Though EER's may also change with the new test procedure, they are not as far off as IEER for VRF.

The AHRI Directory of Certified Performance provides the rated EER and IEER values for all VRF systems sold in North America. These tables compare those values for each model listed in the database to the minimum EER's and IEER's in ASHRAE 90.1. The IEER's are compared to the 90.1 values required after January 1, 2017. The table was not updated for the 2019 version because the VRF ASRAC working group has not completed its work.

All Air-to-Air Heat Pumps in AHRI Database

EER		
% better than 90.1 minimum	Count	Proportion
>20%	346	13.6%
10 to 20%	353	13.9%
5 to 10%	482	18.9%
0 to 5%	1223	48.1%
Below	140	5.5%
	2544	

IEER		
% better than 90.1 minimum	Count	Proportion
>100%	136	5.3%
50 to 100%	1395	54.8%
20 to 50%	923	36.3%
10 to 20%	54	2.1%
5 to 10%	28	1.1%
0 to 5%	8	0.3%
	2544	

Figure 3: A comparison of EER and IEER of active air-cooled VRF heat pump models in the AHRI Directory of Certified Performance to the EER and IEER minimum values in ASHRAE 90.1. The minimum values for IEER after January 1, 2017 were used.

If IEER were to be used, more than 98% of the VRF systems exceed the 10% threshold to claim the 10% cooling efficiency credit. If EER were to be used, about 27.5% of systems could claim the 10% cooling efficiency credit, with another 19% able to claim the 5% credit.

Bibliography: The docket containing all information related to the Federal appliance efficiency rulemaking for Variable Refrigerant Flow Multi-Split Air Conditioners and Heat Pumps is found here: https://www.regulations.gov/docket?D=EERE-2018-BT-STD-0003
2019-02-21 - 22 VRF ASRAC Test Sub Committee Working Group Presentation. https://www.regulations.gov/document?D=EERE-2018-BT-STD-0003-0027

AHRI Directory of Certified Performance https://www.ahridirectory.org/Search/SearchHome?ReturnUrl=%2f

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This change will have no effect on cost because there are a significant number (>25% of models listed in the AHRI database) of VRF systems that exceed the minimum EER requirements by at least 10%

Public Comment# 2132

Public Comment 5:

IECC®: C406.1 (New), C406.1.1, C406.1.2 (New)

Proponents:
Gregory Nicholls, The Preview Group, Inc., representing American Institute of Architects (gnicholls@preview-group.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C406.1 Additional energy efficiency credit requirements New buildings shall comply with either Section C406.1.1 or C406.1.2. ~~shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:~~

1. ~~More efficient HVAC performance in accordance with Section C406.2.~~
2. ~~Reduced lighting power in accordance with Section C406.3.~~
3. ~~Enhanced lighting controls in accordance with Section C406.4.~~
4. ~~On-site supply of renewable energy in accordance with Section C406.5.~~
5. ~~Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.~~
6. ~~High-efficiency service water heating in accordance with Section C406.7.~~
7. ~~Enhanced envelope performance in accordance with Section C406.8.~~
8. ~~Reduced air infiltration in accordance with Section C406.9~~

C406.1.1 Single credit Buildings shall comply with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9

C406.1.2 Flexible credits New buildings shall achieve a total of 10 credits from Tables C406.1.2(1) through C406.1.2(5). Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit.

Commenter's Reason: The original reason statement said the proposal would not increase or decrease the cost of construction, and that it does not require more investment, but that is rarely the case. Even more rare would be the case for when compliance would cost less.
REASON

For all occupancies, compliance currently is achieved by increasing HVAC efficiency by 10%. For all occupancies in Zone 5A for example, the best case is for Group B, where you get 6 points of the 10 required, which means there will be additional cost to achieve more points. If you choose to add a DOAS system for a project in Zone 5A in this proposal, you get anywhere from 0 to 5 points, where it currently achieves compliance. If your school project in Zone 5A chooses to provide better air leakage, it currently passes, but in this proposal you get 1 point. If you choose renewable energy resources in any zone for any use group, the current code would comply, but under this proposal, none would.

The concept is beautiful, but to sell it as not typically requiring additional cost investment is not true. Rather than scrap the whole thing until scoring (or points needed to pass) is revised, I am suggesting that the designer and owner have the option to use the more flexible matrix being proposed. Feedback then can be used to judge if the matrix is actually as effective as the proponent wishes without increased cost.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
With the option to use the current code choices or the proposed flexible credits, this code change would actually be at no cost increase.

Public Comment# 2032

Public Comment 6:

Proponents:
Hope Medina, representing Colorado Chapter of ICC (hmedina@coloradocode.net)

requests Disapprove

Commenter's Reason: This proposal is over complicated for end users. The tables listed in this proposal are titled utilizing the building occupancies found in Chapter 3 of the IBC and state occupancies in the titles but Section C406.1 states use groups. There is no reference in this proposal of what is a use group. It could be interpreted as function of space found in Table 1004.5 of the IBC, or building area type found in Table C405.3.2(1) of the IECC, or common space types/building type specific space types found in Table C405.3.2(2) of the IECC, or Section 302.2 of the IBC. The wording should be consistent for all end users to be able to determine what the requirements are asking for.
One more demonstration of the complexity of this proposal is when there are multiple uses for the building. The end users are required to perform an area weighted average of floor area to determine the percentage of points to award for that category. In addition there was no equation provided for the end users to be utilized when performing this area weighted average.

This proposal mandates that 10 points are required, but in many of the climate zones and occupancies the projects would be required to do more than 1, or, 2, or 3 practices to obtain 10 points. This proposal also contains values in these tables that exceed the 10 points required. This is confusing to end users why there would values that exceed 10. There should not be values that exceed 10 if the goal number to reach is 10. It appears that this is being set up for future editions of the energy code to increase this number from 10 to a larger number.

This proposal, if approved, may lead to this section of the code no longer being adopted without being amended out. This section has had issues in the past with not being adopted, or enforce for compliance. It does not do any good for energy efficiency when something is written into code that isn't enforced for compliance in the real world application. This section is important for the energy efficiency of projects, and we feel that has been able to get projects more efficient without an exorbitant amount of extra work for any of the end users. It really was a win win for everyone involved in the building community.

The proposal removed the wording of package options to requirements within the title of the section even though this section is about options. We need to be mindful of how this appears to the end users of this code. Currently the title and the section provides options for the building owners and designers to choose additional efficiency for their projects. When you change the title as suggested with this proposal you remove the appearance of having options even though this proposal still is based on options. Why would you want to create more opposition to a section of this code?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1696

Public Comment 7:

Proponents:
Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests Disapprove

Commenter's Reason: Proposals CE218, CE226, and CE240 should be withdrawn by the proponent because they do the opposite of what is intended, and a cost justification was not included. The analysis does attempt to balance out equal energy performance, but it does not take into consideration the cost impact of having to comply with multiple choices of the current code which currently requires only one of the listed efficiency options. For example, choose either 10% HVAC equipment efficiency increase or Reduced Light Power or one of the other 6 options and comply with the code. It is also very difficult to determine code compliance for builders building in multiple zones, because the point system varies drastically across zones and what can be used as a solution in one zone will not receive enough points to qualify in other zones.
The following are examples of the combinations of requirements that would be required to comply with the proposed change.

Notes:

1. Changes, in all but Option 4, are based on taking the lowest number or total points available to determine compliance.

2. Numerous options are available beyond the examples shown below. The following is just a sample of the difficulty and if cost were applied to the change the cost impact.

Option 1 – 10% Increase Equipment Efficiency which would meet current code.

1. In addition to the 10% HVAC equipment efficiency the builder would need to:

2. Provide onsite Renewable Energy in all Zones.

3. Plus, include Reduced Lighting Power of 10% in Zones 3C, 4C and 5C.

Option 2 – 10% Increase Equipment Efficiency which would meet current code.

1. In addition to the 10% HVAC equipment efficiency the builder would need to:

2. Provide Reduced Lighting Power of 10% in all Zones.

3. Plus, Zone 1B also include a Dedicated Outdoor Air System.

4. Plus, Zones 2A, 3A, 3B, 3C, 4A, 4B, 5A, 5C, 6B, and 7 the builder would be required to include a Heat Pump Water Heater. Zone 3C would also need to include Enhanced Envelope Performance.

5. Zones 1A, 2B, 4C, 5B, and 6A could have an Enhanced Envelope in place of the Heat Pump Water Heater and Zones 4C and 5C would also be required to have Reduced Air Infiltration.

6. Zone 8 would only need to have Reduced Air Infiltration.

Option 3 – 5% Increase Equipment Efficiency.

1. In addition to the 5% HVAC equipment efficiency which the justification states will help in compliance because it is difficult to get a 10% increase in HVAC equipment efficiency the builder would need to:

2. Provide On-Site Renewable Energy.

3. Plus, in Zones 3A, 3B, 4B, 4C, and 5C also Reduce Lighting Power by 10%.

4. Zones 4A, 5A, 5B, 6B, 7 and 8 do not need to have Reduce Light Power of 10%, but they must have Lamp Efficacy.

5. And, Zone 3C can get by with only adding Enhance Envelope to the On-Site Renewable Energy requirement.

Option 4 – If the above is complicated and hard to determine then compliance can be obtained by:

1. Installing 5% Increase HVAC Equipment Efficiency, and

2. Installing a Recovered or Renewable Water Heating System for the entire project.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1214

Public Comment 8:

Proponents:
Martha VanGeem, self, representing Masonry Alliance for Codes and Standards; Emily Lorenz, representing PCI (emilyblorenz@gmail.com)

requests Disapprove

Commenter's Reason: The public comment asks for disapproval because the costs of implementing each item and cost effectiveness have not been shown. Only energy savings and energy cost savings have been shown in the PNNL report 28370. While the current code has the nine options for reducing energy use, only one was required for compliance. In this proposal, now that it is tabular format, multiple expensive options often need to be chosen.

For example, while C406.3 (reduced lighting power) was reported as the most chosen option in the current code, now other options need to also be chosen for various building types and climate zones. For example, see Group R and I occupancies in Table C406.1(2). Or Group B occupancies for Climate Zones 4 through 8 in Table C406.1(1). Both of these require more than one option.

In other instances, the designer can now achieve 10 points for C406.3, which is 10% lower lighting power density. However, the lighting requirements are now so efficient (if CE206 on lower lighting power densities is approved, which was unanimously approved by the committee) that complying with C406.3 will be VERY difficult, especially considering the manner in which LED lights illuminate a space.

As another example, if the designer does not choose C406.3 (lower lighting power density) because CE206 is approved, then the designer is left doing almost everything else in order to obtain 10 points in schools Table C406.1(3), Climate Zone 5A (Chicago and many other highly populated cities east of the Mississippi River). This assumes that renewables will also not be chosen because they are often more expensive. Option C406.6 DOAS is not available for schools.
That leaves only 5 options:

- 3 points from C406.2.3 (heating),
- 2 points for C406.4 (digital controls),
- 2 points max for C406.7 (service water heating),
- 2 points for C406.8 (UA), and
- 1 point for C406.9 (air leakage).

All 5 of these would need to be met. The lower UA values have not been shown to be cost effective. The PNNL report shows very little energy savings (and sometimes increased energy use) for lower UA. An air leakage value of 0.25 has not been shown to be cost effective. The PNNL report shows very little energy savings (and sometimes increased energy use) for lower air leakage, and this is presuming air leakage reduction from 1.0 down to 0.25 cfm/ft^2. This baseline of 1.0 cfm/ft^2 for the 2018 code seems questionable when the current code requires an air leakage of 0.40 and when considering the more recent testing results in the cited research in ASHRAE 1478-RP by Wagdy Anis, Wiss Janey, and Elstner.

- **In the current code only ONE option was required. Cost effectiveness for meeting these multiple options or expensive options has not been shown.**

Because of the above, the cost impact statement is incorrect. The proposal will most likely increase the cost of construction. It will more likely require more investment because it will often require a more expensive item from the list or more than one item from the list. A detailed cost effectiveness analysis for different types of buildings in different climates is required.

This would make a great guide for above code programs that don't take into account cost effectiveness, but doesn't belong in the IECC.

The correct reference for ASHRAE 1478 RP is:
Anis, Wagdy. 2014. ASHRAE 1478-RP Measuring Airtightness of Mid- and High-Rise Non-Residential Buildings. Wiss, Janney, Elstner Associates, Inc. for ASHRAE. www.ashrae.org

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The net effect of a Disapprove action is that the code will not be changed, therefore there are no potential cost impacts.

Public Comment# 1591

CE219-19

IECC®: C406.1

Proposed Change as Submitted

Proponents: Marilyn Williams, representing National Electrical Manufacturers Association (mar_williams@nema.org)

2018 International Energy Conservation Code

Revise as follows:

C406.1 Requirements. Buildings shall comply with ~~one~~ two or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9

Reason: Section C406.1 establishes a set of additional efficiency measure options above base code requirements. The present code requires compliance with only one measure, yet the list of efficiency options has continued to grown without additing any efficiency to buildings. This proposal would modify the requirement so buildings would comply with two packages instead of just one to increase the energy efficiency of buildings.

Cost Impact: The code change proposal will increase the cost of construction
The impact would be the cost of the added measure which increases the energy efficiency of the building.

CE219-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Based on action on CE218 (Vote: 13-2).

Assembly Action: **None**

CE219-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Harold Jepsen, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us); Megan Hayes, representing NEMA (megan.hayes@nema.org)

requests As Submitted

Commenter's Reason: Because of successful approval of CE218 as modified at the Committee Action Hearing, this proposal was not necessary and therefore not approved. This As Submitted proposal is needed to progress the energy efficiency of the code in the event CE218 is not approved at the Public Comment Hearing. This public comment would allow this proposal, CE219, to be heard and would not be called to the floor if CE218 is successful in the PCH.
Reason statements and justifications from the original proposal still stand as originally submitted.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This proposal will increase the energy efficiency of the energy code through adding a second efficiency option to buildings. Return on investment for each additional efficiency package option is as noted in each individual option's proposal reason statement.

Public Comment# 1441

Public Comment 2:

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Submitted

Commenter's Reason: Increasing the requirement from one to two increases energy efficiency while remaining flexible and providing options to do it. Allowing the designer and owner to determine what is the best option for their project.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The proposal’s cost impact statement is accurate.

Public Comment# 1539

CE220-19

IECC®: C406.1

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

C406.1 Requirements. Buildings shall comply with ~~one~~ two or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9

Reason: The purpose of this code change proposal is to improve the efficiency of the prescriptive compliance path by requiring the selection of two additional efficiency package options instead of only one. Section C406 was adopted in the 2012 IECC not only as an immediate efficiency improvement, but also as a means of facilitating code improvements in the future. As new technologies become available, the package options can be updated or the list of options can be expanded (as it was in the 2018 IECC) to provide more flexibility for code users. As additional efficiency is needed, the number of required options can be increased.
Several states have adopted a package- or points-based approach similar to Section C406, and as more efficiency is needed, the number of options (or points) has been increased. We note that this proposal deals only with the prescriptive path, and that a separate proposal will address needed efficiency improvements in the performance path.

Cost Impact: The code change proposal will increase the cost of construction
The proposal requires additional efficiency measures to be installed in the building which will increase costs. However, we expect that design professionals and builders will select the package options that are the most cost-effective and the easiest to implement into specific designs.

CE220-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Based on action on CE218 and CE219 (Vote: 13-2).

Assembly Action: **None**

CE220-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it is a simple improvement in energy efficiency that would be easily implemented by any jurisdiction that has adopted the 2012, 2015, or 2018 IECC. It maintains the current structure of Section C406, and simply increases the required number of options from one to two.

We acknowledge that the Committee favored a more comprehensive revision of this section through CE218 and related proposals. CE218 and CE220 are mutually exclusive. However, it is not certain whether CE218 will be finally approved. If not, CE220 is technically sound, and if the structure of Section C406 that has been adopted in most states is retained, this moderate improvement in efficiency will be valuable.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
As stated in the original proposal, the proposal requires additional efficiency measures to be installed in the building which will increase costs. However, we expect that design professionals and builders will select the package options that are the most cost-effective and the easiest to implement into specific designs.

Public Comment# 1450

CE224-19

IECC: C406.2, TABLE C406.2 (New)

Proposed Change as Submitted

Proponents: Mark Lessans, Ingersoll Rand, representing Ingersoll Rand (mark.lessans@irco.com)

2018 International Energy Conservation Code

Revise as follows:

C406.2 More efficient HVAC equipment performance. Equipment shall ~~exceed~~ comply with the ~~minimum efficiency requirements listed in Tables C403.3.2(1) through C403.3.2(7) by 10 percent,~~ following requirements, as applicable, in addition to the requirements of Section C403. ~~Where multiple performance requirements are provided, the equipment shall exceed all requirements by~~ :

1. Package unitary air-cooled systems with cooling capacity greater than 65,000 Btu/h shall meet or exceed the applicable efficiency requirements listed in Table C406.2, or shall exceed the mandatory federal minimum efficiency requirements for IEER by not less than 10 percent, whichever is greater.
2. All other electrically operated unitary air conditioners and heat pumps with cooling capacity less than 760,000 Btu/h shall exceed the mandatory federal minimum efficiency requirements by not less than 10 percent.
3. Variable refrigerant flow systems shall exceed the energy efficiency provisions of ANSI/ASHRAE/IESNA 90.1 by not less than 10 percent.
4. All other systems shall exceed the applicable minimum efficiency requirements listed in Tables C403.3.2(1) through C403.3.2(7) by not less than 10 percent. Equipment not listed in Tables C403.3.2(1) through C403.3.2(7) shall be limited to 10 percent of the total building system capacity.

Add new text as follows:

TABLE C406.2
MINIMUM EFFICIENCY REQUIREMENTS: MORE EFFICIENT HVAC EQUIPMENT PERFORMANCEUNITARY AIR-COOLED SYSTEMS

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE
Air conditioners, air cooled	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)	Single Package	18.0 IEER	AHRI 340/360
		All other	Single Package	17.8 IEER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric Resistance (or None)	Single Package	17.0 IEER	
		All other	Single Package	16.8 IEER	
	≥ 240,000 Btu/h	Electric Resistance (or None)	Single Package	14.5 IEER	
		All other	Single Package	14.3 IEER	
Heat pumps, air cooled (cooling mode)	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)	Single Package	16.0 IEER	AHRI 340/360
		All other	Single Package	15.8 IEER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric Resistance (or None)	Single Package	15.0 IEER	
		All other	Single Package	14.8 IEER	
	≥ 240,000 Btu/h	Electric Resistance (or None)	Single Package	14.5 IEER	
		All other	Single Package	14.3 IEER	
Heat pumps, air cooled (heating mode)	≥ 65,000 Btu/h and < 135,000 Btu/h (cooling capacity)	–	47° F db/43° F wb outdoor air	3.5 COP	AHRI 340/360
	≥ 135,000 Btu/h (cooling capacity)	–	47° F db/43° F wb outdoor air	3.6 COP	

Reason: The purpose of this code change proposal is to ensure that next-generation commercial unitary air conditioners and heat pumps - those which are high-efficiency by future standards - are effectively promoted by Section C406.2 of the IECC. In doing so, this proposal will better align the energy code with DOE appliance and equipment standards, above-code programs, and manufacturer plans to improve their product offerings in response to them.

As written, C406.2 requires that all minimum efficiency requirements listed in the equipment efficiency tables of Section C403 be exceeded 10 percent. This requirement is appropriate new buildings which utilize multiple equipment types for space conditioning, as well as for equipment that has multiple performance compliance paths. However, for package air-cooled unitary systems, conventionally referred to as rooftop units (RTUs), there are typically three different efficiency metrics listed in the equipment efficiency tables, all of which must be met. Exceeding these efficiencies proportionally does not make sense given updated standards and the capabilities of RTUs, and creates conflicting as well as commercially unattainable requirements.

This proposal solves this issue for package RTUs by focusing their requirements in C406.2 predominantly on cooling efficiency as defined by IEER, as this equipment operates primarily in cooling mode, even in cold climates. Additionally, IEER is the metric used by DOE for federal appliance standards covering this equipment. This proposal aligns efficiency requirements for commercial unitary air conditioners with those in the Consortium for Energy Efficiency (CEE) Advanced Tier specification, which took effect on January 1, 2019. CEE does not develop an Advanced Tier specification for commercial package heat pumps, so improvements proportionally similar are used in this proposal.

If approved, this proposal would raise IEER for package air-cooled unitary systems by roughly 25-40% above the requirements of Section C403, as well as roughly 10-20% above the efficiencies required by updated DOE appliance standards that take effect in 2023. Additionally, this proposal creates a "backstop" of 10% above federal appliance standards, so that the intent of Section C406.2 is met if DOE standards for this equipment is updated prior to revisions to Table C406.2. All other efficiency metrics governing RTUs will remain in place, as the equipment still must comply with all requirements of Section C403.

This code change is necessary to avoid conflicting requirements between EER and IEER, as well as commercially unattainable requirements for AFUE. Regarding EER (full-load performance) and IEER (blended part- and full-load performance), optimizing for one performance condition will yield sub-optimal performance at another. While new products may improve both EER and IEER, one can only be improved incrementally at the expense of the other, and therefore requiring both to improve proportionally is not appropriate. Regarding AFUE, the requirements placed on furnaces and gas heating elements by C406.2 requires moving to a condensing technology, which is not commercially available in RTUs outside of highly niche applications. The product availability gap is related to condensate disposal; in rooftop applications there is no industry-accepted practice to dispose of condensing furnace condensate discharge, and inappropriate applications will lead to roof damage.

This code change proposal makes significant improvements to package air-cooled unitary system cooling efficiencies, and removes conflicting requirements that would prevent premium efficiency, next-generation equipment from being used in new construction. It maintains the intent of Section C406, while also keeping C406.2 relevant given changes to appliance standards and industry innovation since its original inclusion in the 2012 IECC.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is an editorial change only.

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: As written, it does not connect to prior approved sections in CE218 (Vote: 15-0).

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

IECC®: C406.2, 406.2.1 (New), C406.2.2 (New), C406.2.3 (New), C406.2.4 (New), C406.2.5 (New)

Proponents:
Mark Lessans, representing Ingersoll Rand (mark.lessans@irco.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Energy Conservation Code

C406.2 More efficient HVAC equipment performance. Equipment shall exceed the minimum efficiency requirements listed in Tables C403.3.2(1) through ~~C403.3.2(7) by 10 percent, in addition to the requirements of Section C403. Where multiple performance requirements are provided, the equipment shall exceed all requirements by 10 percent.~~ C403.3.2(9) and *Variable refrigerant flow systems* shall exceed the energy efficiency provisions of ANSI/ASHRAE/~~IESNA 90.1 by 10 percent. Equipment~~ IES 90.1 in accordance with Sections C406.2.1, C406.2.2, C406.3.3, or C406.2.4. Equipment shall also meet applicable requirements of Section C403. Energy efficiency credits for heating shall be selected from C406.2.1 or C406.2.3 and energy efficiency credits for cooling shall be selected from C406.2.2, C406.2.4 or C406.2.5. Selected credits shall include a heating or cooling energy efficiency credit or both. Equipment not listed in Tables C403.3.2(1) through ~~C403.3.2(7)~~ C403.3.2(9) and *Variable refrigerant flow systems* not listed in the energy efficiency provisions of ANSI/ASHRAE/IES 90.1 shall be limited to 10 percent of the total building system ~~capacity.~~ capacity for heating equipment where selecting C406.2.1 or C406.2.3 and cooling equipment where selecting C406.2.2, C406.2.4 or C406.2.5.

406.2.1 Five percent heating efficiency improvement. Equipment shall exceed the minimum heating efficiency requirements by 5 percent.

C406.2.2 Five percent cooling efficiency improvement. Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 5 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

C406.2.3 Ten percent heating efficiency improvement. Equipment shall exceed the minimum heating efficiency requirements by 10 percent.

C406.2.4 Ten percent cooling efficiency improvement. Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 10 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

C406.2.5 More than ten percent cooling efficiency improvement. Where equipment exceeds the minimum annual cooling and heat rejection efficiency requirements by more than 10 percent, energy efficiency credits for cooling may be determined using Equation 4-1, rounded to the nearest whole number. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

$EEC_{HEC} = EEC_{10} \times [1 + ((CEI - 10 \text{ percent}) \div 10 \text{ percent})]$ (Equation 4-1)

Where:

EEC_{HEC} = energy efficiency credits for cooling efficiency improvement

EEC_{10} = C406.2.4 credits from Tables C406.1(1) through C406.1(5)

CEI = the lesser of: the improvement above minimum cooling and heat rejection efficiency requirements, or 15 percent

Commenter's Reason: This proposal has been modified in light of committee action on CE 218. As revised, C406.2 allows the building designer to take credits for high efficiency HVAC cooling performance, but only for improvements in cooling efficiency of up to 10% above the energy efficiency requirements in C403. This presents a significant gap, as there are high efficiency HVAC systems commercially available today that go well beyond a 10% improvement in cooling performance over the minimum requirements.
This public comment simply adds an additional subsection to CE 218, C406.2.5, to address this gap. With this additional language, if a building designer selects an HVAC system with a cooling performance that exceeds minimum requirements by more than 10%, they would be able to get additional energy efficiency credits proportional to the improvement of the cooling performance. For example, if equipment is selected that exceeds minimum cooling efficiency requirements by 12%, she would be able to multiply credits taken in C06.2.4 by 1.2.

Approval of this proposal as modified by public comment will help enable next-generation, high efficiency HVAC systems to receive appropriate credit under the revised C406 format. This will give designers additional flexibility under C406, while achieving the same level of energy savings, and help pull through premium efficiency equipment into the marketplace.

Credit for performance is capped at 15% above minimum cooling performance requirements, or a “points multiplier” of 1.5, in order to discourage a designer from selecting an inappropriate system for a given application, merely because of its energy efficiency rating. This cap has been revised downward from 20% in response to concerns raised at the Committee Action Hearings that a 20% maximum allowable cooling performance improvement was too high.

Examples:

(1) Group B Building in Climate Zone 5B with Cooling Efficiency Improvement of 12% = 6 energy efficiency credits:
EEC_{HEC} = 5 credits x [1 + ((12% – 10%) ÷ 10%)] = 5 credits x 1.2 = 6 credits

(2) Group R Building in Climate Zone 2A with Cooling Efficiency Improvement of 13% = 5 energy efficiency credits:
EEC_{HEC} = 4 credits x [1 + ((13% – 10%) ÷ 10%)] = 4 credits x 1.3 = 5.2 credits (round to 5 credits)

(3) Group E Building in Climate Zone 3B with Cooling Efficiency Improvement of 25% = 6 energy efficiency credits:
EEC_{HEC} = 4 credits x [1 + ((15% – 10%) ÷ 10%)] = 4 credits x 1.5 = 6 credits (capped at performance improvement of 15%)

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
Under Section C406 as revised, building designers will need as many options as possible to achieve credits toward compliance. This proposal creates the opportunity for additional points through cooling efficiency, thereby increasing flexibility without sacrificing efficiency, and allowing designers to choose a more optimal path forward. As such, it will decrease the cost of construction. Finally, this added flexibility will make it easier for a jurisdiction to go beyond code and require more than 10 additional energy efficiency credits under C406.

Public Comment# 1149

CE226-19

IECC®: SECTION C406, C406.1, TABLE C406.1(1) (New), TABLE C406.1(2) (New), TABLE C406.1(3) (New), TABLE C406.1(4) (New), TABLE C406.1(5) (New), C406.1.1, C406.2, C406.2.1 (New), C406.2.2 (New), C406.2.3 (New), C406.2.4 (New), C406.3, C406.3.1, C406.3.3 (New), C406.5 (New), C406.5.1, C406.5.2 (New), C406.7, C406.7.1, C406.7.2, C406.7.3 (New), C406.7.4 (New)

Proposed Change as Submitted

Proponents: Louis Starr, representing Northwest Energy Efficiency Alliance (lstarr@neea.org)

2018 International Energy Conservation Code

SECTION C406
ADDITIONAL EFFICIENCY ~~PACKAGE OPTIONS~~ REQUIREMENTS

C406.1 ~~Requirements.~~ Additional efficiency requirements. ~~Buildings shall comply~~ New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits may also be as calculated in accordance the relevant subsection of C406. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9

Add new text as follows:

TABLE C406.1(1)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP B OCCUPANCIES

Sub-section / Climate Zone:	**1A**	**1B**	**2A**	**2B**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6 A**	**6 B**	**7**	**8**
C406.2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	1	1	NA	1
C406.2.2: 5% Cooling Eff Imprv.	6	6	5	5	4	4	3	3	3	2	2	2	1	2	2	2	1
C406.2.3: 10 % Heating Eff Imprv.	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	2	1	1	2	2	NA	1
C406.2.4: 10 % Cooling Eff Imprv.	11	12	10	9	7	7	6	5	6	4	4	5	3	4	3	3	3
C406.3.1: Reduce Light Power 10%	9	8	9	9	9	9	10	8	9	9	7	8	8	6	7	7	6
C406.3.3: Lamp Efficacy	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.4: Enh. Digital Light Ctrl	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1
C406.5.1: On-site Renewable Egy.	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
C406.6 : Dedicated OA Sys (DOAS)	4	4	4	4	4	3	2	5	3	2	5	3	2	7	4	5	3
C406.7.2: Recovered/Renew SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.3: Eff fossil fuel SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.4: Heat Pump SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.8: Enhanced Envelope Perf	1	4	2	4	4	3	NA	7	4	5	10	7	6	11	10	14	16
C406.9: Reduced Air Infiltration	2	1	1	2	4	1	NA	8	2	3	11	4	1	15	8	11	6

TABLE C406.1(2)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP R AND I OCCUPANCIES

Sub-section / Climate Zone:	**1A**	**1B**	**2A**	**2B**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6 A**	**6 B**	**7**	**8**
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	NA	NA	1	NA	1	1	1	1	2	1	2	2
C406 .2.2: 5% Cooling Eff Imprv.	3	3	2	2	1	1	1	1	1	NA	1	1	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	NA	1	NA	NA	1	1	1	2	2	1	3	2	3	4
C406 .2.4: 10 % Cooling Eff Imprv.	5	5	4	3	2	3	1	2	2	1	1	1	1	1	1	1	1
C406 .3.1: Reduce Light Power 10%	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2
C406 .3.3: Lamp Efficacy	2	2	2	2	1	2	2	1	1	1	1	1	1	1	1	1	1
C406 .4: Enh. Digital Light Ctrl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .5.1: On-site Renewable Egy.	8	8	8	8	7	8	8	7	7	7	7	7	7	7	7	7	7
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	4	2	NA	6	3	4	8	5	5	10	7	11	12
C406 .7.2: Recovered/Renew SWH	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406 .7.3: Eff fossil fuel SWH	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406 .7.4: Heat Pump SWH	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406 .8: Enhanced Envelope Perf	3	6	3	5	4	4	1	4	3	3	4	5	3	5	4	6	6
C406 .9: Reduced Air Infiltration	6	5	3	11	6	4	NA	7	3	3	9	5	1	13	6	8	3

TABLE C406.1(3)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP E OCCUPANCIES

Sub-section / Climate Zone:	**1A**	**1B**	**2A**	**2B**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6 A**	**6 B**	**7**	**8**
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	4
C406 .2.2: 5% Cooling Eff Imprv.	4	4	3	3	2	2	2	2	1	1	1	1	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	3	4	3	4	3	4	3	5	7
C406 .2.4: 10 % Cooling Eff Imprv.	7	8	7	6	5	4	3	4	3	1	2	2	1	2	2	2	1
C406 .3.1: Reduce Light Power 10%	8	8	8	9	8	9	9	8	9	9	8	9	8	7	8	7	7
C406 .3.3: Lamp Efficacy	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .4: Enh. Digital Light Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406 .5.1: On-site Renewable Egy.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5
C406 .6 : Dedicated OA Sys (DOAS)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .7.2: Recovered/Renew SWH[a]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C406 .7.3: Eff fossil fuel SWH [a]	NA	1	1	1	1	1	1	2	2	3	2	3	2	3	3	3	5
C406 .7.4: Heat Pump SWH [a]	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	1	1	NA	1	1	1	1
C406 .8: Enhanced Envelope Perf	3	7	3	4	2	4	1	1	3	1	2	3	NA	4	3	6	9
C406 .9: Reduced Air Infiltration	1	1	1	2	NA	NA	NA	NA	NA	NA	1	NA	NA	4	1	4	3

a. For schools with full service kitchens or showers

TABLE C406.1(4)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP M OCCUPANCIES

Sub-section / Climate Zone:	**1A**	**1B**	**2A**	**2B**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6 A**	**6 B**	**7**	**8**
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	NA	1	1	2	2	2	2	3	2	3	4
C406 .2.2: 5% Cooling Eff Imprv.	5	6	4	4	3	3	1	2	2	1	1	2	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	2	4	3	4	5	5	3	6	8
C406 .2.4: 10 % Cooling Eff Imprv.	9	12	9	8	6	6	3	4	4	1	2	3	NA	2	2	2	1
C406 .3.1: Reduce Light Power 10%	13	13	15	14	16	14	17	15	15	14	12	14	14	16	16	14	12
C406 .3.3: Lamp Efficacy	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .4: Enh. Digital Light Ctrl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .5.1: On-site Renewable Egy.	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	6
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	3	3	1	3	2	2	2	3	2	4	3	4	4
C406 .7.2: Recovered/Renew SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .7.3: Eff fossil fuel SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .7.4: Heat Pump SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .8: Enhanced Envelope Perf	4	6	3	4	3	3	1	6	4	4	4	5	4	6	5	8	9
C406 .9: Reduced Air Infiltration	1	1	1	2	1	1	NA	3	1	1	3	2	1	7	3	6	3

TABLE C406.1(5)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR OTHER OCCUPANCIES

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	3
C406 .2.2: 5% Cooling Eff Imprv.	5	5	4	4	3	3	2	2	2	1	1	2	1	1	1	1	1
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	2	3	3	3	3	4	3	5	5
C406 .2.4: 10 % Cooling Eff Imprv.	8	9	8	7	5	5	3	4	4	2	2	3	2	2	2	2	2
C406 .3.1: Reduce Light Power 10%	8	8	9	9	9	9	10	8	9	9	7	8	8	8	8	8	7
C406 .3.3: Lamp Efficacy	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .4: Enh. Digital Light Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406 .5.1: On-site Renewable Egy.	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	7
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	4	3	2	5	3	3	5	4	3	7	5	7	6
C406 .7.2: Recovered/Renew SWH [b]	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406 .7.3: Eff fossil fuel SWH [b]	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406 .7.4: Heat Pump SWH [b]	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406 .8: Enhanced Envelope Perf	3	6	3	4	3	4	1	5	4	3	5	5	4	7	6	9	10
C406 .9: Reduced Air Infiltration	3	2	2	4	4	2	NA	6	2	2	6	4	1	10	5	7	4

a. Other occupancy groups include all Groups except for Groups B, R, I, E, and M.

b. For occupancy groups listed in C406 .7.1.

C406.1.1 Tenant spaces. Tenant spaces shall comply with sufficient options form Tables C406 .1(1) through C406 .1(5) to achieve a minimum number of 5 credits, where credits are selected from Section C406.2, C406.3, C406.4, C406.6 or C406.7. ~~Alternatively~~ Where the entire building complies using credits from Section C406 .5, C406 .8 or C406 .9, tenant spaces within the building shall be deemed to comply with ~~Section C406.5 where the entire building is in compliance.~~ this section

Exception: Previously occupied tenant spaces that comply with this code in accordance with Section C501.

C406.2 More efficient HVAC equipment performance. Equipment shall exceed the minimum efficiency requirements listed in Tables C403.3.2(1) through ~~C403.3.2(7) by 10 percent, in addition to the requirements of Section C403. Where multiple performance requirements are provided, the equipment shall exceed all requirements by 10 percent.~~ C403.3.2(9) and *Variable refrigerant flow systems* ~~shall exceed~~ listed in the energy efficiency provisions of ANSI/ASHRAE/IESNA 90.1 ~~by 10 percent. Equipment~~ in accordance with Sections C406 .2.1, C406 .2.2, C406 .2.3 or C406 .2.4. Equipment shall also meet applicable requirements of Section C403. Energy efficiency credits for heating shall be selected from C406 .2.1 or C406 .2.3 and energy efficiency credits for cooling shall be selected from C406 .2.2 or C406 .2.4. Selected credits shall include a heating or cooling energy efficiency credit or both. Equipment not listed in Tables C403.3.2(1) through ~~C403.3.2(7)~~ C403.3.2(9) shall be limited to 10 percent of the total building system ~~capacity.~~ capacity for heating equipment where selecting C406 .2.1 or C406 .2.3 and cooling equipment where selecting C406 .2.2 or C406 .2.4.

Add new text as follows:

C406.2.1 Five percent heating efficiency improvement Equipment shall exceed the minimum heating efficiency requirements by 5 percent.

C406.2.2 Five percent cooling efficiency improvement Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 5 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

C406.2.3 Ten percent heating efficiency improvement Equipment shall exceed the minimum heating efficiency requirements by 10 percent.

C406.2.4 Ten percent cooling efficiency improvement Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 10 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

Revise as follows:

C406.3 Reduced lighting power. ~~The total connected interior lighting power calculated in accordance with Section C405.3.1 shall be less than 90 percent of the total lighting power allowance calculated in accordance with Section C405.3.2.~~

Buildings shall comply with Section C406.3.1 or C406.3.2 and dwelling units and sleeping units within the building shall comply with C406.3.3.

~~C406.3~~ C406.3.1 Reduced lighting ~~power.~~ power by more than 10 percent. The total connected interior lighting power calculated in accordance with Section C405.3.1 shall be less than 90 percent of the total lighting power allowance calculated in accordance with Section C405.3.2.

Add new text as follows:

C406.2.3 Reduced lighting power by more than 15 percent. Where the total connected interior lighting power calculated in accordance with Section C405.3.1 is less than 85 percent of the total lighting power allowance calculated in accordance with Section C405.3.2, additional energy efficiency credits shall be determined based on Equation 4-12, rounded to the nearest whole number.

$AEEC_{LPA} = AEEC_{10} \times 10 \times (LPA - LPD) / LPA$ (Equation 4-12)

Where:

$AEEC_{LPA}$ = C406 .3.2 additional energy efficiency credits

LPD = total connected interior lighting power calculated in accordance with Section C405.3.1

LPA = total lighting power allowance calculated in accordance with Section C405.3.2

$AEEC_{10}$ = C406.3.1 credits from Tables C406.1(1) through C406.1(5)

C406.3.3 Lamp efficacy Not less than 95 percent of the interior lighting power (watts) from lamps in permanently installed light fixtures in dwelling units and sleeping units shall be provided by lamps with a minimum efficacy of 65 lumens per watt.

C406.5 On-site renewable energy. Buildings shall comply with Section C406.5.1 or C406.5.2

Revise as follows:

~~C406.5~~ C406.5.1 ~~On-site renewable energy.~~ Basic Renewable Credits The total minimum ratings of on-site renewable energy systems not including systems used for credits under Section C406.7.2 shall be one of the following:

1. Not less than ~~1.71~~ 0.86 Btu/h per square foot ~~(5.4~~ (2.7 W/m^2) or ~~0.50~~ 0.25 watts per square foot ~~(5.4~~ (2.7 W/m^2) of conditioned floor area.
2. Not less than ~~3~~ 2 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.

Add new text as follows:

C406.5.2 Enhanced Renewable Credit Where the total minimum ratings of on-site renewable energy systems exceeds the rating in C406.5.1(1), additional energy efficiency credits shall be determined based on Equation 4-13, rounded to the nearest whole number.

$AEEC_{RRa} = AEEC_{2.5} \times RR_a / RR_1$ (Equation 4-13)

Where:

$AEEC_{RRa}$ = C406 .5.2 additional energy efficiency credits

RR_a = actual total minimum ratings of *on-site renewable energy* systems (in Btu/h, watts per square foot or W/m^2)

$RR1$ = minimum ratings of *on-site renewable energy* systems required by C406 .5.1(1) (in Btu/h, watts per square foot or W/m^2)

$AEEC_{2.5}$ = C406.5.1 credits from Tables C406 .1(1) through C406.1(5)

C406.7 Reduced energy use in service water heating. Buildings shall comply with Sections C406.7.1 and either C406 .7.2, C406 .7.3 or C406 .7.4.

Revise as follows:

~~C406.7~~ C406.7.1 ~~Reduced energy use in service water heating.~~ Building Type ~~Buildings shall be~~ To qualify for this credit, the building shall contain one be of the following use groups and the additional energy efficiency credit shall be prorated by conditioned floor area of the portion of the building comprised of the following ~~types to~~ use ~~this compliance method~~ groups:

1. *Group R*-1: Boarding houses, hotels or motels.
2. Group I-2: Hospitals, psychiatric hospitals and nursing homes.
3. Group A-2: Restaurants and banquet halls or buildings containing food preparation areas.
4. Group F: Laundries.
5. *Group R*-2.

6. Group A-3: Health clubs and spas.
7. Group E: Schools with full-service kitchens or locker rooms with showers
8. Buildings showing a service hot water load of 10 percent or more of total building energy loads, as shown with an energy analysis as described in Section C407.

~~**C406.7.1**~~ **C406.7.2** ~~**Load fraction.**~~ **Recovered or renewable water heating** The building service water-heating system shall have one or more of the following that are sized to provide not less than ~~60~~ 30 percent of the building's annual hot water requirements, or sized to provide ~~100~~ 70 percent of the building's annual hot water requirements if the building ~~shall otherwise~~ is required to comply with Section C403.9.5:

1. Waste heat recovery from service hot water, heat-recovery chillers, building equipment, or process equipment.
2. *On-site renewable energy* water-heating systems.

Add new text as follows:

C406.7.3 Efficient fossil fuel water heater The combined input-capacity-weighted-average equipment rating of all fossil fuel water heating equipment in the building shall be not less than 95% Et or 0.95 EF. This option shall receive only half the listed credits for buildings required to comply with C404.2.1.

C406.7.4 Heat pump water heater Where electric resistance water heaters are allowed, all service hot water system heating requirements shall be met using heat pump technology with a combined input-capacity-weighted-average EF of 3.0. Air-source heat pump water heaters shall not draw conditioned air from within the building, except exhaust air that would otherwise be exhausted to the exterior.

Reason: C406 Credits for Dwelling Lighting Efficacy
This proposal builds on top of a proposal that assigns energy efficiency credits to each option in Section C406 (CE218-19). For clarity, that entire base proposal is included here with additional provisions and table row additions that provide additional energy efficiency credits when:

- The lighting power density is reduced by more than 15% below the required lighting power allowance. For this option the 10% reduction credits in Section C406.3.1 are multiplied by the ratio of actual lighting power density reduction to lighting power allowance
- The efficacy of lamps installed in sleeping and dwelling units is higher than required in the residential section of the code and appropriate credits for that improvement are added as new lines in the credit tables.

The provision expands the available credits for more than 10% lighting power reduction where the lighting power density is reduced by more than 15%.

Currently, a 10% lighting reduction in lighting power allowance is required for this extra efficiency option; however dwelling units and sleeping units can follow the residential lighting efficacy requirements. As a result, the applicability of option C406.3 is unclear for multi-family buildings. This measure would make clear the 10% lighting reduction applies to areas in a multi-family building that are not dwelling units and sleeping units and would apply a higher efficacy rating in the dwelling and sleeping units than is required in the residential lighting requirements.

To achieve this extra efficiency credit, this measure would increase the efficacy requirement for lamps in permanently installed fixtures and make them more in line with lamps available today.

This measure provides more clarity for multi-family buildings for the extra efficiency credit. Lamps meeting the higher efficacy requirement are readily available and appropriate for an optional credit.

Bibliography:
Hart, R., R. Nambiar, M. Tyler, M., Y. Xie, and J. Zhang. “Relative Credits for Extra Efficiency Measures: Technical Brief.” Pacific Northwest National Laboratory (PNNL), Richland, WA (US), January 2019.

https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-28370Rev.1.pdf.

www.1000bulbs.com for lamp prices

Cost Impact: The code change proposal will not increase or decrease the cost of construction
To achieve the lighting credit in multi-family buildings, this proposal will require higher efficicacy lamps in dwelling units and sleeping units. However, these lamps are readily available in the market place, and checking internet sources has found them to actually be less costly than the slightly lower efficacy alternative required under the residential code. LED lamps were found to be about 85% the cost of similar output compact fluorescent lamps. If compared to incandescent lamps, there may be a cost increase, but the life of either the CFL or LED lamps is 10 or 15 times as long, resulting in a much lower cost per year of service.

Further, the current proposal does not require more investment, but rather expands existing options permitted under the 2018 IECC. In fact, credit is now given to lighting reductions greater than 10%. The intention is to assess relative savings equity amongst current options, and identify additional options to increase flexibility and more effectively utilize new technologies and construction practices.

There is not expected to be an increased cost, as several of the evaluated options are included in current code. In some cases, costs may be reduced, as the outlined approach provides partial credit for selected items as well as credit for items that may have previously been included in the building design without credit. Costs, and cost effectiveness, are not evaluated for individual measures due to the vast number of potential combinations amongst building types, climates, and selected options. Actual costs will vary based on the items selected by the building designer—architects, engineers, and other involved trades—based on the needs and goals of the individual project.

CE226-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Modified**

Committee Modification:
C406.1 Additional efficiency requirements. New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. ~~Credits may also be as calculated in accordance the relevant subsection of C406.~~ Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9

C406.3.3 Lamp efficacy. Not less than 95 percent of the permanently installed lighting , excluding kitchen appliance light fixtures, serving ~~interior lighting power (watts) from lamps in permanently installed light fixtures in~~ dwelling units and sleeping units shall be provided by lamps with ~~a minimum~~ an efficacy of not less than 65 lumens per watt or luminaires with an efficacy of not less than 45 lumens per watt.

Committee Reason: The proposal increases lighting reduction The modifications brought consistency with CE262, CE218 and allowed exemption for kitchen appliance lighting (Vote: 13-2).

Assembly Action: **None**

CE226-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests Disapprove

Commenter's Reason: Proposals CE218, CE226, and CE240 should be withdrawn by the proponent because they do the opposite of what is intended, and a cost justification was not included. The analysis does attempt to balance out equal energy performance, but it does not take into consideration the cost impact of having to comply with multiple choices of the current code which currently requires only one of the listed efficiency options. For example, choose either 10% HVAC equipment efficiency increase or Reduced Light Power or one of the other 6 options and comply with the code. It is also very difficult to determine code compliance for builders building in multiple zones, because the point system varies drastically

across zones and what can be used as a solution in one zone will not receive enough points to qualify in other zones.
The following are examples of the combinations of requirements that would be required to comply with the proposed change.

Notes:

1. Changes, in all but Option 4, are based on taking the lowest number or total points available to determine compliance.

2. Numerous options are available beyond the examples shown below. The following is just a sample of the difficulty and if cost were applied to the change the cost impact.

Option 1 – 10% Increase Equipment Efficiency which would meet current code.

1. In addition to the 10% HVAC equipment efficiency the builder would need to:

2. Provide onsite Renewable Energy in all Zones.

3. Plus, include Reduced Lighting Power of 10% in Zones 3C, 4C and 5C.

Option 2 – 10% Increase Equipment Efficiency which would meet current code.

1. In addition to the 10% HVAC equipment efficiency the builder would need to:

2. Provide Reduced Lighting Power of 10% in all Zones.

3. Plus, Zone 1B also include a Dedicated Outdoor Air System.

4. Plus, Zones 2A, 3A, 3B, 3C, 4A, 4B, 5A, 5C, 6B, and 7 the builder would be required to include a Heat Pump Water Heater. Zone 3C would also need to include Enhanced Envelope Performance.

5. Zones 1A, 2B, 4C, 5B, and 6A could have an Enhanced Envelope in place of the Heat Pump Water Heater and Zones 4C and 5C would also be required to have Reduced Air Infiltration.

6. Zone 8 would only need to have Reduced Air Infiltration.

Option 3 – 5% Increase Equipment Efficiency.

1. In addition to the 5% HVAC equipment efficiency which the justification states will help in compliance because it is difficult to get a 10% increase in HVAC equipment efficiency the builder would need to:

2. Provide On-Site Renewable Energy.

3. Plus, in Zones 3A, 3B, 4B, 4C, and 5C also Reduce Lighting Power by 10%.

4. Zones 4A, 5A, 5B, 6B, 7 and 8 do not need to have Reduce Light Power of 10%, but they must have Lamp Efficacy.

5. And, Zone 3C can get by with only adding Enhance Envelope to the On-Site Renewable Energy requirement.

Option 4 – If the above is complicated and hard to determine then compliance can be obtained by:

1. Installing 5% Increase HVAC Equipment Efficiency, and

2. Installing a Recovered or Renewable Water Heating System for the entire project.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1215

CE229-19

IECC: C202, C406.1, TABLE C406.1(1) (New), TABLE C406.1(2) (New), TABLE C406.1(3) (New), TABLE C406.1(4) (New), TABLE C406.1(5) (New), C406.1.1, C406.2 , C406.2.1 (New), C406.2.3 (New), C406.2.4 (New), C406.4, C406.5, C406.5.1 (New), C406.5.2 (New), C406.7, C406.7.1 (New), C406.7.1, C406.7.3 (New), C406.7.4 (New)

Proposed Change as Submitted

Proponents: Jonathan McHugh, representing McHugh Energy Consultants Inc. (jon@mchughenergy.com)

2018 International Energy Conservation Code

SECTION C202
GENERAL DEFINITIONS

Add new definition as follows:

LUMEN MAINTENANCE CONTROLS: A lighting control strategy that adjusts luminaire power over time to maintain constant light output as luminaires age, dirt accumulates or both. This strategy allows for energy savings in the life of the system then increases power as the system ages.

HIGH END TRIM: A lighting control strategy that sets the required maximum light level for each space.

SECTION C406
ADDITIONAL EFFICIENCY ~~PACKAGE OPTIONS~~ REQUIREMENTS

C406.1 Requirements. ~~Buildings shall comply~~ New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Alternatively, credits shall be as calculated in accordance the relevant subsection of Section C406. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9

Add new text as follows:

TABLE C406.1(1)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP B OCCUPANCY

Sub-section / Climate Zone:	**1A**	**1B**	**2A**	**2B**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6 A**	**6 B**	**7**	**8**
C406.2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	1	1	NA	1
C406.2.2: 5% Cooling Eff Imprv.	6	6	5	5	4	4	3	3	3	2	2	2	1	2	2	2	1
C406.2.3: 10 % Heating Eff Imprv.	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	2	1	1	2	2	NA	1
C406.2.4: 10 % Cooling Eff Imprv.	11	12	10	9	7	7	6	5	6	4	4	5	3	4	3	3	3
C406.3: Reduced Light Power	9	8	9	9	9	9	10	8	9	9	7	8	8	6	7	7	6
C406.4: Enh. Digital Light Ctrl	4	4	4	4	4	4	4	3	4	4	3	3	4	3	3	3	3
C406.5.1: On-site Renewable Egy.	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
C406.6 : Dedicated OA Sys (DOAS)	4	4	4	4	4	3	2	5	3	2	5	3	2	7	4	5	3
C406.7.2: Recovered/Renew SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.3: Eff fossil fuel SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.4: Heat Pump SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.8: Enhanced Envelope Perf	1	4	2	4	4	3	NA	7	4	5	10	7	6	11	10	14	16
C406.9: Reduced Air Infiltration	2	1	1	2	4	1	NA	8	2	3	11	4	1	15	8	11	6

TABLE C406.1(2)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP R AND I OCCUPANCIES

Sub-section / Climate Zone:	**1A**	**1B**	**2A**	**2B**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6 A**	**6 B**	**7**	**8**
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	NA	NA	1	NA	1	1	1	1	2	1	2	2
C406 .2.2: 5% Cooling Eff Imprv.	3	3	2	2	1	1	1	1	1	NA	1	1	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	NA	1	NA	NA	1	1	1	2	2	1	3	2	3	4
C406 .2.4: 10 % Cooling Eff Imprv.	5	5	4	3	2	3	1	2	2	1	1	1	1	1	1	1	1
C406 .3: Reduced Light Power	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2
C406 .4: Enh. Digital Light Ctrl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .5.1: On-site Renewable Egy.	8	8	8	8	7	8	8	7	7	7	7	7	7	7	7	7	7
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	4	2	NA	6	3	4	8	5	5	10	7	11	12
C406 .7.2: Recovered/Renew SWH	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406 .7.3: Eff fossil fuel SWH	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406 .7.4: Heat Pump SWH	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406 .8: Enhanced Envelope Perf	3	6	3	5	4	4	1	4	3	3	4	5	3	5	4	6	6
C406 .9: Reduced Air Infiltration	6	5	3	11	6	4	NA	7	3	3	9	5	1	13	6	8	3

TABLE C406.1(3)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP E OCCUPANCY

Sub-section / Climate Zone:	**1A**	**1B**	**2A**	**2B**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6 A**	**6 B**	**7**	**8**
C406.2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	4
C406.2.2: 5% Cooling Eff Imprv.	4	4	3	3	2	2	2	2	1	1	1	1	NA	1	1	1	NA
C406.2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	3	4	3	4	3	4	3	5	7
C406.2.4: 10 % Cooling Eff Imprv.	7	8	7	6	5	4	3	4	3	1	2	2	1	2	2	2	1
C406.3: Reduced Light Power	8	8	8	9	8	9	9	8	9	9	8	9	8	7	8	7	7
C406.4: Enh. Digital Light Ctrl	3	4	3	4	3	4	3	4	5	4	4	5	3	4	4	3	2
C406.5.1: On-site Renewable Egy.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5
C406.6 : Dedicated OA Sys (DOAS)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.2: Recovered/Renew SWH[a]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C406 .7.3: Eff fossil fuel SWH [a]	NA	1	1	1	1	1	1	2	2	3	2	3	2	3	3	3	5
C406 .7.4: Heat Pump SWH [a]	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	1	1	NA	1	1	1	1
C406.8: Enhanced Envelope Perf	3	7	3	4	2	4	1	1	3	1	2	3	NA	4	3	6	9
C406.9: Reduced Air Infiltration	1	1	1	2	NA	NA	NA	NA	NA	NA	1	NA	NA	4	1	4	3

a. For schools with showers or full service kitchens

TABLE C406.1(4)
ADDITIONAL ENERGY EFFICIENCY CREDITS FOR GROUP M OCCUPANCIES

Sub-section / Climate Zone:	**1A**	**1B**	**2A**	**2B**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6 A**	**6 B**	**7**	**8**
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	NA	1	1	2	2	2	2	3	2	3	4
C406 .2.2: 5% Cooling Eff Imprv.	5	6	4	4	3	3	1	2	2	1	1	2	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	2	4	3	4	5	5	3	6	8
C406 .2.4: 10 % Cooling Eff Imprv.	9	12	9	8	6	6	3	4	4	1	2	3	NA	2	2	2	1
C406 .3: Reduced Light Power	13	13	15	14	16	14	17	15	15	14	12	14	14	16	16	14	12
C406 .4: Enh. Digital Light Ctrl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .5.1: On-site Renewable Egy.	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	6
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	3	3	1	3	2	2	2	3	2	4	3	4	4
C406 .7.2: Recovered/Renew SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .7.3: Eff fossil fuel SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .7.4: Heat Pump SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .8: Enhanced Envelope Perf	4	6	3	4	3	3	1	6	4	4	4	5	4	6	5	8	9
C406 .9: Reduced Air Infiltration	1	1	1	2	1	1	NA	3	1	1	3	2	1	7	3	6	3

C406.1(5)
TABLE Additional Energy Efficiency Credits for Other[a] Occupancies

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406.2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	3
C406.2.2: 5% Cooling Eff Imprv.	5	5	4	4	3	3	2	2	2	1	1	2	1	1	1	1	1
C406.2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	2	3	3	3	3	4	3	5	5
C406.2.4: 10 % Cooling Eff Imprv.	8	9	8	7	5	5	3	4	4	2	2	3	2	2	2	2	2
C406.3: Reduced Light Power	8	8	9	9	9	9	10	8	9	9	7	8	8	8	8	8	7
C406.4: Enh. Digital Light Ctrl	4	4	4	4	4	4	4	4	5	4	4	4	4	4	4	3	3
C406.5.1: On-site Renewable Egy.	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	7
C406.6 : Dedicated OA Sys (DOAS)	3	4	3	3	4	3	2	5	3	3	5	4	3	7	5	7	6
C406.7.2: Recovered/Renew SWH[b]	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406.7.3: Eff fossil fuel SWH [b]	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406.7.4: Heat Pump SWH [b]	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406.8: Enhanced Envelope Perf	3	6	3	4	3	4	1	5	4	3	5	5	4	7	6	9	10
C406.9: Reduced Air Infiltration	3	2	2	4	4	2	NA	6	2	2	6	4	1	10	5	7	4

a. Other occupancy groups include all Groups except for Groups B, R, I, E, and M.

b. For occupancy groups listed in Section C406.7.1.

C406.1.1 Tenant spaces. Tenant spaces shall comply with sufficient options form Tables C406 .1(1) through C406 .1(5) to achieve a minimum number of 5 credits, where credits are selected from Section C406.2, C406.3, C406.4, C406.6 or C406.7. ~~Alternatively, tenant spaces shall~~ Where the entire building complies using credits from Section C406.5, C406.8 or C406.9 tenant spaces within the buildings shall be deemed to comply with Section C406.5 where the entire building is in compliance.

Exception: Previously occupied tenant spaces that comply with this code in accordance with Section C501.

C406.2 More efficient HVAC equipment performance. Equipment shall exceed the minimum efficiency requirements listed in Tables C403.3.2(1) through ~~C403.3.2(7) by 10 percent, in addition to the requirements of Section C403. Where multiple performance requirements are provided, the equipment shall exceed all requirements by 10 percent.~~ C403.3.2(9) and *Variable refrigerant flow systems* ~~shall exceed~~ listed in the energy efficiency provisions of ANSI/ASHRAE/IESNA 90.1 ~~by 10 percent. Equipment~~ in accordance with Section C406.2.1, C406.2.2, C406.2.3 or C406.2.4. Equipment shall also meet applicable requirements of Section C403. Energy efficiency credits for heating shall be selected from Section C406.2.1 or C406.2.3 and energy efficiency credits for cooling shall be selected from Section C406.2.2 or C406.2.4. Selected credits shall include a heating or cooling energy efficiency credit or both. . Equipment not listed in Tables C403.3.2(1) through ~~C403.3.2(7)~~ C403.3.2(9) and *Variable refrigerant flow systems* not listed in the energy efficiency provisions of ANSI/ASHRAE/IES 90 .1 shall be limited to 10 percent of the total building system ~~capacity.~~ capacity for heating equipment where selecting Section C406.2.1 or C406.2.3 and cooling equipment where selecting Section C406.2.2 or C406.2.4.

Add new text as follows:

C406.2.1 Five percent heating efficiency improvement Equipment shall exceed the minimum heating efficiency requirements by 5 percent.

C406.2.2 Five percent cooling efficiency improvement Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 5 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

C406.2.3 Ten percent heating efficiency improvement Equipment shall exceed the minimum heating efficiency requirements by 10 percent.

C406.2.4 Ten percent cooling efficiency improvement Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 10 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

Revise as follows:

C406.4 Enhanced digital lighting controls. ~~Interior lighting in~~ At least 90 percent of the building floor area shall have interior lighting with the following enhanced lighting controls for luminaires providing *general lighting*, that shall be located, scheduled and operated in accordance with Section ~~C405.2.2.~~ C405.2.

1. Luminaires shall be configured for continuous dimming.

2. Luminaires shall be addressed individually. Where individual addressability is not available for the luminaire class type, a controlled group of not more than four luminaries shall be allowed.
3. Not more than eight luminaires shall be controlled together in a *daylight zone*.
4. Fixtures shall be controlled through a digital control system that includes the following function:
   4.1. Control reconfiguration based on digital addressability.
   4.2. Load shedding.
   4.3. Individual user control of overhead general illumination in open offices.
   4.4. Occupancy sensors shall be capable of being reconfigured through the digital control system.
5. Construction documents shall include submittal of a Sequence of Operations, including a specification outlining each of the functions in Item 4.
6. Functional testing of lighting controls shall comply with Section C408. *High end trim* controls shall be enabled and configured to limit the initial maximum output or maximum power draw of the controlled lighting to 85 percent or less of full light output or full power draw for both of the following:
   6.1 All areas that have *lumen maintenance controls*
   6.2 50% of the remaining floor area.

C406.5 On-site renewable energy. ~~The total minimum ratings of on-site renewable energy systems shall be one of the following:~~

1. ~~Not less than 1.71 Btu/h per square foot (5.4 W/m^2) or 0.50 watts per square foot (5.4 W/m^2) of conditioned floor area.~~
2. ~~Not less than 3 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.~~

Buildings shall comply with Section C406 .5.1 or C406 .5.2.

Add new text as follows:

C406.5.1 Basic renewable credits. The total minimum ratings of on-site renewable energy systems not including systems used for credits under Sections C406.7.2 shall be one of the following:

1. Not less than 0.86 Btu/h per square foot (2.7 W/m^2) or 0.25 watts per square foot (2.7 W/m^2) of conditioned floor area.
2. Not less than 2 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.

C406.5.2 Enhanced Renewable Credits Where the total minimum ratings of on-site renewable energy systems exceeds the rating in C406.5.1(1), additional energy efficiency credits shall be determined based on Equation 4-13, rounded to the nearest whole number.

$AEEC_{RRa} = AEEC_{2.5} \times RR_a / RR_1$ (Equation 4-13)

Where:

$AEEC_{RRa}$ = C406 .5.2 additional energy efficiency credits

RR_a = actual total minimum ratings of *on-site renewable energy* systems in Btu/h, watts per square foot or W/m2)

RR_1= minimum ratings of *on-site renewable energy* systems required by C406 .5.1(1) in Btu/h, watts per square foot or W/m^2)

$AEEC_{2.5}$ = C406 .5.1 credits from Tables C406.1(1) through C406.1(5)

C406.7 Reduced energy use in service water heating. Buildings shall comply with Section C406 .7.1 and Section C406.7.2, C406.7.3 or C406 .7.4.

Revise as follows:

~~**C406.7.**~~ **C406.7.1** ~~**Reduced energy use in service water heating**~~ **Building type.** To qualify for this credit, the building shall contain one be of the following use groups and the additional energy efficiency credit shall be prorated by conditioned floor area of the portion of the building comprised of the following ~~types to~~ use ~~this compliance method~~ groups:

1. *Group R*-1: Boarding houses, hotels or motels.
2. Group I-2: Hospitals, psychiatric hospitals and nursing homes.
3. Group A-2: Restaurants and banquet halls or buildings containing food preparation areas.
4. Group F: Laundries.

5.*Group R*-2.
6. Group A-3: Health clubs and spas.
7. Group E: Schools with full-service kitchens or locker rooms with showers
8. Buildings showing a service hot water load of 10 percent or more of total building energy loads, as shown with an energy analysis as described in Section C407.

~~C406.7.1~~ C406.7.2 ~~Load fraction.~~ Recovered or renewable water heating. The building service water-heating system shall have one or more of the following that are sized to provide not less than ~~60~~ 30 percent of the building's annual hot water requirements, or sized to provide ~~100~~ 70 percent of the building's annual hot water requirements if the building ~~shall otherwise~~ is required to comply with Section C403.9.5:

1. Waste heat recovery from service hot water, heat-recovery chillers, building equipment, or process equipment.
2. *On-site renewable energy* water-heating systems.

Add new text as follows:

C406.7.3 Efficient fossil fuel water heater. The combined input-capacity-weighted-average equipment rating of all fossil fuel water heating equipment in the building shall be not less than 95 percent Et or 0.95 EF. This option shall receive only half the listed credits for buildings required to comply with C404.2.1.

C406.7.4 Heat pump water heater. Where electric resistance water heaters are allowed, all service hot water system heating requirements shall be met using heat pump technology with a combined input-capacity-weighted-average EF of 3.0. Air-source heat pump water heaters shall not draw conditioned air from within the building, except exhaust air that would otherwise be exhausted to the exterior.

Reason:
C406 Credits for Enhanced digital lighting controls.

This proposal builds on top of a proposal (CE218-19) that assigns energy efficiency credits to each option in Section C406. For clarity, that entire base proposal is included here. Additional provisions and table row modifications are as follows:

- The provisions of Enhanced Digital lighting are clarified to require high end trim tuning, including definitions to support those clarifications.
- The credits in the tables are increased for enhanced digital light control based on the clarified provisions in C406.4 that are expected to produce increased savings.

Compared to the existing enhanced lighting controls in C406.4, this proposal provides for more certain savings through light level tuning with the option of lumen maintenance control.

Enhanced lighting controls (Section C406.4) can save more energy by tuning maximum light levels to just what is needed throughout the building. Making this requirement explicit and requiring documentation can actually achieve greater savings.

In the proposed code language, changes are made to allow for the following:

- Definitions are added for lumen maintenance controls and high end trim. These definitions are adapted from NEMA-LSD-64. The high end trim definition exactly matches the NEMA definition, and the lumen maintenance definition is adjusted to refer to luminaire power rather than lamp power.
- The area required with the specified controls is adjusted to 90%. Under current language, all luminaires in the building would need to meet the control requirements. This does not make sense for areas like mechanical and electrical rooms, stairwells, and restrooms, where the specified controls would not provide an energy benefit.
- The specified controls are required only for luminaires providing general lighting.
- A requirement for high end trim was added for any areas with lumen maintenance controls, plus 50% of the remaining area.

High end trim or tuning accounts for the fact that maximum lighting with full output at the lighting power allowance level typically provides more lighting than necessary, due to increments in luminaire size and limits on exact luminaire spacing. Requiring tuning that reduces light levels and power by at least 15%, along with documentation in the lighting functional testing process will reduce actual light power levels. While the original language for this type of control provides the capability to tune, without the trim requirement, there is not a strong argument for savings actually occurring. Lumen maintenance controls also start with a lower light level and adjust the lighting upward to compensate for lumen and dirt depreciation. Requiring tuning to 85% or lower will result in more savings than the savings shown for the existing requirement without this trim language. In the field, tuning down to 70% light and power levels or lower is often possible.

This proposal addresses lumen maintenance controlled luminaires, but does not require lumen maintenance controls. Lumen maintenance controls will adjust the lighting power over time to increase power as the light output reduces from lamp, dirt and room lumen depreciation. This strategy can save average energy over time, but only if the controls are tuned initially. When these controls are applied, all areas with lumen maintenance control require tuning, with half the remaining area also requiring high end trim tuning. Where lumen maintenance controls are not used, the high trim requiremnt applies to 50% of the lit area.

Note: Tables C406.1(1) through C406.1(5) include entries for climate zones 1A through 8. Should climate zones 0A and 0B be added to the IECC, use values for 1A in 0A and values for 1B in 0B.

Bibliography:

Hart, R., R. Nambiar, M. Tyler, M., Y. Xie, and J. Zhang. "Relative Credits for Extra Efficiency Measures: Technical Brief." Pacific Northwest National Laboratory (PNNL), Richland, WA (US), January 2019. https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-28370Rev.1.pdf.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal makes the application easier to implement on the one hand. Making the applicability only to 90% of general lighting reduces the cost. Requiring tuning apears to increase the cost; however, it is currently required by C408 in daylighting areas, so the area where tuning is already required could be equivalant to 50% of the lighting area. In all, this proposal is more a clarification and a reinforcement of tuning requirements that are already found for daylighting areas in Section C408.

CE229-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **Disapproved**

Committee Reason: This is better handled during the public comment, the proponent and opponent are encouraged to work together to resolve differences on Section C406.4 Item 6 (Vote 14-1).

Assembly Action: **None**

CE229-19

Individual Consideration Agenda

Public Comment 1:

IECC®: 202 (New), C406.4

Proponents:
Jonathan McHugh, representing McHugh Energy Consultants Inc. (jon@mchughenergy.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

~~**LUMEN MAINTENANCE CONTROLS:** A lighting control strategy that adjusts luminaire power over time to maintain constant light output as luminaires age, dirt accumulates or both. This strategy allows for energy savings in the life of the system then increases power as the system ages.~~

HIGH END TRIM: A lighting control strategy that sets the required maximum light level for each space.

C406.4 Enhanced digital lighting controls. At least 90 percent of the building floor area shall have interior lighting with the following enhanced lighting controls for luminaires providing *general lighting,* that shall be located, scheduled and operated in accordance with Section C405.2.

1. Luminaires shall be configured for continuous dimming.
2. Luminaires shall be addressed individually. Where individual addressability is not available for the luminaire class type, a controlled group of not more than four luminaries shall be allowed.
3. Not more than eight luminaires shall be controlled together in a *daylight zone*.

4. Fixtures shall be controlled through a digital control system that includes the following function:
   4.1. Control reconfiguration based on digital addressability.
   4.2. Load shedding.
   4.3. Individual user control of overhead general illumination in open offices.
   4.4. Occupancy sensors shall be capable of being reconfigured through the digital control system.

5. Construction documents shall include submittal of a Sequence of Operations, including a specification outlining each of the functions in Item 4.
6. Functional testing of lighting controls shall comply with Section C408. *High end trim* controls shall be enabled and configured to limit the initial maximum output or maximum power draw of the controlled lighting to 85 percent or less of full light output or full power draw for ~~both of the following:~~ the general lighting in at least 50% of the floor area.
   ~~6.1. 6.1 All areas that have *lumen maintenance controls*~~
   ~~6.2 50% of the remaining floor area.~~

Commenter's Reason: The rationale for the proposed change is to simplify the added energy efficiency associated with tuning. Both lumen maintenance controls and institutional tuning both require high end trim (reducing) the intial light output of luminaires. Eventual adjustments that occur over time can be manual or in the case with lumen maintenance controls, automatically. As a result, it is not necessary to have a separate definition of lumen maintenance or to have the extra complexity of subtracting off the area served by lumen maintenace controls to calculate the amount of floor area served by high end tuning without the lumen maintenace controls. The intent is to lower the initial light output or power draw of lighting by at least 15% for general lighting serving 50% of the floor area to receive the energy efficiency credits.
High end trim is one of the few lighting features in this section (besides individual user controls in open offices) that actually saves energy. Without the high end trim feature, this measure does not save comparable energy to the 10% LPD reduction.

The 15% percent lighting reduction of lighting power reduction is achievable. This is what was written by a committe of expert lighting designers and researchers in support of the controllable lighitng proposal for the 2013 version of California's Title 24 part 6: *"We estimated the potential energy savings from this measure using the methodology described above in Section 3.2.3. Typical lighting installations are designed to provide a higher light level at the start of the lamping cycle, in order to account for lamp lumen depreciation and other light loss factors over lamp life. In addition, the constraints of standard lighting geometries, available luminaire sizes, and lamping usually create a situation in which the lighting designer must specify even higher light levels than are necessary to meet minimum maintained illuminance requirements. Based on these factors, we assume that by tuning lighting to the required level during the initial part of lamp life, a 15% power reduction over the lamping cycle is possible."* (page 20 Benya et all 2011) In response to comments that this is not applicable now to modern lighting systems that use LEDs with lower lumen depreciation, it is worth noting that the new ASHRAE 90.1-2019 LPDs were developed with an across board lamp lumen depreciation of 85%.

If we are moving to an energy equivalent points system, to keep the high level of points that is currently allocated the enhanced digital lighting controls, one would need to either keep the high end trim requirements,or replace this control with another control function that has equivalent savings and is enabled and verified through a functional performance test.

Bibliography: James Benya, PE, Michael Neils, PE, and Francis Rubinstein. Requirements for Controllable Lighting. 2011 California Building Energy Efficiency Standards. March 21, 2011

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment only clarifies and simplifies the original proposal that did not impact the cos tof construction.

Public Comment# 2164

CE233-19

IECC®: C406.10 (New), SECTION C406, C406.1, C406.1.1

Proposed Change as Submitted

Proponents: Harold Jepsen, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us)

2018 International Energy Conservation Code

Add new text as follows:

C406.10 Automation Receptacle Control The following shall be automatically controlled:

1.At least 50% of all 125 V, 15 and 20-amp receptacles installed in enclosed offices, conference rooms, rooms used primarily for copy and/or print functions, breakrooms, classrooms, and individual workstations, including those installed in modular partitions and module office workstation systems.
2.At least 25% of branch circuit feeders installed for modular furniture not shown on the construction documents.
3.Either split controlled receptacles shall be provided, with the top receptacle controlled, or a controlled receptacle shall be located within 12 inches of each uncontrolled receptacle.

This control shall function on:

1.A scheduled basis using a time-of-day operated control device that turns receptacle power off at specific programmed times and can be programmed separately for each day of the week. The control device shall be configured to provide an independent schedule for each portion of the building of not more than 5000 ft^2 and not more than one floor. The occupant shall be able to manually override an area for not more than two hours. Any individual override switch shall control the receptacles of not more than 5000 ft
2.An occupant sensor control that shall turn receptacles off within 20 minutes of all occupants leaving a space; or
3.An automated signal from another control or alarm system that shall turn receptacles off within 20 minutes after determining that the area is unoccupied.

All controlled receptacles shall be permanently marked in accordance with NFPA 70 and be uniformly distributed throughout the space. Plug-in devices shall not comply.

Exceptions: Receptacles for the following shall not require an automatic control device:

1. Receptacles specifically designated for equipment requiring continuous operation (24/day, 365 days/year).
2. Spaces where an automatic control would endanger the safety or security of the room or building occupants.
3. Within a single modular office workstation, non-controlled receptacles are permitted to be located more than 12 inches, but not more than 72 inches from the controlled receptacles serving that workstation.

SECTION C406
ADDITIONAL EFFICIENCY PACKAGE OPTIONS

Revise as follows:

C406.1 Requirements. Buildings shall comply with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9.
9. Automatic receptacle control in accordance with Section C406.10.

C406.1.1 Tenant spaces. Tenant spaces shall comply with Section C406.2, C406.3, C406.4, C406.6, C406.7 or ~~C406.7.~~ C406.10. Alternatively, tenant spaces shall comply with Section C406.5 where the entire building is in compliance.

Exception: Previously occupied tenant spaces that comply with this code in accordance with Section C501.

Reason: Reason: This proposal will:
1. Increase building energy efficiency

2. Offer a well-studied, cost effective efficiency measure

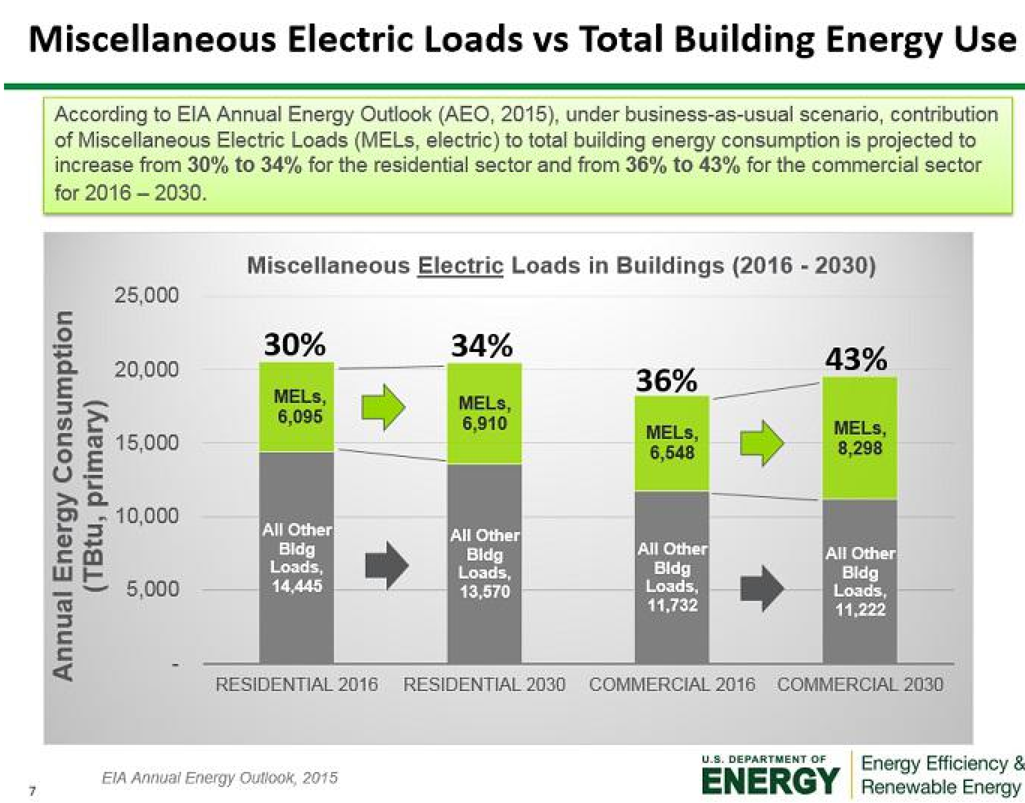
3. Maintain building occupant's safe usability

4. Keep enforceability simple

5. Align with other energy efficiency codes, increasing design compliance

Although commercial buildings continue to decrease their energy use through more efficient lighting, mechanical, and domestic water systems, the Miscellaneous Electrical Loads (MELs) energy segment continues to rise. More and more electrical power consuming devices are being plugged into building electrical systems. Some, such as fans, space heaters, printers, monitors, plug in lamps are left on, when spaces are unoccupied. Other devices may be left plugged in and continue to draw power even when inactive or in standby modes. This wastes energy and is counter to the energy efficiency aim of the IECC.

Some jurisdictions which adopt the IECC for their commercial buildings, like Florida and Washington, have amended the IECC to include automatic receptacle control, thereby addressing the growing energy consumption concern of these loads. For more than eight years, other energy efficiency codes have included automatic receptacle control provisions to reduce the wasted energy. Yet, the IECC lags behind offering no viable solution to the growing receptacle and miscellaneous loads on commercial building electrical systems. The Annual Energy Outlook of 2015 from the US EIA, indicate that these load categories will grow from 36% of a commercial buildings energy use, to 43% over the next 15 years.



This provision simply assures receptacle loads that are not needed when building occupants leave high receptacle load use areas, are automatically turned off, saving the energy that would otherwise be wasted. It requires that controlled receptacles clearly be marked as required by NFPA 70, to eliminate user confusion of proper use, and provides good practice exceptions where controlling receptacles would endanger safety and security, or areas of continuous operation.

Expressed safety concerns where extensive use of extension cords and plug strips would be used are unfounded. There are no documented studies validating this problem exists. The proposed language requires either a split duplex receptacle with a controlled or uncontrolled receptacle in the same device, or an uncontrolled receptacle be located no more than 12 inches from a controlled receptacle. This provides occupants in an automatic receptacle-controlled space, clear access to both label marked controlled receptacles and uncontrolled receptacles.

Although there are no requirements for receptacle density in commercial buildings, a design professional will ensure there is an appropriate distribution of receptacles to effectively accomplish the mission of the building. There's no evidence that the distribution of receptacle outlets and controlling some of them has any adverse impact on the utility of this requirement.

Enforceability of this provision is straight forward for building departments and their inspectors. Construction drawings indicate which receptacles are controlled and which are uncontrolled. Onsite inspection will clearly show complying labelled receptacles and operation is easily varied with the shut-off controls already in place with the lighting system.

There have been a considerable number of studies over the years that share the viability and cost effectiveness of automatic receptacle control. Some noted here.

1. One study demonstrated effectiveness (e.g. Zhang2012) with simply payback on this type of equipment between 1.5 and 9 years for small and large offices. This considers the most comprehensive information on office plug load types, installation densities, usage patterns, and power states based on field surveys and monitoring (Kawamoto 2000, 2001; Moorefield, Frazer & Bendt 2011; Roberson 2002, 2004; Roth 2002, 2004; Sanchez 2007; Webber 2001, 2005).

2. A CASE initiative study for CA Title 24-2013 found that smaller office buildings (10,000 sqft) had an annual electrical savings of 4,900 kwh/year and a demand savings of 1.97 kW. Based on installed costs and utilization of lighting control system elements already installed. The simple payback was 4.2 years. For larger office buildings (175,000 sqft) the annual electrical savings were 107,000 kwh/year and a demand savings of 23.6 kW for a simple payback of 2.4 years.

3. A GSA Green Proving Ground Program study conducted in 8 buildings with monitored receptacle control through market available plug strips found "Results underscored the effectiveness of schedule-based functionality, which reduce plug loads at workstations by 26%, even though advanced computer power management was already in place, and nearly 50% in printer room and kitchens." In the study buildings, receptacle loads averaged 21% of building energy use and monitored more than 295 devices over three different test periods to validate the findings. It found payback through timer scheduled control of kitchens of 0.7 years, printer rooms of 1.1 years and miscellaneous devices in 4.1 years. At workstations, the payback was 7.8 years.

4. A study done on "Office Space Plug Load Profiles and Energy Savings Interventions" at the University of Idaho and presented at the ACEEE summer Study in 2012 found that average savings of 0.60 kWh/SF Yr. with plug strip control interventions. This study provided guidance for utility programs to assist with development of plug load efficiency measures and was based on a more detailed report, "Plug Load Profiles" (Acker, B. et. al. 2012).

5. The DOE Better Buildings program issued a December 2015 "Decision Guides for Plug and Process Loads Controls" to help educate and guide decision processes for effective receptacle-based load control. It highlights that "Plug and Process Loads" account for 33% of the total energy consumed by commercial buildings. It sites seven decision strategies including that of Integrated plug load controls with other building systems as one of the largest for energy savings across most building types for whole-building retrofit and new construction categories.

6. A study performed “Advancing the Last Frontier – Reduction of Commercial Plug Loads” presented at the ACEEE summer study of 2016, indicated field study results demonstrating savings of 19% when deploying plug in control strategies in office workstation environments.

Cost Impact: The code change proposal will increase the cost of construction
Costs estimated to be $0.26/ft[2] for small office implementation and $0.19/ft[2] for large office. Payback estimated at 4.2 years for small office buildings (10,000swft) and 2.4 years for large office buildings (100,000sqft). Source: 2013 California Building Energy Efficiency Standards CASE report.

CE233-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: Disapproved

Committee Reason: Due to the decision to get it into requirements, the proponent requested disapproval, and prior action on CE216. A public comment is needed to address the issues raised in CE216 (Vote: 15-0).

Assembly Action: None

CE233-19

Individual Consideration Agenda

Public Comment 1:

IECC®: SECTION C406, C406.1, C406.1.1, C406.10 (New), C406.10.1 (New)

Proponents:
Harold Jepsen, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us); Megan Hayes, representing NEMA (megan.hayes@nema.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

SECTION C406
ADDITIONAL EFFICIENCY PACKAGE OPTIONS

C406.1 Requirements. Buildings shall comply with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9.
9. Automatic receptacle control in accordance with Section C406.10.

C406.1.1 Tenant spaces. Tenant spaces shall comply with Section C406.2, C406.3, C406.4, C406.6, C406.7 or C406.10. Alternatively, tenant spaces shall comply with Section C406.5 where the entire building is in compliance.

Exception: Previously occupied tenant spaces that comply with this code in accordance with Section C501.

C406.10 Automation Receptacle Control The following shall have ~~be~~ automatic~~ally~~ receptacle controls~~led~~ complying with section C406.10.1 :

1. At least 50% of all 125 V, 15 and 20-amp receptacles installed in enclosed offices, conference rooms, rooms used primarily for copy and/or print functions, breakrooms, classrooms, and individual workstations, including those installed in modular partitions and module office workstation systems.
2. At least 25% of branch circuit feeders installed for modular furniture not shown on the construction documents.
3. ~~Either split controlled receptacles shall be provided, with the top receptacle controlled, or a controlled receptacle shall be located within 12 inches of each uncontrolled receptacle.~~

~~This control shall function on:~~

1. ~~A scheduled basis using a time-of-day operated control device that turns receptacle power off at specific programmed times and can be programmed separately for each day of the week. The control device shall be configured to provide an independent schedule for each portion of the building of not more than 5000 ft^2 and not more than one floor. The occupant shall be able to manually override an area for not more than two hours. Any individual override switch shall control the receptacles of not more than 5000 ft~~

2. ~~An occupant sensor control that shall turn receptacles off within 20 minutes of all occupants leaving a space; or~~

3. ~~An automated signal from another control or alarm system that shall turn receptacles off within 20 minutes after determining that the area is unoccupied.~~

~~All controlled receptacles shall be permanently marked in accordance with NFPA 70 and be uniformly distributed throughout the space. Plug-in devices shall not comply.~~

~~**Exceptions:** Receptacles for the following shall not require an automatic control device:~~

~~1.~~ Receptacles specifically designated for equipment requiring continuous operation (24/day, 365 days/year).

2. ~~Spaces where an automatic control would endanger the safety or security of the room or building occupants.~~

3. ~~Within a single modular office workstation, non-controlled receptacles are permitted to be located more than 12 inches, but not more than 72 inches from the controlled receptacles serving that workstation.~~

C406.10.1 Automatic receptacle control function. Automatic receptacle controls shall comply with the following:

1. Either split controlled receptacles shall be provided with the top receptacle controlled, or a controlled receptacle shall be located within 12 inches of each uncontrolled receptacle.
2. Each controlled receptacle shall be controlled by one of the following methods:
   2.1. A scheduled basis using a time-of-day operated control device that turns receptacle power off at specific programmed times and can be programmed separately for each day of the week. The control device shall be configured to provide an independent schedule for each portion of the building of not more than 5000 ft^2 square feet and not more than one floor. The occupant shall be able to manually override an area for not more than two hours. Any individual override switch shall control the receptacles of not more than 5000 ftsquare feet.

   2.2. An occupant sensor control that shall turn receptacles off within 20 minutes of all occupants leaving a space; or

   2.3 An automated signal from another control or alarm system that shall turn receptacles off within 20 minutes after determining that the area is unoccupied.

3. All controlled receptacles shall be permanently marked in accordance with NFPA 70 and be uniformly distributed throughout the space.

Exceptions: Automatic receptacle controls are not required for the following:

1. Receptacles specifically designated for equipment requiring continuous operation (24/day, 365 days/year).

2. Spaces where an automatic control would endanger the safety or security of the room or building occupants.

3. Within a single modular office workstation, non-controlled receptacles are permitted to be located more than 12 inches, but not more than 72 inches from the controlled receptacles serving that workstation.

Commenter's Reason: This Public Comment allows an Automatic Receptacle Control provision as an additional efficiency option to be heard in public comment hearings in the event a mandatory provision is not approved. This would NOT be heard if the mandatory provision, already approved as modified during the Committee Action Hearings, remains approved as modified during the Public Comment Hearings.
The public comment language changes herein, reflects the Floor Modifications approved at the earlier Committee Action Hearings.

The reason statement for energy savings and costs analysis is the same as presented in the orginal proposal.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This code change proposal will only increase the cost of construction if chosen as an Additionl Efficiency Package Option. Costs estimated to be $0.26/ft^2 for small office implementation and $0.19/ft^2 for large office. Payback estimated at 4.2 years for small office buildings (10,000sqft) and 2.4 years for large office buildings (100,000sqft). Source: 2013 California Building Energy Efficiency Standards CASE report.

Public Comment# 1439

CE237-19

IECC®: C406.1, C406.10 (New), C406.10.1 (New), C406.10.2 (New), TABLE 406.10.2 (New), C406.10.3 (New), C406.10.4 (New), C406.10.5 (New)

Proposed Change as Submitted

Proponents: Harold Jepsen, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us)

2018 International Energy Conservation Code

Revise as follows:

C406.1 Requirements. Buildings shall comply with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. Include an energy monitoring system in accordance with C406.10

Add new text as follows:

C406.10 Energy Monitoring Buildings shall be equipped to measure, monitor, record and report energy consumption data in compliance with Section C406.10.1 through C406.10.5.

C406.10.1 Electrical energy metering. For electrical energy, including all electrical energy supplied to the building and its associated site, including but not limited to site lighting, parking, recreational facilities, and other areas that serve the building and its occupants, meters or other measurement devices shall be provided to collect energy consumption data for each end-use category required by Section C406.10.2.

C406.10.2 End-use metering categories. Meters or other approved measurement devices shall be provided to collect energy use data for each end-use category listed in Table 406.10.2. These meters shall have the capability to collect energy consumption data for the whole building or for each separately metered portion of the building. Where multiple meters are used to measure any end-use category, the data acquisition system shall total all of the energy used by that category. Not more than 5 percent of the measured load for each of the end-use categories listed in Table 406.10.2 is permitted to be from a load not withing the category.

Exceptions:

1.HVAC and water heating equipment serving only an individual dwelling unit does not require end-use metering.
2.End-use metering is not required for fire pumps, stairwell pressurization fans or any system that operates only during testing or emergency.

TABLE 406.10.2
ENERGY USE CATEGORIES

LOAD CATEGORY	**DESCRIPTION OF ENERGY USE**
Total HVAC system	Heating, cooling and ventilation including, but not limited to fans, pumps, boilers, chillers and water heating. Energy used by 120 volt equipment, or by 208/120 volt equipment that is located in a building where the main service is 480/277 volt power, is permitted to be excluded from Total HVAC system energy use.
Interior lighting	Lighting systems located within the *building.*
Exterior lighting	Lighting systems located on the building site but not within the building.
Plug loads	Devices, appliances and equipment connected to convenience receptacle outlets.
Process loads	Any single load that is not included in a HVAC, lighting, or plug load category and that exceeds 5 percent of the peak connected load of the whole building including, but not limited to data centers, manufacturing equipment and commercial kitchens.
Building operations and other miscellaneous loads	The remaining loads not included elsewhere in this table including, but not limited to, vertical transportation systems, automatic doors,

C406.10.3 Meters. Meters or other measurement devices required by this Section shall be configured to automatically communicate energy consumption data to the data acquisition system required by Section C406.10.4. Source meters shall be allowed to be any digital-type meter. Lighting, HVAC, or other building systems that can monitor their energy consumption shall be permitted instead of meters. Current sensors shall be permitted, provided that they have a tested accuracy of +/-2 percent. Required metering systems and equipment shall have the capability to provide at least hourly data that is fully integrated into the data acquisition system and graphical energy report in accordance with Sections 406.10.4 and C406.10.5.

C406.10.4 Data acquisition system. A data acquisition system shall have the capability to store the data from the rquired meters and other sensing devices for a minimum of 36 months. The data acquisition system shall have the capability to store real-time energy consumption data and provide hourly, daily, monthly, and yearly logged data for each end-use category required by Section C406.10.2.

C406.10.5 Graphical energy report. A permanent and readily accessible reporting mechanism shall be provided in the building that is accessible by building operation and management personnel. The reporting mechanism shall have the capability to graphically provide the energy consumption for each end-use category required by Section C406.10.2 at least every hour, day, month and year for the previous 36 months.

Reason: The investment made for the infrastructure of a building in order to comply with the IECC is significant. The assumption that is currently made upon commissioning a facility is that energy efficiency measures will not degrade, or go out of calibration, over time and their energy consumption will not increase as time passes from the time they were commissioned. Such an assumption is completely inaccurate and any payback assumed for energy efficient infrastructure investments will be lengthened, thereby reducing the ROI and increasing the payback period. The only means to retain the energy performance of a building is to continuously monitor energy consumption levels of various energy consuming

systems and compare them to previous levels. Monitoring sub-systems provides key indications when changes have been made or systems are not operating to specification, which increases energy consumption. Examples include, but are not limited to:
1. Increased energy consumption in HVAC system loads will point to failures in motors, drive systems, bearings, etc.

2. Degrading building envelope

3. Configuration changes to the building that may drive increased energy consumption.

4. Increase of energy consumption from lighting loads may indicate changes in arrangement of the office space that resulted in reduced lighting loads may indicate change in arrangement of the office space that resulted in reduced lighting driving the installation of more lighting above permitted energy code levels, failure of occupant sensors, inappropriate lighting schedules, lamps that need to be replaced or cleaned, etc.

5. Monitoring plug loads will indicate then computer equipment is left on during non-working hours and use of space heaters that compromise the efficiency of the facility due to set points on the HVAC system.

The requirements in this proposal save energy by continually monitoring and reporting actionable energy consumption data to building owners and operators. For large buildings, this data is further broken out by the major sub-systems (HVAC, lighting, process loads, and plug loads). There are well documented studies that demonstrate the energy savings from metering and monitoring systems. Several state energy codes have recognized the benefits and require energy monitoring to support a continual high level of performance from the energy efficient investment.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change proposal “will” increase the cost of construction because it will require additional hardware, software and labor during installation. Providing specific cost would violate antitrust laws, however the following link to a report provided by the GSA demonstrates an example of cost and savings: https://www.gsa.gov/cdnstatic/Energy_Submetering_Finance_Paper_Knetwork_2012_11_269%28508%29.pdf

CE237-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: As Modified

Committee Modification:
C406.1 Additional energy efficiency credit ~~R~~requirements. ~~Buildings shall comply~~ New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.

2. Reduced lighting power in accordance with Section C406.3.

3. Enhanced lighting controls in accordance with Section C406.4.

4. On-site supply of renewable energy in accordance with Section C406.5.

5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.

6. High-efficiency service water heating in accordance with Section C406.7.

7. Enhanced envelope performance in accordance with Section C406.8.

8. Reduced air infiltration in accordance with Section C406.9.

9. Where not required by Section C405.10 ~~I~~ include an energy monitoring system in accordance with C406.10.

Table C406.1(1) Additional Energy Efficiency Credits for Group B Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Energy Monitoring	4	4	4	4	3	3	3	3	3	3	2	3	2	2	2	2	2

Table C406.1(2) Additional Energy Efficiency Credits for Group R and I Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Energy Monitoring	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table C406.1(3) Additional Energy Efficiency Credits for Group E Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Energy Monitoring	3	3	3	3	3	3	3	3	3	2	2	3	2	2	2	2	2

Table C406.1(4) Additional Energy Efficiency Credits for Group M Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Energy Monitoring	4	5	5	5	5	4	4	4	4	3	3	4	3	4	4	4	3

Table C406.1(5) Additional Energy Efficiency Credits for Other[a] Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Energy Monitoring	3	3	3	3	3	3	3	3	3	3	2	3	2	2	2	3	2

[a] Other occupancy groups include all Groups except for Groups B, R, I, E, and M.

Committee Reason: This is consistent with actions on CE215 but for smaller buildings. Suggested a public comment to include tenant access to reports in Section C406.10.5. The modification corrects language of the proposal to align with CE215 (Vote: 11-4).

Assembly Action: **None**

CE237-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C406.1

Proponents:
Harold Jepsen, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us); Megan Hayes, representing NEMA (megan.hayes@nema.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C406.1 Additional energy efficiency credit requirements New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of

C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. ~~Where not required by Section C405.10 include an e~~ Energy monitoring system in accordance with C406.10.

Commenter's Reason: This Public Comment allows language modifications to CE237 (an additional efficiency option Energy Monitoring proposal), to be heard in the public comment hearings, in the event a mandatory provision is not approved. This public comment will not be called to the floor if the mandatory provision, already approved as modified during the Committee Action Hearing, remains approved. The public comment language changes are needed to properly apply energy monitoring as an additional efficiency package option when there is no mandatory requirement (as was approved in the Committee Action Hearing).
The reason statement for energy savings and costs analysis is the same as presented in the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The code change proposal will only increase the cost of construction if chosen as an Additional Efficiency Package
Option. Implementation requires additional hardware, software and labor during installation. Providing specific cost would violate antitrust laws, however the following link to a report provided by the GSA demonstrates an example of cost and savings:
https://www.gsa.gov/cdnstatic/Energy_Submetering_Finance_Paper_Knetwork_2012_11_269%28508%29.pdf

Public Comment# 1455

Public Comment 2:

IECC®: C406.10.5 (New)

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C406.10.5 Graphical energy report. A permanent and readily accessible reporting mechanism shall be provided in the building that is accessible by building operation and management personnel, building owner, and the tenant of each space. The reporting mechanism shall have the capability to graphically provide the energy consumption for each end-use category required by Section C406.10.2 at least every hour, day, month and year for the previous 36 months.

Commenter's Reason: The original proposal does have some merits as an option. The modification made was to address who receives the reports for the energy use of the building or space. The intent is to monitor the energy usage to be cognitive of how much and how the energy is used within the building or space, but the original proposal left out key players in the mix. If the tenants of the space or owners of the building are not provided with this information they are not able to address any concerns of how one may be wasting energy. Knowledge is power, and this knowledge needs to be provided where it can be useful and used appropriately. If one does not know how much energy is being used one can not fix any wasting measures.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The public comment is only a clarification and clarifications do not have a cost impact. Therefore, the net effect of the public comment and the proposal is the cost increase reason in the original proposal.

Public Comment# 1540

Public Comment 3:

IECC®: C406.1, Table C406.1(1) (New), TABLE (New)

Proponents:
Wayne Stoppelmoor, representing NEMA (wayne.stoppelmoor@schneider-electric.com); Megan Hayes, representing NEMA (megan.hayes@nema.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C406.1 ~~Additional energy efficiency credit r~~ Requirements New buildings shall ~~achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building~~ comply~~ies~~ with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. Where not required by Section C405.10 include an energy monitoring system in accordance with C406.10.

~~Table C406.1(1)~~

~~Additional Energy Efficiency Credits for Group B Occupancies~~

~~Climate Zone:~~	~~1A~~	~~1B~~	~~2A~~	~~2B~~	~~3A~~	~~3B~~	~~3C~~	~~4A~~	~~4B~~	~~4C~~	~~5A~~	~~5B~~	~~5C~~	~~6A~~	~~6B~~	~~7~~	~~8~~
~~C406.10 Energy Monitoring~~	~~4~~	~~4~~	~~4~~	~~4~~	~~3~~	~~3~~	~~3~~	~~3~~	~~3~~	~~3~~	~~2~~	~~3~~	~~2~~	~~2~~	~~2~~	~~2~~	~~2~~

TABLE ~~C406.1(2)~~

~~Additional Energy Efficiency Credits for Group R and I Occupancies~~

~~Climate Zone:~~	~~1A~~	~~1B~~	~~2A~~	~~2B~~	~~3A~~	~~3B~~	~~3C~~	~~4A~~	~~4B~~	~~4C~~	~~5A~~	~~5B~~	~~5C~~	~~6A~~	~~6B~~	~~7~~	~~8~~
~~C406.10 Energy Monitoring~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~

TABLE ~~C406.1(3)~~
~~Additional Energy Efficiency Credits for Group E Occupancies~~

~~Climate Zone:~~	~~1A~~	~~1B~~	~~2A~~	~~2B~~	~~3A~~	~~3B~~	~~3C~~	~~4A~~	~~4B~~	~~4C~~	~~5A~~	~~5B~~	~~5C~~	~~6A~~	~~6B~~	~~7~~	~~8~~
~~C406.10 Energy Monitoring~~	~~3~~	~~3~~	~~3~~	~~3~~	~~3~~	~~3~~	~~3~~	~~3~~	~~3~~	~~2~~	~~2~~	~~3~~	~~2~~	~~2~~	~~2~~	~~2~~	~~2~~

TABLE ~~C406.1(4)~~

~~Additional Energy Efficiency Credits for Group M Occupancies~~

~~Climate Zone:~~	~~1A~~	~~1B~~	~~2A~~	~~2B~~	~~3A~~	~~3B~~	~~3C~~	~~4A~~	~~4B~~	~~4C~~	~~5A~~	~~5B~~	~~5C~~	~~6A~~	~~6B~~	~~7~~	~~8~~
~~C406.10 Energy Monitoring~~	~~4~~	~~5~~	~~5~~	~~5~~	~~5~~	~~4~~	~~4~~	~~4~~	~~4~~	~~3~~	~~3~~	~~4~~	~~3~~	~~4~~	~~4~~	~~4~~	~~3~~

TABLE ~~C406.1(5)~~

~~Additional Energy Efficiency Credits for Other[a] Occupancies~~

~~Climate Zone:~~	~~1A~~	~~1B~~	~~2A~~	~~2B~~	~~3A~~	~~3B~~	~~3C~~	~~4A~~	~~4B~~	~~4C~~	~~5A~~	~~5B~~	~~5C~~	~~6A~~	~~6B~~	~~7~~	~~8~~
~~C406.10 Energy Monitoring~~	~~3~~	~~3~~	~~3~~	~~3~~	~~3~~	~~3~~	~~3~~	~~3~~	~~3~~	~~3~~	~~2~~	~~3~~	~~2~~	~~2~~	~~2~~	~~3~~	~~2~~

~~a.Other occupancy groups include all Groups except for Groups B, R, I, E, and M.~~

Commenter's Reason: This Public Comment allows modifications to the proposed additional effiency option for Energy Monitoring, to be heard in public comment hearings, in the event CE218 (C406 Additional Efficiency Package Option credit system) is not approved. This would NOT be brought to the floor if CE218 and CE215 maintain approval as modified during the Committee Action Hearing. The public comment language changes are needed to properly apply energy monitoring as an additional efficiency option when there is no C406 credit system as proposed in CE218 (approved as modified at the Committee Action Hearing).
The reason statement for energy savings and costs analysis is the same as presented in the original proposal

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The code change proposal will only increase the cost of construction, if chosen as an Additional Efficiency Package Option. Implementation will require additional hardware, software and labor during installation. Providing specific cost would violate antitrust laws, however the following link to a report provided by the GSA demonstrates an example of cost and savings:
https://www.gsa.gov/cdnstatic/Energy_Submetering_Finance_Paper_Knetwork_2012_11_269%28508%29.pdf

Public Comment# 1460

Public Comment 4:

Proponents:
Harold Jepsen, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us); Megan Hayes, representing NEMA (megan.hayes@nema.org)

requests As Submitted

Commenter's Reason: This Public Comment allows the langague of CE237 to revert back to it's original proposed language and to be heard in the public comment hearings in the event the mandatory provision (CE215) and additional efficiency credit system (CE218) are not approved. This public comment will not be called to the public comment hearing floor if the mandatory provision (approved at the Committee Action Hearings) and the additional efficiency credit system (approved at the Committee Actions Hearings) remain approved.
The reason statement for energy savings and costs analysis is the same as presented in the original proposal

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The code change proposal will only increase the cost of construction if chosen as an Additional Efficiency Package Option. Implementation requires additional hardware, software and labor during installation. Providing specific cost would violate antitrust laws, however the following link to a report provided by the GSA demonstrates an example of cost and savings:
https://www.gsa.gov/cdnstatic/Energy_Submetering_Finance_Paper_Knetwork_2012_11_269%28508%29.pdf

Public Comment# 1873

CE238-19

IECC: C202 (New), C406.1, C406.10(New), C406.10.1(New)

Proposed Change as Submitted

Proponents: Sharon Bonesteel, representing Salt River Project (sharon.bonesteel@srpnet.com); Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

SECTION C202
GENERAL DEFINITIONS

Add new definition as follows:

ELECTRICAL ENERGY STORAGE SYSTEM (EESS). A system used to provide standby or emergency power, an uninterruptable power supply, load shedding, load sharing or similar capabilities in accordance with Section 1206 of the *International Fire Code*.

LOAD. A portion of a system that consumes electric energy. The total electrical *load* of a building is the sum of all electricity consuming appliances, lights and systems, necessary for a building to function as designed.

ON-PEAK. The time of use during which the cost per kiloWatt-hour (kWh) is the highest and when the maximum generation resources are required to supply electricity to the customer.

OFF-PEAK. The time of use during which the cost per kiloWatt-hour (kWh) is the lowest and when generation resources are being underutilized.

ENERGY MANAGEMENT SYSTEM. An electronic system that protects stationary storage batteries from operating outside of their safe operating parameters, and generates an alarm and trouble signal for off normal conditions.

SECTION C406
ADDITIONAL EFFICIENCY PACKAGE OPTIONS

Revise as follows:

C406.1 Requirements. Buildings shall comply with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9.
9. Provision of an electrical energy storage system (EESS) controlled via an energy management system that shall be programed to shift a portion of the building load from on-peak to off-peak, in accordance with Section C406.10.

Add new text as follows:

C406.10 Electrical energy storage system (EESS). EESS shall be controlled by an energy management system that is programmed to shift the load from on-peak to off-peak.

C406.10.1 System storage capabilities. The system shall be capable of storing the following:

1. Not less than 0.05 watts per square foot (0.54 W/m^2) of conditioned floor area,
2. Not less than 10 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.

Reason: The conservation of energy and its related cost are the foundation of the IECC. Demand charges make a large impact on a businesses' utility bill. The inclusion of energy storage will allow these businesses to shift that load from on-peak (most expensive per kw) to off-peak (least expensive per kw) and thus reduce their demand charges. Utilizing off-peak energy to charge up the energy storage for use during on-peak times results in efficient use of the energy generation facilities available to the business.

Definitions that are common in the utility world are not defined in the codes. Utilities clearly indicate on their websites the on-peak and off-peak hours, as well as the cost difference between a kw based upon the time of use. Referencing definitions for EESS from the 2018 IFC and Load calculations clearly being defined in 2017 NFPA Art.220.40, facilitates consistency between codes.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This code change provides another option within Section C406, allowing businesses to utilize their energy efficiently. The shift of a load from on-peak period to off-peak is an important aspect of the effective use of energy. This code change also provides definitions that are common in the utility world and are necessary for the inclusion of energy storage in the effective use of energy. Referencing definitions in the IFC and the NEC facilitate consistancy between codes.

CE238-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There is too much confusion over issues which reference the IFC and electrical storage (Vote: 10-5).

Assembly Action: **None**

CE238-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C406.10.1 (New)

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org); Sharon Bonesteel AIA CBO CP, salt river project, representing Salt River Project (sharon.bonesteel@srpnet.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C406.10.1 System storage capabilities. The system shall be capable of storing the following:

1. Not less than ~~0.05~~ 0.5 watts per square foot (~~0.54~~ 5.4 W/m²) of conditioned floor area, and
2. Not less than ~~10~~ 0.1 percent of the annual energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.

Energy efficiency credit: Electrical Energy Storage Systems shall be assigned 1 credit in all building types located in all climate zones.

Commenter's Reason: This modification improves the proposal by doing the following:
-It modifies the system storage requirements. According to EIA data from CBECS 2012, the average commercial building uses 14.6 kWh / square foot of electricity per year. The typical peak demand is around 5-6 Watts per square foot for less energy intensive buildings (offices, retail, etc.). For a 10,000 square foot commercial building, 0.5 W/sf for the storage system is equal to 5 kW (compared to the building peak demand of 50 to 60 kW). If the building mechanical, water heating, and lighting equipment use 50% of the total electricity in the building, then they use 73,000 kWh per year (50% of 10,000 sf * 14.6 kWh/sf). The revised requirement of 0.1% of the annual energy used is equal to a storage system with a total capacity of 73 kWh.

-It provides information for the credit calculations that were approved in CE 218. Electrical energy storage systems will provide the same service or services in all buildings located in any climate zone, which is the reason for the same credit for all building types and all climate zones.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment revises the proposed new option based on more recent information about electrical storage needs. This is only a clarification that does not affect the proposal's cost impact statement.

CE239-19

IECC: C202, C406.1, C406.10 (New)

Proposed Change as Submitted

Proponents: Marilyn Williams, representing National Electrical Manufacturers Association (mar_williams@nema.org)

2018 International Energy Conservation Code

Add new definition as follows:

FAULT DETECTION AND DIAGNOSTICS (FDD) SYSTEM. A software platform that utilizes building analytic algorithms to convert data provided by sensors and devices to automatically identify faults in building systems and provide a prioritized list of actionable resolutions to those faults based on cost or energy avoidance, comfort and maintenance impact.

Revise as follows:

C406.1 Requirements. Buildings shall comply with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. Include a fault detection and diagnostics (FDD) system in accordance with Section C406.10.

Add new text as follows:

C406.10 Fault detection and diagnostics system. A fault detection and diagnostics system shall be installed to monitor the HVAC system's performance and automatically identify faults. The system shall:

1. Include permanently installed sensors and devices to monitor the HVAC system's performance;
2. Sample the HVAC system performance at least once per 15 minutes;
3. Automatically identify and report HVAC system faults;
4. Automatically notify authorized personnel of identified HVAC system faults;
5. Automatically provide prioritized recommendations for repair of identified faults based on analysis of data collected from the sampling of the HVAC system performance; and
6. Be capable of transmitting the prioritized fault repair recommendations to remotely located authorized personnel.

Reason: Energy efficiency of a new building's HVAC system will degrade over time caused by poorly maintained, failing and improperly controlled equipment. The proposed FDD requirement will reduce that degradation by detecting HVAC system faults and notifying building operators so that actions may be taken to reduce energy consumption of the building. Additionally, FDD systems are being utilized to drive operational efficiency, make better use of maintenance personnel, and resolve comfort issues.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
If the alternative being proposed to the list of additional energy efficiency measures by this proposal is selected, it “will” increase the cost of construction because it will require additional hardware, software and labor during installation. Providing specific cost would violate antitrust laws, however a published example of cost and savings is provided from the following link https://ecobuilding.schneider-electric.com/documents/10807/217223/Lab+Project+Building+Analytics+Case+Study/a6d8b9b6-7fdd-4e87-a90b-c98ece595a25: Setup/install cost - $23,190, Annual maintenance cost - $35,407, and Annual savings - $286,000.

CE239-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:

C406.1 Additional energy efficiency credit ~~R~~ requirements. ~~Buildings shall comply~~ New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.

2. Reduced lighting power in accordance with Section C406.3.

3. Enhanced lighting controls in accordance with Section C406.4.

4. On-site supply of renewable energy in accordance with Section C406.5.

5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with

Section C406.6.

6. High-efficiency service water heating in accordance with Section C406.7.

7. Enhanced envelope performance in accordance with Section C406.8.

8. Reduced air infiltration in accordance with Section C406.9

9. Where not required by Section C403.2.3 ~~I~~ include a fault detection and diagnostics (FDD) system in accordance with Section C406.10.

Table C406.1(1) Additional Energy Efficiency Credits for Group B Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Fault Detection	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1

Table C406.1(2) Additional Energy Efficiency Credits for Group R and I Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Fault Detection	1	1	1	1	1	1	NA	1	1	NA	1	1	NA	1	1	1	1

Table C406.1(3) Additional Energy Efficiency Credits for Group E Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Fault Detection	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2

Table C406.1(4) Additional Energy Efficiency Credits for Group M Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Fault Detection	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	2	2

Table C406.1(5) Additional Energy Efficiency Credits for Other[a] Occupancies

Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
C406.10 Fault Detection	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1

[a] Other occupancy groups include all Groups except for Groups B, R, I, E, and M.

Committee Reason: This aligns with 218 14-0 This allows credit for this provision in those buildings that aren't required to have it. The modification provides alignment with CE218 (Vote 14-1).

Assembly Action: **None**

CE239-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C406.1

Proponents:
Harold Jepsen, Legrand, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C406.1 Additional energy efficiency credit requirements. New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. ~~Where not required by Section C403.2.3 include a f~~ Fault detection and diagnostics (FDD) system in accordance with Section C406.10.

Commenter's Reason: This Public Comment allows language modifications to CE239 (an additional efficiency option Fault Detection Diagnostic proposal), to be heard in the public comment hearings, in the event a mandatory provision is not approved. This public comment will not be called to the floor if the mandatory provision, already approved as modified during the Committee Action Hearing, remains approved. The public comment language changes are needed to properly apply fault detection diagnostics as an additional efficiency package option when there is no mandatory requirement (as was approved in the Committee Action Hearing).
The reason statement for energy savings and costs analysis is the same as presented in the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
If the alternative being proposed to the list of additional energy efficiency measures by this proposal is selected, it will increase the cost of construction because it will require additional hardware, software and labor during installation. Providing specific cost would violate antitrust laws, however a published example of cost and savings is provided from the following link
https://ecobuilding.schneiderelectric.com/documents/10807/217223/Lab+Project+Building+Analytics+Case+Study/a6d8b9b6-7fdd-4e87-a90b-c98ece595a25: Setup/install cost of $23,190, Annual maintenance cost of $35,407, and Annual savings of $286,000.

Public Comment# 1888

Public Comment 2:

IECC®: C406.1, TABLE (New),

TABLE

(New), Table (New)

Proponents:
Wayne Stoppelmoor (wayne.stoppelmoor@schneider-electric.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

C406.1 ~~Additional energy efficiency credit r~~ Requirements.

New buildings shall ~~achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building complies~~ comply with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. Where not required by Section C403.2.3 include a fault detection and diagnostics (FDD) system in accordance with Section C406.10.

TABLE ~~C406.1(1)~~

~~Additional Energy Efficiency Credits for Group B Occupancies~~

~~Climate Zone:~~	~~1A~~	~~1B~~	~~2A~~	~~2B~~	~~3A~~	~~3B~~	~~3C~~	~~4A~~	~~4B~~	~~4C~~	~~5A~~	~~5B~~	~~5C~~	~~6A~~	~~6B~~	~~7~~	~~8~~
~~C406.10 Fault Detection~~	~~2~~	~~2~~	~~2~~	~~2~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~

TABLE ~~C406.1(2)~~

~~Additional Energy Efficiency Credits for Group R and I Occupancies~~

~~Climate Zone:~~	~~1A~~	~~1B~~	~~2A~~	~~2B~~	~~3A~~	~~3B~~	~~3C~~	~~4A~~	~~4B~~	~~4C~~	~~5A~~	~~5B~~	~~5C~~	~~6A~~	~~6B~~	~~7~~	~~8~~
~~C406.10 Fault Detection~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~NA~~	~~1~~	~~1~~	~~NA~~	~~1~~	~~1~~	~~NA~~	~~1~~	~~1~~	~~1~~	~~1~~

TABLE ~~C406.1(3)~~

~~Additional Energy Efficiency Credits for Group E Occupancies~~

~~Climate Zone:~~	~~1A~~	~~1B~~	~~2A~~	~~2B~~	~~3A~~	~~3B~~	~~3C~~	~~4A~~	~~4B~~	~~4C~~	~~5A~~	~~5B~~	~~5C~~	~~6A~~	~~6B~~	~~7~~	~~8~~
~~C406.10 Fault Detection~~	~~1~~	~~2~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~2~~

TABLE

~~C406.1(4)~~

~~Additional Energy Efficiency Credits for Group M Occupancies~~

~~Climate Zone:~~	~~1A~~	~~1B~~	~~2A~~	~~2B~~	~~3A~~	~~3B~~	~~3C~~	~~4A~~	~~4B~~	~~4C~~	~~5A~~	~~5B~~	~~5C~~	~~6A~~	~~6B~~	~~7~~	~~8~~
~~C406.10 Fault Detection~~	~~2~~	~~2~~	~~2~~	~~2~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~2~~	~~2~~

Table ~~C406.1(5)~~

~~Additional Energy Efficiency Credits for Other[a] Occupancies~~

~~Climate Zone:~~	~~1A~~	~~1B~~	~~2A~~	~~2B~~	~~3A~~	~~3B~~	~~3C~~	~~4A~~	~~4B~~	~~4C~~	~~5A~~	~~5B~~	~~5C~~	~~6A~~	~~6B~~	~~7~~	~~8~~
~~C406.10 Fault Detection~~	~~2~~	~~2~~	~~2~~	~~2~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~

~~a.Other occupancy groups include all Groups except for Groups B, R, I, E, and M.~~

Commenter's Reason: This Public Comment allows language modifications to CE239 (an additional efficiency option Fault Detection Diagnostic proposal), to be heard in the public comment hearings, in the event CE218(C406, additional efficiency package option credit system) is not approved. This public comment will not be called to the floor if CE218 and CE111 maintain approval as modified during the Committee Action Hearing. The public comment language changes are needed to properly apply fault detection diagnostics as an additional efficiency package option when there is no C406 credit system as proposed in CE218.
The reason statement for energy savings and costs analysis is the same as presented in the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
If the alternative being proposed to the list of additional energy efficiency measures by this proposal is selected, it “will” increase the cost of construction because it will require additional hardware, software and labor during installation. Providing specific cost would violate antitrust laws, however a published example of cost and savings is provided from the following link
https://ecobuilding.schneiderelectric.com/documents/10807/217223/Lab+Project+Building+Analytics+Case+Study/a6d8b9b6-7fdd-4e87-a90b-c98ece595a25: Setup/install cost of $23,190, Annual maintenance cost of $35,407, and Annual savings of $286,000.

Public Comment# 1894

Public Comment 3:

Proponents:
Harold Jepsen, Legrand, representing National Electrical Manufacturers Association (harold.jepsen@legrand.us)

requests As Submitted

Commenter's Reason: This Public Comment allows the langague of CE239 to revert back to it's original proposed language and to be heard in the public comment hearings in the event the mandatory provision (CE111) and the C406 additional efficiency package option credit system (CE218) are not approved. This public comment will not be called to the public comment hearing floor if the mandatory provision (approved at the Committee Action Hearings) and the additional efficiency credit system (approved at the Committee Actions Hearings) remain approved.
The reason statement for energy savings and cost analysis is the same as presented in the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
If the alternative being proposed to the list of additional energy efficiency measures by this proposal is selected, it “will” increase the cost of construction because it will require additional hardware, software and labor during installation. Providing specific cost would violate antitrust laws, however a published example of cost and savings is provided from the following link
https://ecobuilding.schneiderelectric.com/documents/10807/217223/Lab+Project+Building+Analytics+Case+Study/a6d8b9b6-7fdd-4e87-a90b-c98ece595a25: Setup/install cost of $23,190, Annual maintenance cost of $35,407, and Annual savings of $286,000.

Public Comment# 1901

CE240-19

IECC®: SECTION C406, C406.1, Table C406.1(1) (New), Table C406.1(2) (New), Table C406.1(3) (New), Table C406.1(4) (New), Table C406.1(5) (New), C406.1.1, C406.2, C406.2.1 (New), C406.2.2 (New), C406.2.3 (New), C406.2.4 (New), C406.5, C406.5.1, C406.5.2 (New), C406.7, C406.7.1, C406.7.2, C406.7.3 (New), C406.7.4 (New), C406.10 (New), Table C406.10(1) (New), Table C406.10(2) (New), Table C406.10(3) (New), Table C406.10(4) (New), ASTM Chapter 06 (New)

Proposed Change as Submitted

Proponents: Nicholas O'Neil, NW Energy Codes Group, representing NW Energy Codes Group (noneil@energy350.com)

2018 International Energy Conservation Code

SECTION C406
ADDITIONAL EFFICIENCY ~~PACKAGE OPTIONS~~ REQUIREMENTS

C406.1 ~~Requirements.~~ Additional energy efficiency requirements ~~Buildings shall comply~~ New buildings shall achieve a total of 10 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits may also be as calculated in accordance the relevant subsection of C406. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. Efficient Kitchen Equipment in accordance with Section C406.10.

Add new text as follows:

Table C406.1(1)
Additional Energy Efficiency Credits for Group B Occupancies

Sub-section / Climate Zone:	**1A**	**1B**	**2A**	**2B**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6 A**	**6 B**	**7**	**8**
C406.2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	1	1	NA	1
C406.2.2: 5% Cooling Eff Imprv.	6	6	5	5	4	4	3	3	3	2	2	2	1	2	2	2	1
C406.2.3: 10 % Heating Eff Imprv.	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	2	1	1	2	2	NA	1
C406 .2.4: 10 % Cooling Eff Imprv.	11	12	10	9	7	7	6	5	6	4	4	5	3	4	3	3	3
C406.3: Reduced Light Power	9	8	9	9	9	9	10	8	9	9	7	8	8	6	7	7	6
C406.4: Enh. Digital Light Ctrl	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1
C406.5.1: On-site Renewable Egy.	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
C406.6 : Dedicated OA Sys (DOAS)	4	4	4	4	4	3	2	5	3	2	5	3	2	7	4	5	3
C406.7.2: Recovered/Renew SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.3: Eff fossil fuel SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.7.4: Heat Pump SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406.8: Enhanced Envelope Perf	1	4	2	4	4	3	NA	7	4	5	10	7	6	11	10	14	16
C406.9: Reduced Air Infiltration	2	1	1	2	4	1	NA	8	2	3	11	4	1	15	8	11	6

Table C406.1(2)
Additional Energy Efficiency Credits for Group R and I Occupancies

Sub-section / Climate Zone:	**1A**	**1B**	**2A**	**2B**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6 A**	**6 B**	**7**	**8**
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	NA	NA	1	NA	1	1	1	1	2	1	2	2
C406 .2.2: 5% Cooling Eff Imprv.	3	3	2	2	1	1	1	1	1	NA	1	1	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	NA	1	NA	NA	1	1	1	2	2	1	3	2	3	4
C406 .2.4: 10 % Cooling Eff Imprv.	5	5	4	3	2	3	1	2	2	1	1	1	1	1	1	1	1
C406 .3: Reduced Light Power	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2
C406 .4: Enh. Digital Light Ctrl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .5.1: On-site Renewable Egy.	8	8	8	8	7	8	8	7	7	7	7	7	7	7	7	7	7
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	4	2	NA	6	3	4	8	5	5	10	7	11	12
C406 .7.2: Recovered/Renew SWH	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406 .7.3: Eff fossil fuel SWH	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406 .7.4: Heat Pump SWH	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406 .8: Enhanced Envelope Perf	3	6	3	5	4	4	1	4	3	3	4	5	3	5	4	6	6
C406 .9: Reduced Air Infiltration	6	5	3	11	6	4	NA	7	3	3	9	5	1	13	6	8	3

Table C406.1(3)
Additional Energy Efficiency Credits for Group E Occupancies

Sub-section / Climate Zone:	**1A**	**1B**	**2A**	**2B**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6 A**	**6 B**	**7**	**8**
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	4
C406 .2.2: 5% Cooling Eff Imprv.	4	4	3	3	2	2	2	2	1	1	1	1	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	3	4	3	4	3	4	3	5	7
C406 .2.4: 10 % Cooling Eff Imprv.	7	8	7	6	5	4	3	4	3	1	2	2	1	2	2	2	1
C406 .3: Reduced Light Power	8	8	8	9	8	9	9	8	9	9	8	9	8	7	8	7	7
C406 .4: Enh. Digital Light Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406 .5.1: On-site Renewable Egy.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5
C406 .6 : Dedicated OA Sys (DOAS)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .7.2: Recovered/Renew SWH [a]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C406 .7.3: Eff fossil fuel SWH [a]	NA	1	1	1	1	1	1	2	2	3	2	3	2	3	3	3	5
C406 .7.4: Heat Pump SWH [a]	NA	NA	NA	NA	NA	NA	NA	1	NA	NA	1	1	NA	1	1	1	1
C406 .8: Enhanced Envelope Perf	3	7	3	4	2	4	1	1	3	1	2	3	NA	4	3	6	9
C406 .9: Reduced Air Infiltration	1	1	1	2	NA	NA	NA	NA	NA	NA	1	NA	NA	4	1	4	3

[a] for schools with full service kitchens or showers

Table C406.1(4)
Additional Energy Efficiency Credits for Group M Occupancies

Sub-section / Climate Zone:	**1A**	**1B**	**2A**	**2B**	**3A**	**3B**	**3C**	**4A**	**4B**	**4C**	**5A**	**5B**	**5C**	**6 A**	**6 B**	**7**	**8**
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	NA	1	1	2	2	2	2	3	2	3	4
C406 .2.2: 5% Cooling Eff Imprv.	5	6	4	4	3	3	1	2	2	1	1	2	NA	1	1	1	NA
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	2	4	3	4	5	5	3	6	8
C406 .2.4: 10 % Cooling Eff Imprv.	9	12	9	8	6	6	3	4	4	1	2	3	NA	2	2	2	1
C406 .3: Reduced Light Power	13	13	15	14	16	14	17	15	15	14	12	14	14	16	16	14	12
C406 .4: Enh. Digital Light Ctrl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .5.1: On-site Renewable Egy.	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	6
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	3	3	1	3	2	2	2	3	2	4	3	4	4
C406 .7.2: Recovered/Renew SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .7.3: Eff fossil fuel SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .7.4: Heat Pump SWH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C406 .8: Enhanced Envelope Perf	4	6	3	4	3	3	1	6	4	4	4	5	4	6	5	8	9
C406 .9: Reduced Air Infiltration	1	1	1	2	1	1	NA	3	1	1	3	2	1	7	3	6	3

Table C406.1(5)
Additional Energy Efficiency Credits for Other[a] Occupancies

Sub-section / Climate Zone:	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6 A	6 B	7	8
C406 .2.1: 5% Heating Eff Imprv.	NA	NA	NA	NA	1	1	1	1	1	2	1	2	1	2	2	3	3
C406 .2.2: 5% Cooling Eff Imprv.	5	5	4	4	3	3	2	2	2	1	1	2	1	1	1	1	1
C406 .2.3: 10 % Heating Eff Imprv.	NA	NA	NA	1	1	1	1	2	2	3	3	3	3	4	3	5	5
C406 .2.4: 10 % Cooling Eff Imprv.	8	9	8	7	5	5	3	4	4	2	2	3	2	2	2	2	2
C406 .3: Reduced Light Power	8	8	9	9	9	9	10	8	9	9	7	8	8	8	8	8	7
C406 .4: Enh. Digital Light Ctrl	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2	1
C406 .5.1: On-site Renewable Egy.	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7	7
C406 .6 : Dedicated OA Sys (DOAS)	3	4	3	3	4	3	2	5	3	3	5	4	3	7	5	7	6
C406 .7.2: Recovered/Renew SWH[b]	10	9	11	10	13	12	15	14	14	15	14	14	16	14	15	15	15
C406 .7.3: Eff fossil fuel SWH [b]	5	5	6	6	8	7	8	8	8	9	9	9	10	10	9	10	11
C406 .7.4: Heat Pump SWH [b]	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
C406 .8: Enhanced Envelope Perf	3	6	3	4	3	4	1	5	4	3	5	5	4	7	6	9	10
C406 .9: Reduced Air Infiltration	3	2	2	4	4	2	NA	6	2	2	6	4	1	10	5	7	4

a. Other occupancy groups include all Groups except for Groups B, R, I, E, and M.

b. For occupancy groups listed in C406 .7.1.

C406.1.1 Tenant spaces. Tenant spaces shall comply with sufficient options form Tables C406 .1(1) through C406 .1(5) to achieve a minimum number of 5 credits, where credits are selected from Section C406.2, C406.3, C406.4, C406.6 ~~or C406.7. Alternatively~~ , C406.7 or C406.10. Where the entire building complies using credits from Section C406 .5, C406 .8 or C406 .9, tenant spaces within the building shall be deemed to comply with ~~Section C406.5 where the entire building is in compliance.~~ this section.

Exception: Previously occupied tenant spaces that comply with this code in accordance with Section C501.

C406.2 More efficient HVAC equipment performance. Equipment shall exceed the minimum efficiency requirements listed in Tables C403.3.2(1) through ~~C403.3.2(7) by 10 percent, in addition to the requirements of Section C403. Where multiple performance requirements are provided, the equipment shall exceed all requirements by 10 percent.~~ C403.3.2(9) and *Variable refrigerant flow systems* ~~shall exceed~~ listed in the energy efficiency provisions of ANSI/ASHRAE/IESNA 90.1 ~~by 10 percent. Equipment~~ in accordance with Sections C406 .2.1, C406 .2.2, C406 .2.3 or C406 .2.4. Equipment shall also meet applicable requirements of Section C403. Energy efficiency credits for heating shall be selected from C406.2.1 or C406.2.3 and energy efficiency credits for cooling shall be selected from C406.2.2 or C406.2.4. Selected credits shall include a heating or cooling energy efficiency credit or both. Equipment not listed in Tables C403.3.2(1) through ~~C403.3.2(7)~~ C403.3.2(9) and *Variable refrigerant flow systems* not listed in the energy efficiency provisions of ANSI/ASHRAE/IES 90.1 shall be limited to 10 percent of the total building system ~~capacity.~~ capacity for heating equipment where selecting C406.2.1 or C406.2.3 and cooling equipment where selecting C406.2.2 or C406.2.4.

Add new text as follows:

C406.2.1 Five percent heating efficiency improvement Equipment shall exceed the minimum heating efficiency requirements by 5 percent.

C406.2.2 Five percent cooling efficiency improvement Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 5 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

C406.2.3 Ten percent heating efficiency improvement Equipment shall exceed the minimum heating efficiency requirements by 10 percent.

C406.2.4 Ten percent cooling efficiency improvement. Equipment shall exceed the minimum cooling and heat rejection efficiency requirements by 10 percent. Where multiple cooling performance requirements are provided, the equipment shall exceed the annual energy requirement, including IEER, SEER, and IPLV.

Revise as follows:

C406.5 On-site renewable energy. Buildings shall comply with Section C406 .5.1 or C406 .5.2. ~~The total minimum ratings of on-site renewable energy systems shall be one of the following:~~

1. ~~Not less than 1.71 Btu/h per square foot (5.4 W/m²) or 0.50 watts per square foot (5.4 W/m²) of conditioned floor area.~~
2. ~~Not less than 3 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.~~

~~C406.5~~ C406.5.1 ~~On-site~~ Basic renewable ~~energy.~~ credits The total minimum ratings of on-site renewable energy systems not including systems used for credits under Section C406.7. shall be one of the following:

1. Not less than ~~1.71~~ 0.86 Btu/h per square foot ~~(5.4~~ (2.7 W/m^2) or ~~0.50~~ 0.25 watts per square foot ~~(5.4~~ (2.7 W/m^2) of conditioned floor area.
2. Not less than ~~3~~ 2 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4.

Add new text as follows:

C406.5.2 Enhanced Renewable Credits Where the total minimum ratings of on-site renewable energy systems exceeds the rating in C406 .5.1(1), additional energy efficiency credits shall be determined based on Equation 4-13, rounded to the nearest whole number.

$AEEC_{RRa} = AEEC_{2.5} \times RRa / RR_1$ (Equation 4-13)

Where:

$AEEC_{RRa}$ = C406.5.2 additional energy efficiency credits

RRa = actual total minimum ratings of *on-site renewable energy* systems in Btu/h, watts per square foot or W/m^2)

RR1 = minimum ratings of *on-site renewable energy* systems required by C406.5.1(1) in Btu/h, watts per square foot or W/m^2)

$AEEC_{2.5}$ = C406.5.1 credits from Tables C406.1(1) through C406.1(5)

C406.7 Reduced energy use in service water heating. Buildings shall comply with Sections C406 .7.1 and either C406 .7.2, C406 .7.3 or C406 .7.4.

~~C406.7~~ C406.7.1 ~~Reduced energy use in service water heating.~~ Building Type ~~Buildings shall be of the following types to use this compliance method~~ To qualify for this credit, the building shall contain one of the following use groups and the additional energy efficiency credit shall be prorated by conditioned floor area of the portion of the building comprised of the following use groups:

1. *Group R*-1: Boarding houses, hotels or motels.
2. Group I-2: Hospitals, psychiatric hospitals and nursing homes.
3. Group A-2: Restaurants and banquet halls or buildings containing food preparation areas.
4. Group F: Laundries.
5. *Group R*-2.
6. Group A-3: Health clubs and spas.
7. Group E: Schools with full-service kitchens or locker rooms with showers
8. Buildings showing a service hot water load of 10 percent or more of total building energy loads, as shown with an energy analysis as described in Section C407.

~~C406.7.1~~ C406.7.2 ~~Load fraction.~~ Recovered or renewable water heating The building service water-heating system shall have one or more of the following that are sized to provide not less than ~~60~~ 30 percent of the building's annual hot water requirements, or sized to provide ~~100~~ 70 percent of the building's annual hot water requirements if the building ~~shall otherwise~~ is required to comply with Section C403.9.5:

1. Waste heat recovery from service hot water, heat-recovery chillers, building equipment, or process equipment.
2. *On-site renewable energy* water-heating systems.

Add new text as follows:

C406.7.3 Efficient fossil fuel water heater The combined input-capacity-weighted-average equipment rating of all fossil fuel water heating equipment in the building shall be not less than 95% Et or 0 .95 EF. This option shall receive only half the listed credits for buildings required to comply with C404.2.1.

C406.7.4 Heat pump water heater Where electric resistance water heaters are allowed, all service hot water system heating requirements shall be met using heat pump technology with a combined input-capacity-weighted-average EF of 3.0 . Air-source heat pump water heaters shall not draw conditioned air from within the building, except exhaust air that would otherwise be exhausted to the exterior.

C406.10 Efficient Kitchen Equipment For buildings and spaces designated as Group A-2 or facilities that include a commercial kitchen with at least one gas or electric fryer, all fryers, dishwashers, steam cookers and ovens shall comply with all of the following:

1. Achieve performance levels in accordance with the equipment specifications listed in Tables C406.10(1) through C406.10(4) when rated in

accordance with the applicable test procedure.

2. Be installed prior to the issuance of the Certificate of Occupancy.
3. Have associated performance levels listed on the construction documents submitted for permitting.

Energy efficiency credits for efficient kitchen equipment shall be independent of climate zone and determined based on Equation 4-14, rounded to the nearest whole number.

$AEEC_K = 20 \times Area_K / Area_B$ (Equation 4-14)

Where:

$AEEC_K$ = C406.10 additional energy efficiency credits

$Area_K$ = Floor area of full service kitchen (ft^2 or m^2)

$Area_B$ = Gross floor area of building (ft^2 or m^2)

Table C406.10(1)
Minimum Efficiency Requirements: Commercial Fryers

Fryer Type	Heavy-Load Cooking Energy Efficiency	Idle Energy Rate	Test Procedure
Standard Open Deep-Fat Gas Fryers	≥ 50%	≤ 9,000 Btu/hr	ASTM Standard F1361-17
Standard Open Deep-Fat Electric Fryers	≥ 83%	≤ 800 watts	
Large Vat Open Deep-Fat Gas Fryers	≥ 50%	≤ 12,000 Btu/hr	ASTM Standard F2144-17
Large Vat Open Deep-Fat Electric Fryers	≥ 80%	≤ 1,100 watts	

Table C406.10(2)
Minimum Efficiency Requirements: Commercial Steam Cookers

Fuel Type	Pan Capacity	Cooking Energy Efficiency[a]	Idle Rate	Test Procedure
Electric Steam	3-pan	50%	400 watts	ASTM Standard F1484-18
	4-pan	50%	530 watts	
	5-pan	50%	670 watts	
	6-pan and larger	50%	800 watts	
Gas Steam	3-pan	38%	6,250 Btu/h	
	4-pan	38%	8,350 Btu/h	
	5-pan	38%	10,400 Btu/h	
	6-pan and larger	38%	12,500 Btu/h	

a. Cooking Energy Efficiency is based on heavy load (potato) cooking capacity

Table C406.10(3)
Minimum Efficiency Requirements: Commercial Dishwashers

	High Temp Efficiency Requirements		Low Temp Efficiency Requirements		Test Procedure
Machine Type	**Idle Energy Rate[a]**	**Water Consumption[b]**	**Idle Energy Rate[a]**	**Water Consumption[b]**	
Under Counter	≤ 0.50 kW	≤ 0.86 GPR	≤ 0.50 kW	≤ 1.19 GPR	ASTM Standard F1696-18 ASTM Standard F1920-15
Stationary Single Tank Door	≤ 0.70 kW	≤ 0.89 GPR	≤ 0.60 kW	≤ 1.18 GPR	
Pot, Pan, and Utensil	≤ 1.20 kW	≤ 0.58 GPR	≤ 1.00 kW	≤ 0.58 GPSF	
Single Tank Conveyor	≤ 1.50 kW	≤ 0.70 GPR	≤ 1.50 kW	≤ 0.79 GPR	
Multiple Tank Conveyor	≤ 2.25 kW	≤ 0.54 GPR	≤ 2.00 kW	≤ 0.54 GPR	
Single Tank Flight Type	Reported	GPH ≤ 2.975x + 55.00	Reported	GPH ≤ 2.975x + 55.00	
Multiple Tank Flight Type	Reported	GPH ≤ 4.96x + 17.00	Reported	GPH ≤ 4.96x + 17.00	

a. Idle results shall be measured with the door closed and represent the total idle energy consumed by the machine including all tank heater(s) and controls. Booster heater (internal or external) energy consumption shall not be part of this measurement unless it cannot be separately monitored.

b. GPR = gallons per rack; GPSF = gallons per square foot of rack; GPH = gallons per hour; x = sf of conveyor belt (i.e., W*L) /min (max conveyor speed).

Table C406.10(4)
Minimum Efficiency Requirements: Commercial Ovens

Fuel Type	Classification	Idle Rate	Cooking-Energy Efficiency, %	Test Procedure
Convection Ovens				
	Full-Size	≤ 12,000 Btu/h	≥ 46	ASTM F1496-13
Electric	Half-Size	≤ 1.0 Btu/h	≥ 71	
	Full-Size	≤ 1.60 Btu/h		
Combination Ovens				
	Steam Mode	≤ 200P[a]+6,511 Btu/h	≥ 41	ASTM F2861-17
	Convection Mode	≤ 150P[a]+5,425 Btu/h	≥ 56	
Electric	Steam Mode	≤ 0.133P[a]+0.6400 kW	≥ 55	
	Convection Mode	≤ 0.080P[a]+0.4989 kW	≥ 76	
Rack Ovens				
	Single	≤ 25,000 Btu/h	≥ 48	ASTM F2093-18
	Double	≤ 30,000 Btu/h	≥ 52	

a. P = Pan Capacity: The number of steam table pans the combination oven is able to accommodate as per the ASTM F1495-14a standard specification.

Add new standard(s) as follows:

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

F1361-17: Standard Test Method for Performance of Open Deep Fat Fryers

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

F2144-17: Standard Test Method for Performance of Large Open Vat Fryers

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

F1484-18: Standard Test Method for Performance of Steam Cookers

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

F1696-18: Standard Test Method for Energy Performance of Stationary-Rack,Door-Type Commercial Dishwashing Machines

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

F1920-15: Standard Test Method for Performance of Rack Conveyor Commercial Dishwashing Machines

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

F1496-13: Standard Test Method for Performance of Convection Ovens

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

F2861-17: Standard Test Method for Enhanced Performance of Combination Oven in Various Modes

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

F2093-18: Standard Test Method for Performance of Rack Ovens

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken PA 19428-2959

F1495-14a: Standard Specification for Combination Oven Electric or Gas Fired

Reason: C406 Credits for Efficient Kitchen Equipment
Kitchen equipment uses a large share of building energy use in restaurants, schools, dormitories, hotels, and other facilities with full service kitchens. More efficient equipment saves energy by improving the heat transfer to the cooking process, either through better equipment insulation or other innovations in the appliances. This proposal provides more flexibility to building designers when it is added to the energy efficiency credit choices. It specifically addresses the large energy use of kitchen equipment.

This proposal allows credit for efficient kitchen equipment in Section C406 where extra efficiency options are required. There is a separate proposal that modifies Section C406 from the current requirement to select one of the listed options, to assigning credits to each measure and requiring a certain number of credits (CE218-19). For clarity, that proposal is included here. In addition to the changes that are the same as that proposal, this proposal adds:

- Requirements for a new kitchen equipment efficiency option.
- A formula to calculate the extra efficiency credits based on the ratio of kitchen area to bulding area.
- Adding the reference to the new kitchen equipment efficiency credits in the tenant section (C406.1.1).

Bibliography:
Hart, R., R. Nambiar, M. Tyler, M., Y. Xie, and J. Zhang. "Relative Credits for Extra Efficiency Measures: Technical Brief." Pacific Northwest National Laboratory (PNNL), Richland, WA (US), January 2019. https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-28370Rev.1.pdf.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The current proposal does not require more investment, but rather expands existing options permitted under the 2018 IECC Section C406. The intention is to identify additional options to increase flexibility and more effectively utilize new technologies and construction practices. There is not expected to be an increased cost, as this simply increases the options for C406 beyond what is included in current code. In some cases, costs may be reduced, as the outlined approach provides partial credit for selected items as well as credit for items that may have previously been included in the building design without credit. Costs, and cost effectiveness, are not evaluated for individual measures due to the vast number of potential combinations amongst building types, climates, and selected options. Actual costs will vary based on the items selected by the building designer—architects, engineers, and other involved trades—based on the needs and goals of the individual project.

Staff Analysis: A review of the standards proposed for inclusion in the code, ASTM F1361-17, F2144-17, F1484-18, F1696-18, F1920-15, F1496-13, F2861-17, F2093-18 and F1495-14a with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

CE240-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: As Submitted

Committee Reason: This adds efficiency options for high energy use equipment. Would like to see a public comment to include all CA ES appliances, and address poor code language (Vote: 14-1).

Assembly Action: None

Individual Consideration Agenda

Public Comment 1:

Proponents:
Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests Disapprove

Commenter's Reason: Proposals CE218, CE226, and CE240 should be withdrawn by the proponent because they do the opposite of what is intended, and a cost justification was not included. The analysis does attempt to balance out equal energy performance, but it does not take into consideration the cost impact of having to comply with multiple choices of the current code which currently requires only one of the listed efficiency options. For example, choose either 10% HVAC equipment efficiency increase or Reduced Light Power or one of the other 6 options and comply with the code. It is also very difficult to determine code compliance for builders building in multiple zones, because the point system varies drastically across zones and what can be used as a solution in one zone will not receive enough points to qualify in other zones.
The following are examples of the combinations of requirements that would be required to comply with the proposed change.

Notes:

1. Changes, in all but Option 4, are based on taking the lowest number or total points available to determine compliance.

2. Numerous options are available beyond the examples shown below. The following is just a sample of the difficulty and if cost were applied to the change the cost impact.

Option 1 – 10% Increase Equipment Efficiency which would meet current code.

1. In addition to the 10% HVAC equipment efficiency the builder would need to:

2. Provide onsite Renewable Energy in all Zones.

3. Plus, include Reduced Lighting Power of 10% in Zones 3C, 4C and 5C.

Option 2 – 10% Increase Equipment Efficiency which would meet current code.

1. In addition to the 10% HVAC equipment efficiency the builder would need to:

2. Provide Reduced Lighting Power of 10% in all Zones.

3. Plus, Zone 1B also include a Dedicated Outdoor Air System.

4. Plus, Zones 2A, 3A, 3B, 3C, 4A, 4B, 5A, 5C, 6B, and 7 the builder would be required to include a Heat Pump Water Heater. Zone 3C would also need to include Enhanced Envelope Performance.

5. Zones 1A, 2B, 4C, 5B, and 6A could have an Enhanced Envelope in place of the Heat Pump Water Heater and Zones 4C and 5C would also be required to have Reduced Air Infiltration.

6. Zone 8 would only need to have Reduced Air Infiltration.

Option 3 – 5% Increase Equipment Efficiency.

1. In addition to the 5% HVAC equipment efficiency which the justification states will help in compliance because it is difficult to get a 10% increase in HVAC equipment efficiency the builder would need to:

2. Provide On-Site Renewable Energy.

3. Plus, in Zones 3A, 3B, 4B, 4C, and 5C also Reduce Lighting Power by 10%.

4. Zones 4A, 5A, 5B, 6B, 7 and 8 do not need to have Reduce Light Power of 10%, but they must have Lamp Efficacy.

5. And, Zone 3C can get by with only adding Enhance Envelope to the On-Site Renewable Energy requirement.

Option 4 – If the above is complicated and hard to determine then compliance can be obtained by:

1. Installing 5% Increase HVAC Equipment Efficiency, and

2. Installing a Recovered or Renewable Water Heating System for the entire project.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1216

CE242-19

IECC®: C406.1, C406.11 (New)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Revise as follows:

C406.1 Requirements. Buildings shall comply with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. Electric Vehicle Supply Equipment in accordance with Section 406.11.

Add new text as follows:

C406.11 Electric Vehicle Supply Equipment. In buildings with at least 20 parking spaces, electric vehicle charging stations rated at 208/240 Volts and 40-80 Amps (Level 2) shall be installed to serve at least 5 percent of the parking spaces. Fractional values shall be rounded up to the nearest whole number.

Reason: There are now over 1 million electric vehicles being driven in the United States. As of November 2018, over 300,000 light duty vehicles were sold in the United States.
According to a report published by the Edison Electric Institute and the Edison Foundation Institute for Electric Innovation:

- The stock of EVs in the US is projected to reach **18.7 million in 2030**, up from slightly more than 1 million at the end of 2018. This is approximately 7% of the 259 million vehicles (cars and light trucks) expected to be on U.S. roads in 2030.
- It took 8 years to sell 1 million EVs. The report projects that the next 1 million EVs will be on the road in less than 3 years—by early 2021.
- Annual sales of EVs will exceed 3.5 million vehicles in 2030, reaching more than 20 percent of annual vehicle sales in 2030. EV sales are estimated to be 1.4 million in 2025.

Most importantly,

- About 9.6 million charge ports will be required to support the18.7 million EVs in 2030. This represents a significant investment in EV charging infrastructure. About 1.2 million Level 2 charging ports will be needed at workplaces, according to the report.

This proposal provides an option to install the EV charging station at the lowest cost - when a building is being built.

In addition, Level 2 charging stations are compatible with all electric vehicles that are sold in the US (which have charging connections that meet the SAE J1772 specifications), and they can provide anywhere from 10 to 50 miles of driving range per hour of charging (depending on the size of the EV battery and the on-board charging rate). There are multiple vendors of Level 2 charging stations, and there are state and utility incentives available in many parts of the US for their installation.

This proposal will improve the efficiency of transportation associated with the building (transportation that moves people, products, and services to and from the building). Electric vehicles get anywhere from 80 to over 130 miles per gallon equivalent (MPGe).

Bibliography: EEI and IEI, *Electric Vehicle Sales Forecast and the Charging Infrastructure Required Through 2030*, November 2018
http://www.edisonfoundation.net/iei/publications/Documents/IEI_EEI%20EV%20Forecast%20Report_Nov2018.pdf

Cost Impact: The code change proposal will increase the cost of construction
This is one of several efficiency options that increase the cost of construction. For Level 2 charging stations, the total installation costs per station will vary from $1000 to over $2000, depending on the number of stations installed and any addition conduits/raceways/panel spaces that are needed. The cost for these stations are likely to be similar or lower than the cost of other efficiency options in Section C406.

CE242-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This does not save energy, this is not the place for this requirement (Vote 11-4).

Assembly Action: **None**

CE242-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C406.11 (New)

Proponents:
Charles Foster, representing EEI (cfoster20187@yahoo.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C406.11 Electric Vehicle Supply Equipment. In buildings with at least ~~20~~ 40 parking spaces, electric vehicle charging stations rated at 208/240 Volts and 40-80 Amps (Level 2) shall be installed to serve at least ~~5~~ 2percent of the parking spaces. Fractional values shall be rounded up to the nearest whole number.

Energy efficiency credit: Electric Vehicle Supply Equipment shall be assigned 1 credit in all building types located in all climate zones.

Commenter's Reason: This proposal is intended simply to provide an alternative (and lower cost) to the "As Submitted"version.
If a parking lot or underground parking garage has 40 or more parking spaces, there will be lighting provided to serve those spaces (and HVAC services if underground). Therefore, there will be panels, conduits, and raceways need to service the garage space, and electric vehicle charging systems would be an incremental cost.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
this proposal would add the cost of a charging station to the cost of constructing certain buildings.

Public Comment# 1587

Public Comment 2:

IECC®: C406.11 (New)

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C406.11 Electric Vehicle Supply Equipment. In buildings with ~~at least~~ ~~20~~ 25 to 99 parking spaces, electric vehicle charging stations rated at 208/240 Volts and 40-80 Amps (Level 2) shall be installed to serve at least ~~5~~ 4 percent of the parking spaces. In buildings with 100 to 199 parking spaces, electric vehicle charging stations rated at 208/240 Volts and 40-80 Amps (Level 2) shall be installed to serve at least 3 percent of the parking spaces. In buildings with at least 200 parking spaces, electric vehicle charging stations rated at 208/240 Volts and 40-80 Amps (Level 2) shall be installed to serve at least 2 percent of the parking spaces. Fractional values shall be rounded up to the nearest whole number.

Energy efficiency credit: Electric Vehicle Supply Equipment shall be assigned 1 credit in all building types located in all climate zones.

Commenter's Reason: This option will save transportation energy, as electric vehicles are much more efficient than vehicles that use gasoline or diesel fuel.
To be consistent with the language of CE 218 and other proposals on energy efficiency credits, this modification assigns a point value for this option. While more EV charging stations at a building will help to save more transportation energy, it was decided to keep the points at a minimum level to ensure that other energy efficiency measures would have to be taken to obtain the necessary number of credits in Section C406.

In addition, the requirements have been modified to lower the cost impact of this option.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Although the proposal will increase the cost of construction, this public comment will reduce the cost increase by reducing the required number of charging stations for larger parking areas.

Public Comment# 1353

Public Comment 3:

Proponents:
Tim Ryan, International Association of Building Officials, representing IABO (t.ryan36421@gmail.com)

requests Disapprove

Commenter's Reason: The International Association of Building Officials is opposed to this proposed change as it goes beyond the scope and intent of the ICC Codes, including the IECC. This provision does not support energy efficiency of buildings but conserves energy while providing convenience to owners of electric vehicles. The primary supporting testimony from proponents of this change was based on the expectation of increased car sales; that certain major cities have adopted similar provisions for their respective jurisdictions; and to address forward thinking. The testimony indicates that these types of requirements tend to be more market driven and are political issues which should be addressed by local and state governance bodies and not by model building codes. Such requirements are more appropriate within land usage and zoning regulations. While the proponents recognize several major jurisdictions that adopted such provisions, it should be recognized that not all jurisdictions agree with such provisions and have considered this issue a private business issue. Therefore, IABO is recommending disapproval of CE242-19.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1834

CE246-19

IECC®: C407.3

Proposed Change as Submitted

Proponents: Ted Williams, representing American Gas Association (twilliams@aga.org)

2018 International Energy Conservation Code

Revise as follows:

C407.3 Performance-based compliance. Compliance based on total building performance requires that a proposed building (*proposed design*) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's *State Energy Price and Expenditure Report*. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations. The reduction in energy cost of the proposed design associated with *on-site renewable energy* shall be not more than 5 percent of the total energy cost. The amount of renewable energy purchased from off-site sources shall be the same in the *standard reference design* and the *proposed design*.

> **Exception:** ~~Jurisdictions that require site energy (1 kWh = 3413 Btu) rather than energy cost as the metric of comparison.~~ Where energy use based on source energy expressed in Btu or Btu per square foot of *conditioned floor area* is substituted for the energy cost, the source energy multipliers shall be 3.16 for electricity and 1.1 for fuels other than electricity, or other multipliers for national or regional annual average energy consumption from nationally-recognized and validated data sources.

Reason: The proposed change brings C407.3 into greater consistency with R405.3 and source energy metric usage in Federal energy programs including Energy Star for Commercial Buildings and Home Energy Score. This revised exception provides the only means of assessing energy performance on fuel cycle energy consumption and ultimately carbon footprints since site energy metrics alone cannot account for these upstream energy system losses. In addition, the allowance in the proposed exception language for use of "other multipliers" addresses a persistent criticism of national average multipliers, which may not reflect regional or local mixes of renewable energy in meeting building demands, and encourages authorities having jurisdiction to use locally-relevant multipliers that are available from utilities and other sources. Also, greater usefulness of the exception is critical since the basic requirements of C407.3 focusing on energy cost is not consistent with the intent of the IECC as stated in C101.3, which addresses energy use and conservation, not energy cost.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal would not increase the cost of construction since the proposal is for changes to an exception. If the use of source energy metrics allows more alternatives for achieving energy performance improvements, it may decrease construction costs ultimately.

CE246-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There is consensus the factors are too fluid and need to be tied to a standard and updated regularly, this approach looks backwards not forwards (Vote: 13-2).

Assembly Action: **None**

CE246-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C407.3

Proponents:
Ted Williams, American Gas Association, representing American Gas Association (twilliams@aga.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C407.3 Performance-based compliance. Compliance based on total building performance requires that a proposed building (*proposed design*) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design*. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's *State Energy Price and Expenditure Report*. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations. The reduction in energy cost of the proposed design associated with *on-site renewable energy* shall be not more than 5 percent of the total energy cost. The amount of renewable energy purchased from off-site sources shall be the same in the *standard reference design* and the *proposed design*.

> **Exception:** Where jurisdictions use source energy rather than energy cost as a metric, energy ~~use~~ consumption shall be based upon ~~based on~~ source energy expressed in Btu or Btu per square foot of conditioned floor area and calculated using the source energy multipliers of 2.95 for grid-supplied electricity, 1.09 for natural gas, 1.15 for propane and 1.19 for fuel oil, ~~is substituted for the energy cost, the source energy multipliers shall be 3.16 for electricity and 1.1 for fuels other than electricity,~~ or other multipliers for national , state, ~~or~~ regional, or local annual average energy consumption and published in governmental sources. ~~from nationally-recognized and validated data sources,~~

Commenter's Reason: The Committee reasoning that source energy factors are "too fluid" ignores the fact that factors for primary fuels are well-established in literature and building rating tools, and the grid electricity factor of 2.95 has been used in the Pacific Northwest National Laboratory (PNNL) May 2019 report, "Preliminary Energy Savings Analysis: 2018 IECC Residential Requirements," making use of this factor as federal analytical policy and procedures. While this factor can be changed as an update, to date no documented effort has been extended to challenge use of this factor. "Consensus" in "standards" regarding this factor is a political and market argument among stakeholder, meanwhile the federal government and other authorities are proceeding with using these factors in building rating.

Bibliography: Taylor, T., Mendon, V., Zhan, M., and Liu, B., "Preliminary Energy Savings Analysis: 2018 IECC Residential Requirements," DOE/EERE, May 2019

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
By allowing use of more reasonable source energy metrics for performance analysis of buildings, greater flexibility in building design would be facilitated and construction cost savings realized.

Public Comment# 2159

CE247-19

IECC®: TABLE C407.5.1(1)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

TABLE C407.5.1(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Portions of table not shown remain unchanged.

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Walls, above-grade	Type: <u>same as proposed</u> ~~Mass wall where proposed wall is mass; otherwise steel-framedwall~~	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table C402.1.4	As proposed
	Solar absorptance: 0.75	As proposed
	Emittance: 0.90	As proposed

SWHF = Service water heat recovery factor, DWHR = Drain water heat recovery.

a. Where no heating system exists or has been specified, the heating system shall be modeled as fossil fuel. The system characteristics shall be identical in both the standard reference design and proposed design.

b. The ratio between the capacities used in the annual simulations and the capacities determined by sizing runs shall be the same for both the standard reference design and proposed design.

c. Where no cooling system exists or no cooling system has been specified, the cooling system shall be modeled as an air-cooled single-zone system, one unit per thermal zone. The system characteristics shall be identical in both the standard reference design and proposed design.

d. If an economizer is required in accordance with Table C403.5(1) and where no economizer exists or is specified in the proposed design, then a supply-air economizer shall be provided in the standard reference design in accordance with Section C403.5.

e. The SWHF shall be applied as follows:
   1. Where potable water from the DWHR unit supplies not less than one shower and not greater than two showers, of which the drain water from the same showers flows through the DWHR unit then SWHF = [1 – (DWHR unit efficiency • 0.36)].
   2. Where potable water from the DWHR unit supplies not less than three showers and not greater than four showers, of which the drain water from the same showers flows through the DWHR unit then SWHF = [1 – (DWHR unit efficiency • 0.33)].
   3. Where potable water from the DWHR unit supplies not less than five showers and not greater than six showers, of which the drain water from the same showers flows through the DWHR unit, then SWHF = [1 – (DWHR unit efficiency • 0.26)].
   4. Where Items 1 through 3 are not met, SWHF = 1.0.

Reason: The purpose of this code change proposal is to improve the efficiency of above-grade walls by eliminating an unnecessary loophole. The current standard reference design assumption for above-grade walls is based on mass walls (where mass walls are proposed) or steel-framed walls (regardless of whether steel or wood-framed walls are proposed). The result is that when a building design incorporates wood-framed walls (which are more efficient than steel-framed walls), the building receives a trade-off credit for the difference in efficiency between the steel and wood framing, even though the choice of framing type may have little or nothing to do with efficiency. While we would prefer a single reference design and related budget, if there are to be different standard reference designs for steel versus mass walls, then logically there should be a different design for wood walls as well.
This proposal applies a more consistent approach that will result in improved efficiency. Whether the wall is mass wall, steel-framed, or wood-framed, the baseline will be the insulation requirement for the corresponding wall type set in the prescriptive table. This will eliminate the trade-off loophole and improve efficiency in most climate zones and occupancy types.

Cost Impact: The code change proposal will increase the cost of construction
This proposal will increase the cost of construction for buildings with wood-framed walls because it will either require additional insulation or the incorporation of other energy efficient measures in Section C407 (to be consistent with the current prescriptive path requirements for wood framing). However, we view this as the elimination of an unnecessary loophole that is applying an incorrect baseline in the simulated performance alternative.

CE247-19

<u>Public Hearing Results</u>

Committee Action: **As Submitted**

Committee Reason: The performance path is intended to be material neutral (Vote: 12-3).

Assembly Action: **None**

CE247-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Greg Johnson, representing Coalition for Fair Energy Codes (gjohnsonconsulting@gmail.com)

requests Disapprove

Commenter's Reason: By setting the standard reference design for frame walls to “as proposed,” the proponents of CE247 claim to be eliminating an unnecessary loophole in the performance path of the code. Instead this reveals a fundamental misunderstanding on their part of the structure of the performance path and its role in establishing a minimum standard.
The standard reference design is intended to be the minimum standard; meaning, if you constructed a building to the standard reference design it would comply with the minimum provisions of the code. **The standard reference design is not supposed to be ‘above code**,’ otherwise ‘proposed designs’ would be forced to comply with above code provisions.

The above grade frame wall provisions **intentionally** use the steel frame wall assembly as the minimum standard because it is the least stringent assembly with which a builder is required to comply. In other words, steel frame walls establish the minimum standard with which all above grade frame walls must comply. This is the way the performance path was purposely crafted.

CE247 distorts the application of the performance path and requires some buildings with above grade frame walls to perform above minimum code (exactly the opposite of material neutrality). It must be disapproved to protect the integrity of the performance path.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
No change to code. Disapproving CE247 prevents construction costs from rising for applicable building projects since it keeps them from having to comply with 'above code' requirements.

Public Comment# 2106

Public Comment 2:

Proponents:

Loren Ross, representing American Wood Council (lross@awc.org)

requests Disapprove

Commenter's Reason:

CE247 is the opposite of material neutrality.

By changing the reference design to “as proposed” rather than a single reference assembly or U-factor, frame walls would be evaluated to different U-factors from Table C402.1.4. This means wood-frame walls would be required to perform better than steel-frame walls because Table C402.1.4 requires wood-frame walls to meet more stringent U-factors. CE247 therefore takes the inequitable treatment of framing materials embedded in the prescriptive path and extends it to the performance path.

This material bias is in direct conflict with the preface of the IECC that states “*This code is founded on the principles intended to establish … provisions that do not give preferential treatment to particular types or classes of materials, products, or methods of construction*.”

CE247 must be disapproved to be consistent with the principles of the IECC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

CE255-19 Part I

IECC: C202, C503.1

Proposed Change as Submitted

Proponents: Bill McHugh, The McHugh Company, representing Chicago Roofing Contractors Association (bill@mc-hugh.us)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC- COMMERCIAL COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL COMMITTEE. SEE THE TENTATIVE HEARING ORDER FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Add new definition as follows:

<u>**ROOF MEMBRANE PEEL AND REPLACEMENT.** Where an existing roof membrane alone is removed, exposing insulation or sheathing, and only a new weather resisting roof membrane is installed.</u>

Revise as follows:

C503.1 General. *Alterations* to any *building* or structure shall comply with the requirements of Section C503 and the code for new construction. *Alterations* shall be such that the existing *building* or structure is not less conforming to the provisions of this code than the existing building or structure was prior to the *alteration*. *Alterations* to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. *Alterations* shall not create an unsafe or hazardous condition or overload existing *building* systems.

Alterations complying with ANSI/ASHRAE/IESNA 90.1. need not comply with Sections C402, C403, C404 and C405.

Exception: The following *alterations* need not comply with the requirements for new construction, provided that the energy use of the building is not increased:

1. Storm windows installed over existing *fenestration*.
2. Surface-applied window film installed on existing single-pane *fenestration* assemblies reducing solar heat gain, provided that the code does not require the glazing or *fenestration* to be replaced.
3. Existing ceiling, wall or floor cavities exposed during construction, provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. *Roof recover*.
6. *Air barriers* shall not be required for *roof recover* and roof replacement where the *alterations* or renovations to the building do not include *alterations*, renovations or *repairs* to the remainder of the building envelope.
7.. <u>Roof membrane peel and replacement.</u>

Reason: This new definition and accompanying technical requirement adds a subset of the Roof Recover operation to the International Energy Conservation Code. The operation means that the buildng owner and manager can re-use the existing insulation providing sustainabilty to the insulation products in place. The operation provides the buildling owner and manager with a code approved, economical option that does not increase the energy use of existing buildings, meeting the bolded intent of the 503.1 General Section of the IECC.
For convenience, the C503.1 General section is below, bolded for emphasis:

C503.1 General. Alterations to any building or structure shall comply with the requirements of Section C503 and the code for new construction. Alterations shall be such that the existing building or structure is **not less conforming to the provisions of this code than the existing building or structure was prior to the alteration.** Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall not create an unsafe or hazardous condition or overload existing building systems.

Cost Impact: The code change proposal will decrease the cost of construction
This type of re-roofing operation is where the roof covering membrane is peeled off, and a new roof covering membrane installed over a prepared surface. This operation is not currently allowed by the International Energy Conservation Code. If allowed, Roof Membrane Peel and Replacement will decrease the cost of construction becuase the operation does not trigger meeting the minimum R-30 c.i. insulation requirements for new construction, as it would today. The operation does not increase the energy usage of the building, consistent with Section C503.1 General's

statements, of the IECC.

CE255-19 Part I

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **Disapproved**

Committee Reason: While it addresses a problem that needs to be addressed, there are no criteria which creates conflict with existing language in the IECC and the IBC and creates inspection problems (Vote: 15-0).

Assembly Action: **None**

CE255-19 Part I

Individual Consideration Agenda

Public Comment 1:

Proponents:
Bill McHugh, representing Chicago Roofing Contractors Association (billmchugh-jr@att.net)

requests As Submitted

Commenter's Reason: There is new information since the May Committee Action Hearings. Both the City of Chicago in their adoption of the International Family of Codes and the Illinois Adoption of the 2018 International Energy Conservation Code have this definition and allowance in 503.1.1.
Roof membrane peel and replacement is a way to provide longer service life to the insulation installed on the building's rooftop. Through re-use of the insulation, life cycle costs of the insulation are reduced and landfills saved of massive amounts of insulation.

If the roof membrane peel causes surface irregularities, the roof membrane manufacturer can recommend preparation of the surface which might include a suitable cover board to the assembly that conforms to a listing.

In addition, there are over 900,000 listings in the FM Approval Guide alone, not counting UL's listings. That gives the designer the ability to find another listing, using the existing insulation, cover board, and new membrane, providing code compliance for both wind and fire.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
The effect of this code change is that the building owner and manager does not need to buy new insulation for this type or roof operation.

The magnitude of cost decrease is hard to calculate because each situation, each roof is different. Some roofs will be slightly less costly, some much less costly. It depends on the conditions of the existing roof assembly and flashings.

The reason for the cost reduction is that the new construction thickness of insulation will not be required in the case of a technical infeasability.

Public Comment# 1781

Public Comment 2:

Proponents:
Justin Koscher, representing Polyisocyanurate Insulation Manufacturers Association (jkoscher@pima.org); Marcin Pazera, Polyisocyanurate Insulation Manufacturers Association, representing Polyisocyanurate Insulation Manufacturers Association (mpazera@pima.org)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it reduces building energy efficiency and creates life-safety issues for reroofing.

- First, this proposal will have a negative impact on the energy efficiency of existing commercial buildings as it creates an exception for roof replacements from the requirements for new construction (including energy efficiency provisions of the IECC).
- Second, it conflicts with the reroofing requirements in Chapter 15 of the IBC (Section 1511.3 “Roof Replacement”), which requires removal of all existing roof coverings down to the roof deck.
- Third, it creates life safety concerns because “peel and replace” systems are not recognized under third-party listings (such as FM Global or UL). Aspects of performance including wind uplift and fire resistance are evaluated with a “system approach,” testing the complete roof assembly rather than individual components. A “peel and replace” membrane would require the same verification to determine whether the new membrane and system meet the building code requirements. This proposal provides zero instruction on how a “peel and replace” project will meet the life and safety requirements of the building code.
- Fourth, this proposal will allow perpetual replacement of the membrane only and it encourages poor roofing practice by not directing the removal of existing materials down to the roof deck to allow for condition assessment of the deck. This further conflicts with the National Roofing Contractors Association’s recommendation for existing roof decks to be inspected from both above and below.
- Finally, this proposal is unnecessary since the IBC under Section C1511.3.1 “Roof Recover” permits a one-time roof recover without removal of the membrane to extend the life of the roof system.

Bibliography: Chapter 9 Reroofing, "The NRCA Roofing Manual: Membrane Roof Systems," National Roofing Contractors Association (2019).

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1633

CE255-19 Part II

IECC: R202 (N1101.6) , R503.1.1 (IRC N1109.1.1)

Proposed Change as Submitted

Proponents: William McHugh, The McHugh Company, representing Chicago Roofing Contractors Association (billmchugh-jr@att.net)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6)
GENERAL DEFINITIONS

Add new definition as follows:

ROOF MEMBRANE PEEL AND REPLACEMENT. Where an existing roof membrane alone is removed, exposing insulation or sheathing, and only a new weather resisting roof membrane is installed.

Revise as follows:

R503.1.1 (IRC N1109.1.1) Building envelope. Building envelope assemblies that are part of the alteration shall comply with Section R402.1.2 or R402.1.4, Sections R402.2.1 through R402.2.13, R402.3.1, R402.3.2, R402.4.3 and R402.4.5.

Exception: The following alterations shall not be required to comply with the requirements for new construction provided that the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
3. Construction where the existing roof, wall or floor cavity is not exposed.
4. Roof re-cover.
5. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.
6. Surface-applied window film installed on existing single pane fenestration assemblies to reduce solar heat gain provided that the code does not require the glazing or fenestration assembly to be replaced.
7. Roof membrane peel and replacement.

Reason: This new definition and accompanying technical requirement adds a subset of the Roof Recover operation to the International Energy Conservation Code. The operation means that the buildng owner and manager can re-use the existing insulation providing sustainabilty to the insulation products in place. The operation provides the buildling owner and manager with a code approved, economical option that does not increase the energy use of existing buildings, meeting the bolded intent of the 503.1 General Section of the IECC.
For convenience, the C503.1 General section is below, bolded for emphasis:

C503.1 General. Alterations to any building or structure shall comply with the requirements of Section C503 and the code for new construction. Alterations shall be such that the existing building or structure is **not less conforming to the provisions of this code than the existing building or structure was prior to the alteration.** Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall not create an unsafe or hazardous condition or overload existing building systems.

Cost Impact: The code change proposal will decrease the cost of construction
This type of re-roofing operation is where the roof covering membrane is peeled off, and a new roof covering membrane installed over a prepared surface. This operation is not currently allowed by the International Energy Conservation Code. If allowed, Roof Membrane Peel and Replacement will decrease the cost of construction becuase the operation does not trigger meeting the minimum R-30 c.i. insulation requirements for new construction, as it would today. The operation does not increase the energy usage of the building, consistent with Section C503.1 General's statements, of the IECC.

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **Disapproved**

Committee Reason: It creates conflict and the need for flexibility was already captured prior actions. This would decrease energy efficiency. Additionally there are issues with third party systems not covering this and there should have been companion change to the definition of re-roof (Vote: 10-1).

Assembly Action: **None**

CE255-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:
Bill McHugh, representing Chicago Roofing Contractors Association (billmchugh-jr@att.net)

requests As Submitted

Commenter's Reason: There is new information since the May Committee Action Hearings. Both the City of Chicago in their adoption of the International Family of Codes and the Illinois Adoption of the 2018 International Energy Conservation Code have this definition and allowance in 503.1.1.
Roof membrane peel and replacement is a way to provide longer service life to the insulation installed on the building's rooftop. Through re-use of the insulation, life cycle costs of the insulation are reduced and landfills saved of massive amounts of insulation.

If the roof membrane peel causes surface irregularities, the roof membrane manufacturer can recommend preparation of the surface which might include a suitable cover board to the assembly that conforms to a listing.

In addition, there are over 900,000 listings in the FM Approval Guide alone, not counting UL's listings. That gives the designer the ability to find another listing, using the existing insulation, cover board, and new membrane, providing code compliance for both wind and fire.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
The effect of this code change is that the building owner and manager does not need to buy new insulation for this type or roof operation.

The magnitude of cost decrease is hard to calculate because each situation, each roof is different. Some roofs will be slightly less costly, some much less costly. It depends on the conditions of the existing roof assembly and flashings.

The reason for the cost reduction is that the new construction thickness of insulation will not be required in the case of a technical infeasability.

Public Comment# 1785

Public Comment 2:

Proponents:
Justin Koscher, representing Polyisocyanurate Insulation Manufacturers Association (jkoscher@pima.org); Marcin Pazera, Polyisocyanurate Insulation Manufacturers Association, representing Polyisocyanurate Insulation Manufacturers Association (mpazera@pima.org)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it reduces building energy efficiency and creates life-safety issues for reroofing. Roof replacements offer a great opportunity to improve energy efficiency of existing residential buildings. This proposal exempts low-slope roofs from compliance with the energy efficiency requirements for roof replacements by allowing the replacement of the membrane only. The replacement of the membrane alone during the lifetime of the building has critical durability consequences, and incentivizes poor roofing practice by not requiring the removal of existing materials down to the roof deck to allow for condition assessment of the deck. The inspection of the deck is recognized as a good industry practice, and the National Roofing Contractors Association (see “The NRCA Roofing Manual: Membrane Roof Systems: 2019”) recommends that existing roof decks be inspected from both above and below. In residential low-slope roof applications, wood decks are a common place, and the underside of the roof system may not be accessible. Thus, the removal and inspection of the deck from above may be the only option, and it is a critical aspect of due diligence in roof replacements. Finally, “peel and replace” systems are not recognized under third-party listings (such as FM Global or UL), and thus this raises concerns with how code compliance for wind uplift and fire resistance will be determined.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1629

CE256-19

IECC®: C503.3.1

Proposed Change as Submitted

Proponents: Darren Meyers, P.E., IECC_LLC representing the National Roofing Contractors Association, representing the National Roofing Contractors Association (dmeyers@ieccode.com)

2018 International Energy Conservation Code

Revise as follows:

C503.3.1 Roof replacement. Roof replacements shall comply with Section C402.1.3, C402.1.4, C402.1.5 or C407 where the existing roof assembly is part of the building thermal envelope and contains insulation entirely above the roof deck.

> **Exception:** Where the required R-value cannot be provided due to above-deck thickness limitations presented by existing rooftop conditions, including an HVAC system or refrigeration equipment, skylight curbs, low door or glazing heights, weep holes, parapet or roof flashing heights, the maximum approved thickness of insulation compatible with the available space and existing uses shall be installed.

Reason: This proposal is CE287-16 resubmitted with the sole difference clarifying “above-deck” thickness and adding “*approved*.” CE287-16 received a Committee recommendation of “Disapproval,” a Public Comment recommendation of “As Modified by Public Comment” (AMPC), but ultimately did not receive the two-thirds necessary to prevail during the “Online Governmental Consensus Vote” (OGCV), leading to “Disapproval” as its Final Action.
Specifically, the newly proposed exception addresses the AMPC and the challenge of constructability when installing additional roof insulation in *reroofing* situations including *roof recover* and *roof replacement* where existing conditions do not allow for the full thickness of insulation required by Table C402.1.3 or Table C402.1.4. Consider the sheer square footage of buildings constructed before an adoption of the 2009 IECC, that now require *reroofing*, without adequate “clear space” to accommodate up to 5+ inches (R-25-ish) or 6+ inches (R-30-ish) of insulation as the IECC evolved thru 2012 to 2015 and now the 2018 Editions. The building stock now considered 10 to 20 to 30+ years old, is far more likely to avail itself of skylight and structural curb heights, scupper and sump depths, door and window access thresholds that would turn into ponds, if five to six inches of insulation were "retroactively" foisted upon building ownership.

Moreover, if the IECC CDC were to consult the premise to Section C505.1, that "... [neither] an increase in demand for either fossil fuel [nor] electrical energy shall comply with this code," so long as the current level of insulation in the roof is replaced with an equivalent thickness/level/R-value of NEW! insulation product, you'd likely conclude that he newly proposed Exception is a "do-no-harm" proposition.

The proposed exception is a pragmatic and constructible solution taken nearly word-for-word from the 2015 IgCC, Section 1003.2.7—Roof Replacement Insulation. We believe the proposal makes clear that the maximum thickness of insulation compatible within the technically-feasible limitations of available space is installed.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This change better positions the IECC to be clearer, more easily applied to *reroofing*, more competitive than the 90.1 Standard alternative on this issue; thereby no cost impact when compared with current provisions.

CE256-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This limits projects where scope exceed more than just a roof replacement, it limits code officials ability to require trade off and it doesn't reference and R-value per inch Concern that one threshold could dictate thickness of entire roof. Encourage proponent to develop a public comment to address this and such issues as "existing rooftop conditions, including"   (Vote: 11-4).

Assembly Action: **None**

CE256-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C503.3.1

Proponents:
Darren Meyers, representing the National Roofing Contractors Association (dmeyers@ieccode.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C503.3.1 Roof replacement. Roof replacements shall comply with Section C402.1.3, C402.1.4, C402.1.5 or C407 where the existing roof assembly is part of the building thermal envelope and contains insulation entirely above the roof deck.

Exception: Where the required *R-value* <u>of insulation entirely above the roof deck</u> cannot be provided due to above-deck thickness limitations presented by existing rooftop conditions, including an HVAC system or refrigeration equipment, skylight curbs, low door or glazing heights, weep holes, parapet or roof flashing heights, the maximum *approved* thickness (*R-value*) of insulation compatible with the available space and existing uses shall be installed. <u>In no case shall the *R-value* of the roof insulation be reduced or the *U-factor* of the roof assembly be increased as part of the *roof replacement*.</u>

Commenter's Reason: The proposal is a pragmatic tool to be utilized solely by the Code Official where the retroactive application of 2021 IECC insulation thicknesses (R-values) are incompatible with existing rooftop conditions.
The proposal is identical to RE217-19 (AM) recommended for “Approval (AM)” by the 2019 IECC Residential Committee. In their reason, the Residential Committee writes: “The proposal provides necessary provisions for builders and code officials to address this situation.”

To the 2019 IECC Commercial Committee’s concerns:

1) The proposal is clearly limited solely to roof replacement operations – NOT any other existing building altering action. To this point, NOTE the “Exception” is located in C503.3.1, entitled “Roof replacement.” NOT a trade-off.

2) Reference to “trade-offs” is a red herring. The proposal does not limit any authority of the *Code Official*. To the contrary, it empowers the *Code Official* directly to supervise the *approval* of permit applications (as is the case, always). This is by reference to the defined term “*approved*” in the phraseology, “maximum *approved* thickness.”

3) The Commercial Committee of 15 consisted of two (2) voting consultants to the foam plastics industry. These consultants raised dissenting issues over confusion among “thickness” and “R-value.” We are keenly aware that roofing contractors, plastics manufacturers and code enforcement are all capable of deriving “R-value” from “thickness” and “thickness” from “R-value.” Afterall, the manufacturer cut sheets and research submittals specify these product characteristics for the utility of both regulators and installers, alike.

4) The proposed language addresses the challenge of constructability when installing additional roof insulation in *roof replacement* situations where existing conditions do not allow for the full thickness of insulation required by Table C402.1.3 or Table C402.1.4. Consider the sheer square footage of buildings constructed before an adoption of the 2009 IECC, that now require *reroofing* without adequate “clear space” to accommodate up to 6+ inches (R-30-ish) of insulation as the IECC evolved from 2012 through the 2018 Editions. The building stock now considered 10 to 20 to 30+ years old, is far more likely to avail itself of skylight and structural curb heights, scupper and sump depths, door and window access thresholds that would turn into ponds, if five to six inches of insulation were "retroactively" foisted upon building ownership.

The proposed exception is a pragmatic and constructible solution taken nearly word-for-word from the 2015 IgCC, Section 1003.2.7—Roof Replacement Insulation. We believe the proposal makes clear that the maximum thickness of insulation compatible within the technically-feasible limitations of available space is installed.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
For existing roofs, where a *roof replacement* is occurring, application of the current language could be interpreted as requiring an increase (in the thickness<u>/R-value</u>) of roof insulation, retroactively. Compliance could become Compliance could become,costly, perhaps impossible, for some areas of the existing roof. The proposal offers relief (maintaining current insulation thickness/R-value in lieu of adding insulation thickness/R-value) in those situations that brings the cost of a roof replacement back in line with the intent of the code for “doing no harm” to an existing structure. This public comment clarifies that intent. Clarifications of the code do not impact costs.

Public Comment# 1704

Public Comment 2:

Proponents:
Bill McHugh, representing Chicago Roofing Contractors Association (billmchugh-jr@att.net)

requests As Submitted

Commenter's Reason: The Chicago Roofing Contractors Association (CRCA) was proponent on CE253-19, a similar proposal. We at CRCA believe that the original NRCA proposal is perfect for this application and are withdrawing our CE253-19 in support of CE256-19. As a result, we are withdrawing CE253-19 in support of NRCA's CE256, As Submitted.

There frequently are issues with existing building conditions when it comes to low flashing heights and meeting the requirements for new construction insulation thicknesses. This proposal focuses on the maximum amount of insulation possible given the constraints that are given on an existing building - and does not increase the energy use of the building. In some cases, it reduces energy usage.

The committee commented that there is no R-Value stated in the proposal. Due to economics, no R-Value statement is needed in the proposal. The highest R-Value insulation is already the market share leader, easiest to handle, lightweight, etc. Since most of the cost of installation is in transport and labor, the material cost does not matter as much either. This exception – through the use of the word 'approved' before 'thickness of insulation', - allows the code official to decide if the flashing heights are tall enough to accommodate the new construction insulation thicknesses. The code official has the last word on whether it's technically infeasible or not to install the thickness of insulation required for new construction. This section gives the needed guidance for the code official to make this decision. If it's just a small amount of area that is technically infeasible, the code official can deny the variance.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

The magnitude of cost decrease is hard to calculate because each situation, each roof is different. Some roofs will be slightly less costly, some much less costly. It depends on the conditions of the existing roof assembly and flashings.

The reason for the cost reduction is that the new construction thickness of insulation will not be required in the case of a technical infeasability.

Public Comment# 1760

Public Comment 3:

Proponents:
Justin Koscher, representing Polyisocyanurate Insulation Manufacturers Association (jkoscher@pima.org); Marcin Pazera, Polyisocyanurate Insulation Manufacturers Association, representing Polyisocyanurate Insulation Manufacturers Association (mpazera@pima.org)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it will reduce building energy efficiency and adds unnecessary language to the code. Roof replacements provide ideal opportunities to improve the energy performance of existing commercial buildings. This proposal adds unnecessary and confusing language to the long-standing requirement that roof replacements shall comply with the thermal envelope requirements for new construction, which can reduce overall building energy use by an average of 5.7%.

- First, the exception is unnecessary because the code already provides authority to the code official where practical difficulties make compliance with the strict letter of the code impractical. A recent survey of Illinois code officials demonstrates that roof replacements do not present unique enforcement challenges as compared to other common building alterations.
- Second, the proposal is overly broad because it contains an open-ended list of common rooftop conditions. Many of these conditions do not create barriers to the installation of additional above deck roof insulation on typical roof replacement projects. Moreover, the open-ended language of "existing rooftop conditions, including [list]" is unenforceable language.
- Third, the proposal incorporates unenforceable language related to the "approved thickness" of insulation. Insulation requirements are written in terms of R-value, not thickness.

We believe unique issues with a particular roof replacement project can be properly and sufficiently addressed under Section C102.1. Therefore, this proposal should be disapproved.

Bibliography: "Existing Commercial Buildings and the Energy Code: An Illinois Enforcement Survey," Midwest Energy Efficiency Alliance (April 2018). Available at: http://www.mwalliance.org/sites/default/files/meea-research/existing-comm-buildings-enforcement-4.11.18.pdf?current=/taxonomy/term/11.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1634

CE261-19

IECC®: 202 (New), SECTION C505, C505.1, C505.1.1 (New), C505.1.2 (New), C505.2 (New), C505.2.1 (New), C505.2.2 (New), C505.2.3 (New), C505.2.4 (New), TABLE C505.2.2 (New), TABLE C505.2.3 (New), TABLE C505.2.4 (New)

Proposed Change as Submitted

Proponents: David Collins, representing SEHPCAC (sehpcac@iccsafe.org); Maureen Guttman, representing BCAP-IBTS (mguttpgh@aol.com); David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

2018 International Energy Conservation Code

Add new definition as follows:

ENERGY USE INTENSITY (EUI). The metric indicating the total amount of energy consumed by a building in one year divided by the total gross floor area of the building.

SECTION C505
CHANGE OF OCCUPANCY OR USE

C505.1 General. Spaces undergoing a change in occupancy ~~that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code. Where the use in a space changes from one use in Table C405.3.2(1) or C405.3.2(2) to another use in Table C405.3.2(1) or C405.3.2(2), the installed lighting wattage shall comply with Section C405.3. Where the space undergoing a change in occupancy or use is in a building with a fenestration area that exceeds the limitations of Section C402.4.1, the space is exempt from Section C402.4.1 provided that there is not an increase in fenestration area.~~ from F, H or U occupancy classification shall comply with Section C503. Buildings or portions of buildings undergoing a change of occupancy without alterations shall comply with Section C502.2.

~~**Exceptions**~~ **Exception:**

~~1.~~ ~~Where the component performance alternative in Section C402.1.5 is used to comply with this section, the proposed UA shall be not greater than 110 percent of the target UA.~~

~~2.~~ Where the total building performance option in Section C407 is used to comply with this section, the annual energy cost of the proposed design shall be not greater than 110 percent of the annual energy cost otherwise permitted by Section C407.3.

Add new text as follows:

C505.1.1 Alterations and change of occupancy Alterations made concurrently with any change of occupancy shall be in accordance with Section C503.

C505.1.2 Portions of buildings Where changes in occupancy and use are made to portions of an existing building, only those portions of the building shall comply with Section C505.2.

C505.2 Energy Use Intensities Building envelope, space heating, cooling, ventilation, lighting and service water heating shall comply with Sections C505.2.1 through C505.2.4.

Exceptions:

1. Where it is demonstrated by analysis approved by the code official that the change will not increase energy use intensity.

2. Where the occupancy or use change is less than 5,000 square feet in area.

C505.2.1 Building Envelope Where a change of occupancy or use is made to a whole building that exceeds the maximum fenestration area allowed by Section C402.4.1, the building shall comply with Section C402.1.5, with a proposed UA that shall not be greater than 110 percent of the target UA.

Exception:

Where the change of occupancy or use is made to a portion of the building, the new occupancy is exempt from Section C402.4.1 provided that there is not an increase in fenestration area.

C505.2.2 Building Mechanical Systems Where a change of occupancy or use results in the same or increased energy use intensity rank as specified in Table C505.2.2, the systems serving the building or space undergoing the change shall comply with Section C403.

C505.2.3 Service Water Heating Where a change of occupancy or use results in the same or increased energy use intensity rank as specified in Table C505.2.3, the service water heating systems serving the building or space undergoing the change shall comply with Section C404.

C505.2.4 Lighting Where a change of occupancy or use results in the same or increased energy use intensity rank as specified in Table C505.2.4, the lighting systems serving the building or space undergoing the change shall comply with Section C405 except for Sections C405.2.6 and C405.4.

TABLE C505.2.2
Building Mechanical Systems

Energy Use Intensity Rank	International Building Code Occupancy Classification and Use
1. High	A-2, B-Laboratories, I-2
2. Medium	A-1, A-3[a], A-4, A-5, B[b], E, I-1, I-3, I-4, M, R-4
3. Low	A-3-Placesof Religious Worship, R-1, R-2, R-3[c], S-1, S-2

a. Excluding places of religious worship.

b. Excluding laboratories.

c. Buildings three stories or less in height above grade plane shall comply with Section R505.

TABLE C505.2.3
Service Water Heating

Energy Use Intensity Rank	International Building Code Occupancy Classification and Use
1. High	A-2, I-1, I-2, R-1
2. Low	All other occupancies and uses

TABLE C505.2.4
Lighting

Energy Use Intensity Rank	International Building Code Occupancy Classification and Use
1. High	B-Laboratories, B-Outpatient Healthcare, I-2, M
2. Medium	A-2, A-3 Courtrooms, B[a], I-1, I-3, I-4, R-1, R-2, R-3[b], R-4, S-1, S-2
3. Low	A-1, A-3[c], A-4, E

a. Excluding laboratories and outpatient healthcare.

b. Buildings three stories or less in height above grade plane shall comply with Section R505.

c. Excluding courtrooms.

Reason: The IECC 2018 change of occupancy requirement (C505.1) begins with this statement:
"Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code."

Field research and surveys of building officials demonstrate that this requirement is difficult to enforce (Clinton et al, 2016). One reason for this is that while it is a clear performance requirement, there is no simple compliance evaluation method other than energy modeling, which is beyond the capabilities of most change-of-occupancy permit applicants. As depicted in the referenced survey findings and community-based pilot research, building officials often require energy efficiency equipment upgrades, such as lighting or HVAC, in buildings undergoing a change of occupancy. This proposal seeks to provide clarity to that approach by providing a simple breakdown of energy use intensity (EUI) by building occupancy type and system type.

The proposed code change draws on a tradition of rehabilitation "smart codes" use-based lookup tables, is more consistent with the intent of the IECC, presents no cost increase, and incorporates extensive research and stakeholder input.

This proposal advances the Energy Use Intensity (EUI) as the metric for energy demand and the trigger for code compliance. Historic energy intensity per square foot is recorded for commercial buildings in the *Commercial Buildings Energy Consumption Survey* (CBECS). The CBECS data make it possible to rank building occupancies in the order of the energy intensities. Note that the ranking of occupancies to trigger specific code requirements has been a feature of the *International Existing Building Code* (IEBC) since its earliest editions (see IEBC 2009 Section 912, Change of Occupancy Classification, Tables 912.4, 912.5 and 912.6), and thus is familiar to building code officials.

Energy intensity data in CBECS is further broken down by various end uses (space conditioning, service water heating and lighting) which makes it possible to identify when it is appropriate to trigger code compliance of specific sections of the IECC. For each of these end uses, an increase in intensity triggers compliance with the correlating code provisions related to new construction in Chapter 4. Only an increase in energy intensities in all three of the end uses triggers full compliance with the code.

There are two exceptions that apply to all four end uses, indicated in Section C505.2:

1. Where it is demonstrated by analysis approved by the code official that the change will not increase energy use intensity.

2. Where the occupancy or use change is less than 5,000 square feet in area.

A matrix has been developed for each system end use that groups building occupancy classifications into HIGH, MEDIUM and LOW energy use intensities, measured in annual kBTU/sf. Data for this analysis came from the U.S. Department of Energy's 2012 CBECS. When occupancy classification or use is being changed from one energy intensity rank to a higher energy use intensity rank (or remains within the same energy use intensity rank), this proposal requires that specific system end-use to comply with the code.

Change of Occupancy Scale - Space Heating, Cooling and Ventilation

EUI Rank	CBECS Building Type	EUI Range kBTU/sq.ft.	IBC Occupancy Classification
1. High	Food Service, Laboratories, Health Care (Inpatient)	> 55	A-2, B-Laboratories, I-2
2. Medium	Public Assembly, Public Order and Safety, Office, Service, Health Care (Outpatient), Education, Retail, Residential Care/Assisted Living	27 - 55	A-1, A-3, A-4, A-5, B, E, I-1, I-3, I-4, M, R-4
3. Low	Religious Worship, Apartments, Warehouse and Storage	<27	A-3 Places of Worship, R-1, R-2, R-3, S-1, S-2

Change of Occupancy Scale - Service Water Heating

EUI Rank	CBECS Building Type	EUI Range kBTU/sq.ft.	IBC Occupancy Classification
1. High	Food Service, Health Care (Inpatient), Residential Care/Assisted Living, Lodging	> 15	A-2, I-1, I-2, R-1
2. Low	All the rest	< 15	All the rest

Change of Occupancy Scale- Lighting

EUI Rank	CBECS Building Type	EUI Range kBTU/sq.ft.	IBC Occupancy Classification
1. High	Laboratories, Health Care (Outpatient), Health Care (Inpatient), Retail	> 11	B-Laboratories, B-Healthcare (Outpatient), I-2, M
2. Medium	Food Service, Office, Health Care (Outpatient), Service, Public Order and Safety, Residential Care/Assisted Living, Lodging, Apartments, Warehouse and Storage	6.5 - 11	A-2, A-3-Courtrooms, B, I-1, I-3, I-4, R-1, R-2, R-3, R-4, S-1, S-2
3. Low	Public Assembly, Religious Worship, Education	< 6.5	A-1, A-3, A-4, E

Occupancy classifications F, H and U are typically not designed primarily for occupant comfort, and are generally classified as low energy use intensity buildings. Thus any change from one of these groups to any other should be required to comply with the provisions under Section C503 Alterations, even if no physical alteration is planned.

Section C505.2.1 Building Envelope is included as a building system, although with different criteria than EUI Intensity. The requirement and exception exist in the 2018 language; they are simply relocated in this proposal.

This code change proposal has been developed with support from the Consortium for Building Energy Innovation (CBEI), a project of the U. S. Department of Energy, and research conducted by Rutgers University Center for Green Building.

Bibliography: Clinton J. Andrews, David Hattis, David Listokin, Jennifer A. Senick, Gabriel B. Sherman & Jennifer Souder (2016): Energy –Efficient Reuse of Existing Commercial Buildings, *Journal of the American Planning Association*. doi.10.1080/01944363.2015.1134275

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The current code requirements trigger full compliance with the code when there is an increase in energy demand. The proposed code change offers the metric of energy use intensity per square foot per year for measuring energy demand by occupancy. It applies this metric separately to three energy end uses: space conditioning, lighting, and water heating. Therefore, compliance with the code is triggered only for the end uses for which energy intensity is increased.

In most cases, the proposed change triggers partial code compliance, and only rarely will it trigger full code compliance.

CE261-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The introduction of EUI is very helpful, but clarification is needed in C505.1 for referenced sections. Proponent encouraged to return with a public comment (Vote: 9-6).

Assembly Action: **None**

CE261-19

Individual Consideration Agenda

Public Comment 1:

IECC®: SECTION C505, C505.1

Proponents:
Maureen Guttman, Building Codes Assistance Project, representing Building Codes Assistance Project (mguttman@bcapcodes.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

SECTION C505
CHANGE OF OCCUPANCY OR USE

C505.1 General. ~~Spaces~~ Buildings or portions of buildings undergoing a change in occupancy from F, H or U occupancy classification to an occupancy classification other than F, H or U shall comply with Section C503. Other ~~B~~buildings or portions of buildings undergoing a change of occupancy without alterations shall comply with Section ~~C502.2~~ C505.2.

> **Exception:** Where the total building performance option in Section C407 is used to comply with this section, the annual energy cost of the proposed design shall be not greater than 110 percent of the annual energy cost otherwise permitted by Section C407.3.

Commenter's Reason: The original code change proposal contained a typographical error that was pointed out by the committee members. The second sentence of Section C505.1 referred to Section C502.2 but should have referred to Section C505.2. The committee elected not to make this minor modification as the proponents could not immediately confirm that the Section number was incorrect.
Committee members also noted an inconsistency between the first and second sentences of Section C505.1. The first sentence refers to "spaces undergoing a change in occupancy..." while the second sentence refers to "buildings or portions of buildings undergoing a change or occupancy...." This modification corrects the language of the first sentence to match the intent of scoping indicated by the second sentence.

A building or portion of building undergoing a change of occupancy from F, H or U to an occupancy other than F, H or U - even without alterations being planned - will realize an increase in EUI according to CBECS data and must therefore be considered an alteration. Such a change in occupancy must comply with Section C503 Alterations.

A building or portion of building other than F, H or U occupancies changing to another occupancy where there are no alterations planned shall comply with Section C505.2, which recognizes that such a change of occupancy may not increase the building's EUI, or may only increase the EUI of individual building systems.

The objective of this code change proposal as amended is to encourage limited but reasonable energy improvements for existing buildings where no other alteration work is planned during a change in occupancy or use. In contrast to the code's existing language, this change will decrease the cost of construction.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The current code requirements trigger full compliance with the code when there is an increase in energy demand. The proposed code change offers the metric of energy use intensity per square foot per year for measuring energy demand by occupancy. It applies this metric separately to three energy end uses: space conditioning, lighting, and water heating. Therefore, compliance with the code is triggered only for the end uses for which energy intensity is increased.

In most cases, the proposed change triggers partial code compliance, and only rarely will it trigger full code compliance.

Public Comment# 1968

CE262-19

IECC®: CA103.6, CA103.7 (New), CA103.8

Proposed Change as Submitted

Proponents: jim edelson, representing New Buildings Institute (jim@newbuildings.org)

2018 International Energy Conservation Code

Revise as follows:

CA103.6 Interconnection pathway. Construction documents shall indicate pathways for routing of conduit or piping from the solar-ready zone to the electrical service panel <u>and electrical energy storage system area,</u> or service hot water system.

Add new text as follows:

<u>**CA103.7** **Electrical energy storage system-ready area.** The floor area of the electrical energy storage system-ready area shall be not less than 2 feet in one dimension and 4 feet in another dimension, and located in accordance with Section 1206.2.8 of the *International Fire Code.* The location and layout diagram of the electrical energy storage system-ready area shall be indicated on the construction documents.</u>

Revise as follows:

~~CA103.7~~ **<u>CA103.8</u>** **Electrical service reserved space.** The main electrical service panel shall have a reserved space to allow installation of a dual-pole circuit breaker for future solar electric ~~installation~~ and <u>a dual-pole circuit breaker for future electrical energy storage system installation These spaces</u> shall be labeled “For Future Solar Electric <u>and Storage</u>.” The reserved ~~space~~ <u>spaces</u> shall be positioned at the end of the panel that is opposite from the panel supply conductor connection.

Reason: Appendix CA in IECC-commercial and Appendix RB in IECC-residential have proven useful for jurisdictions seeking to add solar ready provisions to state or local codes. As many jurisdictions in which the appendices are being considered are also facing current or future constraints on electric grid capacity to accomodate existing and new distributed solar generation resources, policy objectives are emerging to support the storage of energy produced by solar panels and shift its temporal impact on the grid.
This proposal modifies Appenidx CA provisions to ensure that there is design and space consideration for a standard sized battery rack, and for the connections to the electrical panels. As with the rationale for solar-ready, it is generally much more cost-effective at the time of new construction to design for future installation of this equipment than it is to retrofit later in the building's life.

The proposed language also cites the IFC to ensure there is sufficient clearance around the battery rack to meet life/safety concerns. The IFC is already referenced in Chapter 6.

Cost Impact: The code change proposal will increase the cost of construction
The cost impacts are limited to additional design professional fees, to markings on the panels, and to additional construction costs only if there were not spare square footage available in the equipment or storage rooms where panels are generally located. In that case, it would be equal to the construction costs for an additional 8 square feet of storage space.

CE262-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposal needs to coordinate better with the IFC (Vote: 15-0).

Assembly Action: **None**

CE262-19

Individual Consideration Agenda

Public Comment 1:

IECC®: CA103.6, CA103.7 (New), CA103.8

Proponents:
Eric Makela, representing New Buildings Institute (ericm@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

CA103.6 Interconnection pathway. Construction documents shall indicate pathways for routing of ~~conduit or piping~~ raceways or cable from the solar-ready zone to the electrical service panel and electrical energy storage system area, or service hot water system.

CA103.7 Electrical energy storage system-ready area. The floor area of the electrical energy storage system-ready area shall be not less than 2 feet in one dimension and 4 feet in another dimension, and located in accordance with Section 1206.2.8 of the *International Fire Code* and Section 110.26 of the NFPA 70. The location and layout diagram of the electrical energy storage system-ready area shall be indicated on the construction documents.

CA103.8 Electrical service reserved space. The main electrical service panel shall have a reserved space to allow installation of a dual-pole circuit breaker for future solar electric and a ~~dual-pole~~ two-pole circuit breaker for future electrical energy storage system installation These spaces shall be labeled "For Future Solar Electric and Storage." The reserved spaces shall be positioned at the end of the panel that is opposite from the panel supply conductor connection.

Commenter's Reason: Disapproval was requested for CE262 at the Code Action Hearings in order to modify and clarify the language to ensure that the solar storage ready requirement would correlate with the International Fire Code and National Electric Code. Also, some of the terminology was changed in the proposal to bring it into alignment with common terminology used in the industry.

Appendix CA in IECC-commercial and Appendix RB in IECC-residential have proven useful for jurisdictions seeking to add solar ready provisions to state or local codes. As many jurisdictions in which the appendices are being considered are also facing current or future constraints on electric grid capacity to accommodate existing and new distributed solar generation resources, policy objectives are emerging to support the storage of energy produced by solar panels and shift its temporal impact on the grid. This proposal modifies Appendix CA provisions to ensure that there is design and space consideration for a standard sized battery rack, and for the connections to the electrical panels. As with the rationale for solar ready, it is generally much more cost-effective at the time of new construction to design for future installation of this equipment than it is to retrofit later in the building's life.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The cost impacts are limited to additional design professional fees, to markings on the panels, and to additional construction costs only if there were not spare square footage available in the equipment or storage rooms where panels are generally located. In that case, it would be equal to the construction costs for an additional 8 square feet of storage space.

Public Comment# 1911

CE263-19 Part I

IECC: Appendix CB (New)

Proposed Change as Submitted

Proponents: Joseph H. Cain, Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

THIS IS A 3 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY IECC-CE COMMITTEE. PARTS II and III WILL BE HEARD BY THE IECC-RE COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

2018 International Energy Conservation Code

Add new text as follows:

Appendix CB
SOLAR PHOTOVOLTAIC (PV) SYSTEM REQUIRED - COMMERCIAL

SECTION CB101
SCOPE

CB101.1 General. These provisions shall be applicable for newly constructed commercial buildings, or additions larger than 5,000 square feet of gross conditioned floor area to commercial buildings, where solar photovoltaic (PV) systems are required.

SECTION CB102
DEFINITIONS

Revise as follows:

CB102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 for general definitions.

Add new text as follows:

COMMUNITY SOLAR FACILITY. A facility that generates electrical energy with a solar photovoltaic system, is qualified as a community energy facility, and allocates bill credits to customers under state and local utility statutes and rules.

SECTION CB103
SOLAR PHOTOVOLTAIC (PV) SYSTEMS

CB103.1 Renewable energy systems. Newly constructed commercial buildings, or additions larger than 5,000 square feet of gross conditioned floor area to commercial buildings, shall have an on-site solar photovoltaic system installed. Photovoltaic (PV) systems shall comply with Sections CB103.2 through CB103.4. The code official is authorized to exempt a covered building from the on-site photovoltaic system requirement or allow an alternative means of compliance under any of the following conditions:

Exceptions:

1.Where the code official determines the building has satisfied the purpose and intent of this provision through the use of alternative on-site renewable energy systems such as wind energy systems.
2.Where the code official determines an on-site or off-site community solar facility is dedicated to the building with a legally binding and executed agreement, in conformance with Section CB103.3.

CB103.2 Photovoltaic (PV) system sizing requirement. Minimum installed capacity of PV systems shall be determined in accordance with this section. The PV system installed nameplate capacity (kW_{DC}) shall be not less than 0.25 times the conditioned floor area (0.25 W_{DC} per square foot). The nameplate PV system size shall be calculated as the sum of each PV module's nameplate output (W_{DC}). For buildings 4 or more stories in height, the conditioned floor area for this calculation shall be based on the largest 3 above-grade stories in the building. Where the on-site renewable energy option in Section C406 is selected, the minimum installed capacity required in this section shall be in addition to that required by Section C406.

CB103.3. Community solar facility Where a community solar facility is used as an alternative to an on-site photovoltaic system, the community solar facility shall provide energy savings benefits directly to the building that would otherwise have been required to have an on-site photovoltaic system. The energy savings benefits shall be allocated from the total resource of the community solar facility in a manner demonstrated to be equivalent to the reductions in energy consumption that would have resulted from the on-site photovoltaic system that is otherwise required. The community solar facility shall provide the required energy savings benefits to the dedicated building for a period not less than twenty years. The energy savings benefits shall not be attributed to other purposes and shall not be transferred to other buildings or property.

CB103.4 Leases and power purchase agreements. On-site photovoltaic systems that are leased by the end-use customer (tenant or owner) or that supply electricity to the end-use customer through a power purchase agreement (PPA) shall be permitted to satisfy the requirement provided the system meets all other requirement criteria.

Reason: Part I
This proposal provides a new Appendix chapter for the commercial portion of the IECC, which would be available to jurisdictions wanting to adopt renewable energy requirements for new commercial buildings and additions greater than 5,000 square feet. This proposal continues to move renewable energy into mainstream practice for the design and construction industries, which helps to decrease demand on utilities. The benefit to the building owner or tenant is lower utility bills. This language does not increase enforcement efforts because the review and inspection process for mechanical and renewable energy systems is currently standard practice.

The Washington State Building Code Council voted to include this language as Appendix D in the Washington State Energy Code. This requirement has been in the main body of the Seattle Energy Code since 2012, and is included as Section C411.

Language has been added to ensure the requirements of the Appendix do not conflict with Section C406. If the on-site renewable energy option in Section C406 is selected, both requirements are cumulative.

Part II

This proposal provides a new Appendix for the residential portion of the IECC which would be available to jurisdictions wanting to adopt renewable energy requirements for new residential buildings; enabling direct opportunity to meet state RPS goals to incorporate renewable energy. This proposal continues to move renewable energy into mainstream practice for the design and construction industries which will diversify the state and jurisdictional energy portfolio amongst traditional energy resources and new renewable generation via utilities and distributed energy resources. The benefit to the homeowner is lower, more consistent energy bills. This language does not increase enforcement efforts because the review and inspection process for mechanical and renewable energy systems is currently standard practice.

This proposal is modeled after the California Energy Commission (CEC) model ordinance language, which is useful to early adopters that want to require PV for new residential buildings in their communities, withÂ modification to allow jurisdictions flexibility to furtherÂ customize.

Individual technical provisions of this appendix are also based on 2019 CA Building Energy Efficiency Standards (BEES):

Joint Appendix JA11 -- Qualification Requirements for Photovoltaic System, and

Section 10-115 -- Community Shared Solar Electric Generation System or Community Shared Battery Storage System Compliance Option for Onsite Solar Electric Generation or Battery Storage Requirements.

Part III

This proposal provides a new Appendix for the International Residential Code which would be available to jurisdictions wanting to adopt renewable energy requirements for new one- and two family dwellings and townhouse buildings; enabling direct opportunity to meet state RPS goals to incorporate renewable energy. This proposal is written to parallel the appendix proposed for the IECC-Residential code provisions found in Part II of this proposal. Please consider the reason statement provided for Part II.

Bibliography: 2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings (See Section 10-115 for Community Solar)
2019 Reference Appendices for Residential and Nonresidential Buildings (See Joint Appendix JA11 for Qualification Requirements for PV)

Rooftop solar PV system report for the 2019 [California Energy] Standards update.

Report prepared by Energy and Environmental Economics, Inc. under contract with the California Energy Commission.

https://efiling.energy.ca.gov/getdocument.aspx?tn=221366

Q3/Q4 2018 Solar Industry Update - January 2019

David Felman, Anna Ebers, and Robert Margolis. Q3/Q4 2018 Solar Industry Update - January 2019

https://www.nrel.gov/docs/fy19osti/73234.pdf

U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018

Ran Fu, David Feldman, Mike Woodhouse, and Robert Margolis. 2018 U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018

https://www.nrel.gov/docs/fy19osti/72399.pdf

Study Summary: https://www.nrel.gov/news/program/2018/costs-continue-to-decline-for-residential-and-commercial-photovoltaics-in-2018.html

Design and Implementation of Community Solar Programs for Low- and Moderate-Income Customers

Heeter, Jenny, Lori Bird, Eric O'Shaughnessy, and Sam Koebrich. 2018. Design and Implementation of Community Solar Programs for Low- and Moderate-Income Customers. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20- 71652.

https://www.nrel.gov/docs/fy19osti/71652.pdf

Cost Impact: The code change proposal will increase the cost of construction
When adopted, this appendix chapter will increase the first cost of commercial building construction, but will reduce overall operating cost, provide for more consistent energy bills and save money on monthly energy bills.

A report completed by NREL shows the current cost benchmark of $1.83 per Wdc for commercial systems, which is a decrease from the previous quarter. If you multiply $1.83 per Watt times 0.25 Watts rated peak photovoltaic energy production per square foot of floor area, then the conservative resulting installation cost would be approximately $458 per 1,000 square feet based on this proposal. In 2021, the federal rebate for photovoltaic systems steps down to 22 percent. There may also be state and local rebates or other subsidies helping to reduce up-front costs.

If PV systems are financed by third parties through a lease or PPA, the first cost of the building might not be impacted, and building occupants will experience immediate savings on energy bills.

Greater cost savings can be realized by installing PV systems on new buildings at the first construction outset due to ease of permitting, more efficient inspections, the ability to integrate solar installations with the regular building schedule and the efficiencies of repetitive procedures.

CE263-19 Part I

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **Disapproved**

Committee Reason: The original proposal appears to trade off renewables for efficiency in C407, there is a lot of work to do - encourage the proponent to develop a shelf ready proposal, addressing size of buildings, alternative compliance options (Vote: 13-2).

Assembly Action: **None**

CE263-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC®: Appendix CB (New), SECTION CB101 (New), CB101.1 (New), SECTION CB102 (New), CB102.1 (New), (New), SECTION CB103 (New), CB103.1 (New), CB103.2 (New), CB103.2.1 (New), CB103.2.2 (New), CB103.3. (New), CB103.4 (New)

Proponents:
Joseph H. Cain, P.E., Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

Appendix CB
SOLAR PHOTOVOLTAIC (PV) SYSTEM REQUIRED - COMMERCIAL

SECTION CB101
SCOPE

CB101.1 General. These provisions shall be applicable for newly constructed commercial buildings, or additions larger than ~~5,000~~ 10,000 square feet of gross conditioned floor area to commercial buildings, where solar photovoltaic (PV) systems are required.

SECTION CB102
DEFINITIONS

CB102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 for general definitions.

COMMUNITY SOLAR FACILITY. A facility that generates electrical energy with a solar photovoltaic system and allocates bill credits to customers, and is qualified as a community energy facility~~, and allocates bill credits to customers~~ under state and local utility statutes and rules.

SECTION CB103
SOLAR PHOTOVOLTAIC (PV) SYSTEMS

CB103.1 Renewable energy systems. Newly constructed commercial buildings, or additions larger than ~~5,000~~ 10,000 square feet of gross conditioned floor area to commercial buildings, shall have an on-site solar photovoltaic system installed. Photovoltaic (PV) systems shall comply with Section~~s~~ CB103.2~~ through CB103.4~~. The code official is authorized to exempt a covered building from the on-site photovoltaic system requirement or allow an alternative means of compliance under any of the following conditions:

~~**Exceptions:**~~

1. Where the code official determines the building has satisfied the purpose and intent of this provision through the use of alternative on-site renewable energy systems~~ such as wind energy systems~~.
2. Where the code official ~~determines~~ approves an on-site or off-site community solar facility ~~is~~ dedicated to the building with a legally binding and executed agreement, in conformance with Section CB103.3.

CB103.2 Photovoltaic (PV) system sizing requirement. Minimum installed capacity of PV systems shall be determined in accordance with this section. The PV system installed nameplate capacity (kW_{DC}) shall be not less than 0.25 times the conditioned floor area (0.25 W_{DC} per square foot). The nameplate PV system size shall be calculated as the sum of each PV module's nameplate output (W_{DC}). For buildings 4 or more stories in height, the conditioned floor area for this calculation shall be based on the largest 3 above-grade stories in the building. ~~Where the on-site renewable energy option in Section C406 is selected, the minimum installed capacity required in this section shall be in addition to that required by Section C406.~~

CB103.2.1 Additional efficiency package options. The PV capacity required in this section shall not be used for compliance with the onsite renewable energy option of Section C406.5.

CB103.2.2 Total building performance. Where the total building performance of Section C407 is used for compliance, the PV capacity required in this section shall be the same in the *standard reference design* and the *proposed design.*

CB103.3. Community solar facility Where a community solar facility is used as an alternative to an on-site photovoltaic system, the community solar facility shall provide energy ~~savings~~ benefits directly to the building that would otherwise have been required to have an on-site photovoltaic system. The energy ~~savings~~ benefits shall be allocated from the total resource of the community solar facility in a manner demonstrated to be equivalent to the ~~reductions in energy consumption~~ generation of energy that would have resulted from the on-site photovoltaic system that is otherwise required. The community solar facility shall provide the required energy ~~savings~~ benefits to the dedicated building for a period not less than twenty years. The energy ~~savings~~ benefits shall not be attributed to other purposes and shall not be transferred to other buildings or property.

~~**CB103.4 Leases and power purchase agreements.** On-site photovoltaic systems that are leased by the end-use customer (tenant or owner) or that supply electricity to the end-use customer through a power purchase agreement (PPA) shall be permitted to satisfy the requirement provided the system meets all other requirement criteria.~~

Commenter's Reason: This proposal provides a new Appendix chapter for the commercial portion of the IECC, which would be available to jurisdictions wanting to adopt renewable energy requirements for new commercial buildings and additions greater than 5,000 square feet. This proposal continues to move renewable energy into mainstream practice for the design and construction industries, which helps to decrease demand on utilities. The benefit to the building owner or tenant is lower utility bills. This language does not increase enforcement efforts because the review and inspection process for mechanical and renewable energy systems is currently standard practice.

The Washington State Building Code Council voted to include this language as Appendix D in the Washington State Energy Code. This requirement has been in the main body of the Seattle Energy Code since 2012, and is included as Section C411.

Language has been added to ensure the requirements of the Appendix do not conflict with Section C406. If the on-site renewable energy option in Section C406 is selected, both requirements are cumulative.

FOR THIS PUBLIC COMMENT:

The definition of Community Solar is revised as an editorial change only.

CB103.1 is revised in response to stakeholder input:

- to revise the threshold for building size to be consistent with ASHRAE

- to clarify that charging language is included in CB103.2

- to clarify that Items 1 and 2 are conditions, rather than exceptions

- other editorial changes as suggested by stakeholder input

CB103.2 is revised in response to stakeholder input:

- to clarify the language regarding Sections C406.5 and C407, to preclude the possibility of double-counting renewable energy systems required to be installed when this appendix chapter is adopted.

CB103.3 is revised in response to stakeholder input:

- editorial changes consistent with Modification CAIN-1

CB103.4 is removed in response to committee discussion, with a IECC-Residential committee member pointing out that ownership of a PV system is not relevant to IECC requirements.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
When adopted, this appendix chapter will increase the first cost of commercial building construction, but will reduce overall operating cost, provide for more consistent energy bills and save money on monthly energy bills.

A report completed by NREL shows the current cost benchmark of $1.83 per Wdc for commercial systems, which is a decrease from the previous quarter. If you multiply $1.83 per Watt times 0.25 Watts rated peak photovoltaic energy production per square foot of floor area, then the conservative resulting installation cost would be approximately $458 per 1,000 square feet based on this proposal. In 2021, the federal rebate for photovoltaic systems steps down to 22 percent. There may also be state and local rebates or other subsidies helping to reduce up-front costs.

If PV systems are financed by third parties through a lease or PPA, the first cost of the building might not be impacted, and building occupants will experience immediate savings on energy bills.

Greater cost savings can be realized by installing PV systems on new buildings at the first construction outset due to ease of permitting, more efficient inspections, the ability to integrate solar installations with the regular building schedule and the efficiencies of repetitive procedures.

Public Comment# 1869

Public Comment 2:

IECC®: CB103.2 (New)

Proponents:
Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

CB103.2 Photovoltaic (PV) system sizing requirement. Minimum installed capacity of PV systems shall be determined in accordance with this section. The PV system installed nameplate capacity (kW_{DC}) shall be not less than 0.25 times the conditioned floor area (0.25 W_{DC} per square foot). The nameplate PV system size shall be calculated as the sum of each PV module's nameplate output (W_{DC}). For buildings 4 or more stories in height, the conditioned floor area for this calculation shall be based on the largest 3 above-grade stories in the building. Where the on-site renewable energy option in Section C406 is selected, the minimum installed capacity required in this section shall be in addition to that required by Section C406. <u>Where the total building performance of Section C407 is used for compliance, the PV system capacity required in this section shall be the same in the s*tandard reference design* and the *proposed design*.</u>

Commenter's Reason: This public comment is provided in the event that CE263-19-Part 1 is considered for approval at the public hearing. As proposed, CE263 should be disapproved for the reasons given by the committee and testimony at the committee action hearing. However, there is one significant concern that is addressed by this public comment. It is related to clarifying that mandated PV capacity should not be used as a basis for making trade-offs that decrease the building performance and thus negate the benefits of adding the mandated PV to a building (the same should also apply to voluntary use of renewable energy generation for the same reason). Renewable energy is not free and is not an unlimited resource. The ability to use it to minimize non-renewable energy use requires that energy conservation not be sacrificed. This public comment is aimed specifically at that concern.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
It is not clear that the public comment would add any additional cost to the original proposal's cost increase. It will, however, prevent mandated PV (if adopted) from being subsidized by weakening the building's energy conservation measures through trade-offs in the performance path. Consequently, this PC will tend to decrease cost of building operation and maximize the benefits of PV.

Public Comment# 1762

Public Comment 3:

IECC®: Appendix CB (New), SECTION CB101 (New), CB101.1 (New), SECTION CB102 (New), CB102.1 (New), (New), SECTION CB103 (New), CB103.1 (New), CB103.2 (New), CB103.2.1 (New), CB103.2.2 (New), CB103.3. (New), CB103.4 (New)

Proponents:
Maureen Guttman, Building Codes Assistance Project, representing Building Codes Assistance Project (mguttman@bcapcodes.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

Appendix CB
SOLAR PHOTOVOLTAIC (PV) SYSTEM REQUIRED - COMMERCIAL

SECTION CB101
SCOPE

CB101.1 General. These provisions shall be applicable for newly constructed commercial buildings, or additions larger than 5,000 square feet of gross conditioned floor area to commercial buildings, where solar photovoltaic (PV) systems are required.

~~SECTION CB102~~
~~DEFINITIONS~~

~~**CB102.1 General.** The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 for general definitions.~~

~~**COMMUNITY SOLAR FACILITY.** A facility that generates electrical energy with a solar photovoltaic system, is qualified as a community energy facility, and allocates bill credits to customers under state and local utility statutes and rules.~~

SECTION CB103
SOLAR PHOTOVOLTAIC (PV) SYSTEMS

CB103.1 Renewable energy systems. Newly constructed commercial buildings, or additions larger than 5,000 square feet of gross conditioned floor area to commercial buildings, shall have an on-site solar photovoltaic system installed. Photovoltaic (PV) systems shall comply with Sections

CB103.2~~ through CB103.4~~. The code official is authorized to exempt a covered building from the on-site photovoltaic system requirement or allow an alternative means of compliance under any of the following conditions:

~~**Exceptions:**~~

1. Where the code official determines the building has satisfied the purpose and intent of this provision through the use of alternative on-site renewable energy systems~~ such as wind energy systems~~.
2. Where the code official approves ~~determines~~ an on-site or off-site community solar facility~~ is~~ dedicated to the building with a legally binding and executed agreement, in conformance with Section CB103.3.
3. Where the code official approves a lease or power purchase agreement in conformance with Section CB103.4.

CB103.2 Photovoltaic (PV) system sizing requirement. Minimum installed capacity of PV systems shall be determined in accordance with this section. The PV system installed nameplate capacity (kW_{DC}) shall be not less than 0.25 times the conditioned floor area (0.25 W_{DC} per square foot). The nameplate PV system size shall be calculated as the sum of each PV module's nameplate output (W_{DC}). For buildings 4 or more stories in height, the conditioned floor area for this calculation shall be based on the largest 3 above-grade stories in the building. ~~Where the on-site renewable energy option in Section C406 is selected, the minimum installed capacity required in this section shall be in addition to that required by Section C406.~~

CB103.2.1 On-site renewable energy option. Where the on-site renewable energy option in Section C406 is selected, the minimum installed capacity required in this section shall be in addition to that required by Section C406.

CB103.2.2 Total building performance option. Where the total building performance option in Section C407 is selected, the minimum installed capacity required in this section shall be in addition to the five percent minimum allowed in Section C407.

CB103.3. Community solar facility Where a community solar facility is used as an alternative to an on-site photovoltaic system, the community solar facility shall provide energy savings benefits directly to the building that would otherwise have been required to have an on-site photovoltaic system. The energy savings benefits shall be allocated from the total resource of the community solar facility in a manner demonstrated to be equivalent to the reductions in energy consumption that would have resulted from the on-site photovoltaic system that is otherwise required. The community solar facility shall provide the required energy savings benefits to the dedicated building for a period not less than twenty years. The energy savings benefits shall not be attributed to other purposes and shall not be transferred to other buildings or property.

CB103.4 Leases and power purchase agreements. On-site photovoltaic systems that are leased by the end-use customer (tenant or owner) or that supply electricity to the end-use customer through a power purchase agreement (PPA) shall be permitted to satisfy the requirement provided the system meets all other requirement criteria.

Commenter's Reason: The proposal to require solar energy on commercial buildings is appropriately positioned as an appendix, allowing a jurisdiction to incorporate this requirement as part of their adopted energy code.

The definition for Community Solar Facility is not required, as the provision of Section CB103.1(2) clearly indicates that the code official must approve such a facility for it to acceptable as an alternative to a system installed on the building. Additionally, the phrase "...is qualified as a community energy facility..." adds confusion since there is no indication as to who provides such qualification.

The second sentence of Section CB 103.1 is modified to clarify that photovotaic systems shall comply with Section CB103.2 only. Subsection CB103.1(3) is added to provide reference to Subsection CB103.4. Subections CB103.3 and CB103.4 are alternatives to the requirements of Section CB103.2 only where approved by the code official.

The last sentence of Section CB103.2 should be a subsection, as it will not apply to every project subject to the provisions of CB103.2.

Subsection CB103.2.2 is added to ensure that even where solar energy systems are required by the AHJ, the renewable energy generated cannot be used to offset the required energy efficiency of Chapter 4 beyond the minimum allowed in Section C407.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This public comment only provides clarification for the original proposal. Therefore, the net effect of both has the same impact on construction costs.

Public Comment# 1979

CE263-19 Part II

IECC: Appendix RB (New)

Proposed Change as Submitted

Proponents: Joseph Cain, representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

2018 International Energy Conservation Code

Add new text as follows:

Appendix RB
SOLAR PHOTOVOLTAIC (PV) SYSTEM REQUIRED

SECTION RB101
SCOPE

RB101.1 General. These provisions shall be applicable for newly constructed *residential buildings* where solar photovoltaic (PV) systems are required.

SECTION RB102
DEFINITIONS

RB102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 for general definitions.

Add new definition as follows:

COMMUNITY SOLAR FACILITY. A facility that generates electrical energy with a solar photovoltaic system, is qualified as a community energy facility, and allocates bill credits to customers, under state and local utility statutes and rules.

STEEP SLOPE. A roof slope greater than two units vertical in 12 units horizontal (17-percent slope).

Add new text as follows:

SECTION RB103
SOLAR PHOTOVOLTAIC SYSTEM

RB103.1 Renewable energy systems. Newly constructed residential buildings shall have an on-site solar photovoltaic (PV) system installed. Photovoltaic systems shall comply with Sections RB103.2 through RB103.6. The code official is authorized to exempt a covered building from the on-site photovoltaic system requirement or allow an alternative means of compliance under any of the following conditions:

Exceptions:

1.Where the code official determines there are practical challenges that cause satisfaction of the requirements to be infeasible. Practical challenges include, but are not limited to, building site location, limited rooftop availability, or shading from nearby structures, topography, or vegetation.
2.Where the code official determines the purpose and intent of this provision is satisfied through the use of alternative on-site renewable energy systems such as wind energy systems.
3.If the code official determines an on-site or off-site community solar facility is dedicated to the building with a legally binding and executed agreement, and is in conformance with Section RB103.5.

RB103.2 Photovoltaic (PV) system sizing requirement. Minimum installed capacity of PV systems shall be determined by using one of the two methods in this section, either prescriptive PV sizing in Section RB103.2.1 or performance PV sizing in Section RB103.2.2. Buildings with *conditioned floor area* of 4,500 square feet or greater shall use the performance PV sizing approach in Section RB103.2.2.

RB103.2.1 Prescriptive PV sizing method. For the prescriptive PV sizing method, the PV system installed nameplate capacity (kW_{DC}) shall be not less than 1.0 times the *conditioned floor area* (1.0 Watts per square foot). The nameplate PV system size shall be calculated as the sum of each PV module's nameplate output (W_{DC}).

RB103.2.2 Performance PV sizing method. For the performance PV sizing method, the PV system shall be sized to meet at least 75 percent of the building's total electrical energy use on an annual basis, including both conditioned and unconditioned space. The minimum PV system size requirement (kW_{DC}) shall be calculated using modeling software or other methods approved by the code official.

RB103.3 Photovoltaic system orientation. Fixed-orientation photovoltaic systems located on *steep sloped* roofs shall be oriented with azimuth of each array between 90 degrees and 300 degrees measured clockwise from true north.

Exception: Photovoltaic systems with one or more arrays oriented outside the prescribed azimuth range when the PV system is modeled using performance PV sizing method in Section RB103.2.2..

RB103.4 Shading. All PV systems shall be designed to meet minimal shading criterion in Section RB103.4.1 or the detailed geometries of PV arrays and obstructions shall be considered in the performance PV sizing method in conformance with Section RB103.4.2.

RB103.4.1 Minimal shading criterion. To comply with minimal shading criterion, a PV array shall be no closer to any shading obstruction than twice the height of the obstruction above the PV array. All obstructions that project above the point on the PV array that is closest to the obstruction shall meet this criterion for the array to be considered minimally shaded.

Exception: Any obstruction located north of all points on the array need not be considered as a shading obstruction...

RB103.4.2 Solar access verification. Where any PV array does not meet the minimal shading criterion of Section RB103.4.1, detailed geometries of the PV array and shading profiles from obstructions shall be considered in the performance PV sizing method. Shading profiles shall be measured with a solar assessment tool or determined from aerial satellite images or other automated resources approved by the code official.

RB103.5 Community solar facility, Where a *community solar facility* is used as an alternative to an on-site photovoltaic system, the *community solar facility* shall provide energy savings benefits directly to the building that would otherwise have been required to have an on-site photovoltaic system. The energy savings benefits shall be allocated from the total resource of the *community solar facility* in a manner demonstrated to be equivalent to the reductions in energy consumption that would have resulted from the on-site photovoltaic system that is otherwise required. The *community solar facility* shall provide the required energy savings benefits to the dedicated *building* for a period not less than twenty years. The energy savings benefits shall not be attributed to other purposes and shall not be transferred to other buildings or property.

SECTION RB104
LEASES AND PURCHASE AGREEMENTS

RB104.1 Leases and power purchase agreements. On-site photovoltaic systems that are leased by the end-use customer (tenant or owner) or that supply electricity to the end-use customer through a power purchase agreement (PPA) shall be permitted to satisfy the requirement provided the system meets all other requirement criteria.

Reason: Part I
This proposal provides a new Appendix chapter for the commercial portion of the IECC, which would be available to jurisdictions wanting to adopt renewable energy requirements for new commercial buildings and additions greater than 5,000 square feet. This proposal continues to move renewable energy into mainstream practice for the design and construction industries, which helps to decrease demand on utilities. The benefit to the building owner or tenant is lower utility bills. This language does not increase enforcement efforts because the review and inspection process for mechanical and renewable energy systems is currently standard practice.

The Washington State Building Code Council voted to include this language as Appendix D in the Washington State Energy Code. This requirement has been in the main body of the Seattle Energy Code since 2012, and is included as Section C411.

Language has been added to ensure the requirements of the Appendix do not conflict with Section C406. If the on-site renewable energy option in Section C406 is selected, both requirements are cumulative.

Part II

This proposal provides a new Appendix for the residential portion of the IECC which would be available to jurisdictions wanting to adopt renewable energy requirements for new residential buildings; enabling direct opportunity to meet state RPS goals to incorporate renewable energy. This proposal continues to move renewable energy into mainstream practice for the design and construction industries which will diversify the state and jurisdictional energy portfolio amongst traditional energy resources and new renewable generation via utilities and distributed energy resources. The benefit to the homeowner is lower, more consistent energy bills. This language does not increase enforcement efforts because the review and inspection process for mechanical and renewable energy systems is currently standard practice.

This proposal is modeled after the California Energy Commission (CEC) model ordinance language, which is useful to early adopters that want to require PV for new residential buildings in their communities, withÂ modification to allow jurisdictions flexibility to furtherÂ customize.

Individual technical provisions of this appendix are also based on 2019 CA Building Energy Efficiency Standards (BEES):

Joint Appendix JA11 -- Qualification Requirements for Photovoltaic System, and

Section 10-115 -- Community Shared Solar Electric Generation System or Community Shared Battery Storage System Compliance Option for Onsite Solar Electric Generation or Battery Storage Requirements.

Part III

This proposal provides a new Appendix for the International Residential Code which would be available to jurisdictions wanting to adopt renewable energy requirements for new one- and two family dwellings and townhouse buildings; enabling direct opportunity to meet state RPS goals to incorporate renewable energy. This proposal is written to parallel the appendix proposed for the IECC-Residential code provisions found in Part II of this proposal. Please consider the reason statement provided for Part II.

Bibliography: 2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings (See Section 10-115 for Community Solar) 2019 Reference Appendices for Residential and Nonresidential Buildings (See Joint Appendix JA11 for Qualification Requirements for PV)

Rooftop solar PV system report for the 2019 [California Energy] Standards update.

Report prepared by Energy and Environmental Economics, Inc. under contract with the California Energy Commission.

https://efiling.energy.ca.gov/getdocument.aspx?tn=221366

Q3/Q4 2018 Solar Industry Update - January 2019

David Felman, Anna Ebers, and Robert Margolis. Q3/Q4 2018 Solar Industry Update - January 2019

https://www.nrel.gov/docs/fy19osti/73234.pdf

U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018

Ran Fu, David Feldman, Mike Woodhouse, and Robert Margolis. 2018 U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018

https://www.nrel.gov/docs/fy19osti/72399.pdf

Study Summary: https://www.nrel.gov/news/program/2018/costs-continue-to-decline-for-residential-and-commercial-photovoltaics-in-2018.html

Design and Implementation of Community Solar Programs for Low- and Moderate-Income Customers

Heeter, Jenny, Lori Bird, Eric O'Shaughnessy, and Sam Koebrich. 2018. Design and Implementation of Community Solar Programs for Low- and Moderate-Income Customers. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20- 71652.

https://www.nrel.gov/docs/fy19osti/71652.pdf

Cost Impact: The code change proposal will increase the cost of construction
When adopted, this appendix chapter will increase the first cost of commercial building construction, but will reduce overall operating cost, provide for more consistent energy bills and save money on monthly energy bills.

A report completed by NREL shows the current cost benchmark of $1.83 per Wdc for commercial systems, which is a decrease from the previous quarter. If you multiply $1.83 per Watt times 0.25 Watts rated peak photovoltaic energy production per square foot of floor area, then the conservative resulting installation cost would be approximately $458 per 1,000 square feet based on this proposal. In 2021, the federal rebate for photovoltaic systems steps down to 22 percent. There may also be state and local rebates or other subsidies helping to reduce up-front costs.

If PV systems are financed by third parties through a lease or PPA, the first cost of the building might not be impacted, and building occupants will experience immediate savings on energy bills.

Greater cost savings can be realized by installing PV systems on new buildings at the first construction outset due to ease of permitting, more efficient inspections, the ability to integrate solar installations with the regular building schedule and the efficiencies of repetitive procedures.

CE263-19 Part II

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
RB103.5 Community solar facility. Where a *community solar facility* is used as an alternative to an on-site photovoltaic system, the *community*

solar facility shall provide energy ~~savings~~ benefits directly to the building that would otherwise have been required to have an on-site photovoltaic system. The energy ~~savings~~ benefits shall be allocated from the total resource of the *community solar facility* in a manner demonstrated to be equivalent to the ~~reductions in energy consumption~~ generation of energy that would have resulted from the on-site photovoltaic system that is otherwise required. The *community solar facility* shall provide the required energy ~~savings~~ benefits to the dedicated *building* for a period not less than twenty years. The energy ~~savings~~ benefits shall not be attributed to other purposes and shall not be transferred to other buildings or property.

Committee Reason: The proposal is needed, it the future, it does need work and "future proofing". The modification offers a clarification and there is consensus it was needed (Vote: 7-4).

Assembly Action: **None**

CE263-19 Part II

Individual Consideration Agenda

Public Comment 1:

IECC®: (New), SECTION RB103 (New), RB103.1 (New), RB103.2 (New), SECTION RB104 (New), RB104.1 (New)

Proponents:
Joseph H. Cain, P.E., Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

COMMUNITY SOLAR FACILITY. A facility that generates electrical energy with a solar photovoltaic system and allocates bill credits to customers, and is qualified as a community energy facility~~, and allocates bill credits to customers,~~ under state and local utility statutes and rules.

STEEP SLOPE. A roof slope ~~greater than~~ two units vertical in 12 units horizontal (17-percent slope) or greater.

SECTION RB103
SOLAR PHOTOVOLTAIC SYSTEM

RB103.1 Renewable energy systems. Newly constructed residential buildings shall have an on-site solar photovoltaic (PV) system installed. Photovoltaic systems shall comply with Sections RB103.2 through RB103.6. The code official is authorized to exempt a covered building from the on-site photovoltaic system requirement or allow an alternative means of compliance under any of the following conditions:

~~**Exceptions:**~~

1. Where the code official determines there are practical challenges that cause satisfaction of the requirements to be infeasible. Practical challenges include, but are not limited to, building site location, limited rooftop availability, or shading from nearby structures, topography, or vegetation.
2. Where the code official determines the purpose and intent of this provision is satisfied through the use of alternative on-site renewable energy systems~~ such as wind energy systems~~.
3. If the code official ~~determines~~ approves an on-site or off-site community solar facility ~~is~~ dedicated to the building with a legally binding and executed agreement, and is in conformance with Section RB103.5.

RB103.2 Photovoltaic (PV) system sizing requirement. Minimum installed capacity of PV systems shall be determined by using one of the two methods in this section, either prescriptive PV sizing in Section RB103.2.1 or performance PV sizing in Section RB103.2.2. Buildings with *conditioned floor area* of 4,500 square feet or greater shall use the performance PV sizing approach in Section RB103.2.2. Where the simulated performance alternative of Section R405 is used for compliance, the PV capacity provided in accordance with this section shall not be included in the analysis or shall be the same in the standard reference design and the proposed design. Where the energy rating index of Section R406 is used for compliance, the PV capacity provided in accordance with this section shall not be used to show compliance with the maximum energy rating index of Section R406.4 but shall be permitted to be included in an energy rating index used for other purposes.

~~SECTION RB104~~
~~LEASES AND PURCHASE AGREEMENTS~~

~~**RB104.1 Leases and power purchase agreements.** On-site photovoltaic systems that are leased by the end-use customer (tenant or owner) or that supply electricity to the end-use customer through a power purchase agreement (PPA) shall be permitted to satisfy the requirement provided the system meets all other requirement criteria.~~

Commenter's Reason: For this Public Comment:
The definition of Community Solar is revised as an editorial change only.

The definition of Steep Slope is revised to be consistent with Proposal G9-19, which was Approved as Submitted by the Structural Committee, by unanimous vote.

G9-19: THIS CODE CHANGE WAS HEARD BY THE IBC-STRUCTURAL COMMITTEE. Committee Action: As Submitted Committee Reason: Editorial: The proposal corrects the definition to be consistent with the requirements in Chapter 15. (Vote: 14-0) Assembly Motion: None

RB103.1 is revised in response to stakeholder input:

- to clarify that Items 1 through 3 are conditions, rather than exceptions

- editorial changes to Conditions 2 and 3

RB103.2 is revised in response to stakeholder input:

- to clarify the language regarding Sections R405 and R406, to preclude the possibility of double-counting renewable energy systems required to be installed when this appendix chapter is adopted.

RB104 is removed in response to committee discussion, with a committee member pointing out that ownership of a PV system is not relevant to IECC requirements.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This proposal will increase the first cost of construction for PV systems that are a cash purchase, but not for systems that are under lease agreements or power purchase agreements (PPA's). The installed cost of new PV systems retrofitted on existing homes is approximately $2.50 per Watt. Greater cost savings can be realized owing to installations on new homes and the efficiencies of repetitive procedures.

Public Comment# 2079

Public Comment 2:

IECC®: RB103.2 (New)

Proponents:
Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

RB103.2 Photovoltaic (PV) system sizing requirement. Minimum installed capacity of PV systems shall be determined by using one of the two methods in this section, either prescriptive PV sizing in Section RB103.2.1 or performance PV sizing in Section RB103.2.2. Buildings with *conditioned floor area* of 4,500 square feet or greater shall use the performance PV sizing approach in Section RB103.2.2. <u>Where the simulated performance alternative of Section R405 is used for compliance, the PV system capacity provided in accordance with this section shall not be included in the analysis or shall be the same in the *standard reference design* and the *proposed design*. Where the energy rating index of Section R406 is used for compliance, the PV system capacity provided in accordance with this section shall not be used to show compliance with the maximum energy rating index of Section R406.4 but shall be permitted to be included in an energy rating index for other purposes.</u>

Commenter's Reason: This public comment is provided in the event that CE263-19-Part 2 is not disapproved at the public hearing. There is at least one significant concern that is addressed by this public comment. It is related to clarifying that mandated PV capacity should not be used as a basis for making trade-offs that decrease the building performance and thus negate the benefits of adding the mandated PV to a building (the same should also apply to voluntary use of renewable energy generation for the same reason). Renewable energy is not free and is not an unlimited resource. The ability to use it to minimize non-renewable energy use requires that energy conservation not be sacrificed. This public comment is aimed specifically at that concern. At a minimum, CE263-19-Part 2 should be modified to address this concern or be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
It is not clear that the public comment would add any additional cost to the original proposal. It will, however, prevent mandated PV (if adopted) from being subsidized by weakening the building's energy conservation measures through trade-offs in the ERI and performance simulation paths. Consequently, this PC will tend to decrease cost of building operation and maximize the benefits of PV.

Public Comment# 1766

Public Comment 3:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it has the potential to create substantial problems for jurisdictions that choose to adopt the new Appendix. This proposal, if adopted by a jurisdiction, appears to attempt to establish a mandatory requirement to install a certain amount of solar generation in each building (or acquire an amount of "community solar generation"), regardless of the energy efficiency measures installed or the cost-effectiveness. We agree with the Commercial Committee that this proposal should be disapproved. Even though the IECC-Residential Committee approved Parts 2 and 3, it acknowledged in its reason that "it does need work." The proposal raises a significant number of questions and will lead to confusion. CE263 prioritizes one electric generation technology (Solar PV) over all others, it introduces new concepts that are not adequately defined, and it creates uncertainty in several areas of the code. This proposal would bring about a major change in the scope and operation of the IECC, and as such, it should be more carefully developed and vetted before being added to the IECC.

We fully support on-site renewable generation as an important technology that should be incorporated in buildings, where appropriate. However, we believe that in a building energy conservation code like the IECC, solar and other renewable energy generation technologies should be designed to meet remaining energy requirements, only after installing all reasonable energy efficiency measures. In other words, renewable energy should not replace reasonable energy efficiency measures -- energy efficiency should be optimized first, before turning to renewable electric generation. Utilizing solar energy to offset inefficient building energy use is wasteful and such energy could be better used for other purposes. Moreover, solar is not the only renewable technology in the arsenal. Therefore, it is important to carefully design any renewable requirements in the code. This code proposal does not meet this standard:

- **CE263 fails to improve energy efficiency.** As noted above, CE263 does not seek to improve efficiency at all, but simply requires a certain amount of solar. We think this is effectively "putting the cart before the horse." In our view, an appendix to add a substantial renewable energy requirement to a building energy efficiency program should first optimize and maximize building energy efficiency.

- **RE223 is a far preferable approach to CE263.** A good example of an appendix that first substantially increases building energy efficiency and then adds a complementary renewable energy requirement is RE223, which we support instead of CE263. (RE223 requires additional energy efficiency in the form of an ERI in the 40s, includes a strong envelope backstop, and then adds sufficient renewable generation to approach net zero.)

- **CE263 fails to provide sufficient technical justification to support the amount of solar required.** The proposal does not demonstrate why the minimum amount of solar required under the proposal is reasonable. CE263 Parts 2 and 3 include two methods for determining the size of the PV system required. Under the prescriptive PV sizing method (RB103.2.1), the size is calculated based on the conditioned floor area. Under the performance PV sizing method (RB103.2.2), the system is sized to "meet at least 75 percent of the building's total electrical energy use …" The basis for and feasibility of both of these approaches is unclear. Nor have the two approaches been shown to produce comparable or reasonable results.

- **CE263 prioritizes one technology over all others and fails to provide clarity as to when the requirements do not apply due to "infeasibility."** CE263 sets a clear preference for promoting solar photovoltaics instead of energy efficiency or any other renewable energy. Rather than requiring a more inclusive list of renewable energy resources for new buildings, CE263 requires an "on-site solar photovoltaic system," with three exceptions. One exception is for on- or off-site community solar, and another exception allows the code official to ignore the requirements where "infeasible." The other exception, which would allow the use of "alternative on-site renewable energy systems such as wind energy systems," will only apply if approved by the code official. The preference for one technology over any others in this new section is problematic. To the extent that renewable energy is to be required for all new buildings, all renewable resources should be on a level playing field, to the extent possible. Moreover, the exception for "infeasibility" to be determined by the code official would likely create enforcement nightmares.

- **CE263 treats leased photovoltaic systems in the same manner as systems that are part of the real property.** Section RB104.1 would allow a leased system (or a power purchase agreement) to meet the requirement for on-site power, even though the tenant may move out or the owner may sell the building, taking the lease with them. Leased systems (often treated as personal property) are simply not equivalent to permanent renewable energy systems that are part of the real property and should not be treated as such in the code. This is a potentially huge loophole that could allow builders, owners and lessors to step around this requirement. Moreover, these provisions pose issues for code officials, who will be required to review and interpret these agreements.

- **The provisions in CE263 for community solar are problematic and confusing.** First, the definition of community solar is far too broad. "A facility that generates electrical energy with a solar photovoltaic system, is qualified as a community energy facility, and allocates bill credits to customers under state and local utility statutes and rules." This definition could be read to include utility "green tariff" programs, or renewable systems that may be located across the country. Whether that was the intent of the definition or not should be made clear. Second, section RB103.5 confuses energy savings with energy generation. We note that even though the Committee attempted to fix these problems, the modifications only confuse matters more. The modified RB103.5 requires a community solar facility to "provide energy benefits directly to the building that would otherwise have been required to have an on-site photovoltaic system." The production of renewable energy does not actually save any energy, and it is not clear what "energy benefits" are, since that term is not defined anywhere in the IECC.

  An on-site or community-based photovoltaic system produces energy during daylight hours – some of which will be used to offset electricity purchases from the utility, and some of which will presumably be sold back to the utility. Should electricity sold back to the utility count as "energy benefits," even though the electricity was not being used by the building during these times? We are concerned that treating all energy produced as "energy saved" or "energy benefits" does not accurately portray the true impact of photovoltaic systems. The proposal also does not explain how on-site renewable energy will be valued in comparison with energy use. What method should be used to accurately estimate solar energy production for the specific home? These are all important issues that could have a major impact on builders and homeowners.

- **CE263 creates uncertainty regarding the treatment of renewables in base code compliance paths**. Section R405 (Simulated Performance Alternative) has never allowed on-site generation as a trade-off against energy efficiency, but we are concerned that someone may try to construe the addition of this appendix as allowing such trade-offs. We note that the IECC-Commercial Committee recommended disapproval of CE263 Part 1 for several reasons, including the risk that it "appears to trade off renewables for efficiency in C407 [performance path]". Another concern is how renewable energy under the new appendix will be treated under the ERI. There does not appear to be a provision to prevent double-counting this energy and also using it under the ERI to improve the ERI score.

CE263 would introduce a host of new problems for jurisdictions that adopt the new appendix and should be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1514

Public Comment 4:

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests Disapprove

Commenter's Reason: This should be disapproved for the following reasons:
-It is picking one technology as the primary "winner". There are other renewable energy technologies on the market.

-Exception 3 only allows the use of community solar facilities, and not any other type of community renewable energy production systems.

-It increases the burden on the code official to determine if there are "practical challenges" to install PV, or whether an alternative on-site renewable energy system satisfies the purpose and intent, or to review contracts with community solar facilities. It provides no guidance as to what is meant by "limited rooftop availability" (5%? 90%) or shading (X% of the roof is shaded for X% of daylight hours?).

-Under the prescriptive sizing method, it does not account for the space needed on the roof to meet 1.0 Watts/square foot and to meet the fire code clearance requirements.

-Under the performance sizing method, which is required for larger houses (≥ 4,500 square feet), it encourages the installation of fossil fuel equipment, as the requirement is to size the panel to meet 75% of the building's annual electric usage. The fewer electric end-uses, the smaller the panel has to be.

-It encourages poor design. Under RB 103.3, systems that face due East (90 degrees clockwise from true north) or Northwest (300 degrees from true north) are allowed to comply. As shown in the EIA article from 2014, https://www.eia.gov/todayinenergy/detail.php?id=18871, fixed panels facing due south have the highest annual output, while panels facing east or west have much lower output (at the same tilt angle). In addition, tilt angle also can affect output, as shown at https://www.civicsolar.com/article/solar-array-tilt-angle-and-energy-output. Proper tilt is close to the latitude of the home, but this proposal has no tilt angle requirements, so panels can be at sub-optimal angles and still qualify.

-It requires a 20 year contract with a community solar facility, which may be too long for many home owners, who would be more comfortable with shorter-term commitments.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval will mean that there is no change to the code.

Public Comment# 1355

CE263-19 Part III

IRC: Appendix U (New)

Proposed Change as Submitted

Proponents: Joseph Cain, representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

2018 International Residential Code

Add new text as follows:

Appendix U
SOLAR PHOTOVOLTAIC (PV) SYSTEM REQUIRED

SECTION AU101
SCOPE

AU101.1 General. These provisions shall be applicable for newly constructed *residential buildings* where solar photovoltaic (PV) systems are required.

SECTION AU102
DEFINITIONS

AU102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 for general definitions.

Add new definition as follows:

COMMUNITY SOLAR FACILITY. A facility that generates electrical energy with a solar photovoltaic system, is qualified as a community energy facility, and allocates bill credits to customers, under state and local utility statutes and rules.

STEEP SLOPE. A roof slope greater than two units vertical in 12 units horizontal (17-percent slope).

Add new text as follows:

SECTION AU103
SOLAR PHOTOVOLTAIC SYSTEM

RB103.1 Renewable energy systems. Newly constructed residential buildings shall have an on-site solar photovoltaic (PV) system installed. Photovoltaic systems shall comply with Sections AU103.2 through AU103.6. The code official is authorized to exempt a covered building from the on-site photovoltaic system requirement or allow an alternative means of compliance under any of the following conditions:

Exceptions:

1.Where the code official determines there are practical challenges that cause satisfaction of the requirements to be infeasible. Practical challenges include, but are not limited to, building site location, limited rooftop availability, or shading from nearby structures, topography, or vegetation.
2.Where the code official determines the purpose and intent of this provision is satisfied through the use of alternative on-site renewable energy systems such as wind energy systems.
3.If the code official determines an on-site or off-site community solar facility is dedicated to the building with a legally binding and executed agreement, and is in conformance with Section AU103.5.

AU103.2 Photovoltaic (PV) system sizing requirement. Minimum installed capacity of PV systems shall be determined by using one of the two methods in this section, either prescriptive PV sizing in Section AU103.2.1 or performance PV sizing in Section AU103.2.2. Buildings with *conditioned floor area* of 4,500 square feet or greater shall use the performance PV sizing approach in Section AU103.2.2.

AU103.2.1 Prescriptive PV sizing method. For the prescriptive PV sizing method, the PV system installed nameplate capacity (kW_{DC}) shall be not less than 1.0 times the *conditioned floor area* (1.0 Watts per square foot). The nameplate PV system size shall be calculated as the sum of each PV module's nameplate output (W_{DC}).

AU103.2.2 Performance PV sizing method. For the performance PV sizing method, the PV system shall be sized to meet at least 75 percent of the building's total electrical energy use on an annual basis, including both conditioned and unconditioned space. The minimum PV system size requirement (kW_{DC}) shall be calculated using modeling software or other methods approved by the code official.

AU103.3 Photovoltaic system orientation. Fixed-orientation photovoltaic systems located on *steep sloped* roofs shall be oriented with azimuth of each array between 90 degrees and 300 degrees measured clockwise from true north.

Exception: Photovoltaic systems with one or more arrays oriented outside the prescribed azimuth range when the PV system is modeled using performance PV sizing method in Section AU103.2.2.

AU103.4 Shading. All PV systems shall be designed to meet minimal shading criterion in Section AU103.4.1 or the detailed geometries of PV arrays and obstructions shall be considered in the performance PV sizing method in conformance with Section AU103.4.2.

AU103.4.1 Minimal shading criterion. To comply with minimal shading criterion, a PV array shall be no closer to any shading obstruction than twice the height of the obstruction above the PV array. All obstructions that project above the point on the PV array that is closest to the obstruction shall meet this criterion for the array to be considered minimally shaded.

Exception: Any obstruction located north of all points on the array need not be considered as a shading obstruction..

AU103.4.2 Solar access verification. Where any PV array does not meet the minimal shading criterion of Section AU103.4.1, detailed geometries of the PV array and shading profiles from obstructions shall be considered in the performance PV sizing method. Shading profiles shall be measured with a solar assessment tool or determined from aerial satellite images or other automated resources approved by the code official.

AU103.5 Community solar facility, Where a *community solar facility* is used as an alternative to an on-site photovoltaic system, the *community solar facility* shall provide energy savings benefits directly to the building that would otherwise have been required to have an on-site photovoltaic system. The energy savings benefits shall be allocated from the total resource of the *community solar facility* in a manner demonstrated to be equivalent to the reductions in energy consumption that would have resulted from the on-site photovoltaic system that is otherwise required. The *community solar facility* shall provide the required energy savings benefits to the dedicated *building* for a period not less than twenty years. The energy savings benefits shall not be attributed to other purposes and shall not be transferred to other buildings or property.

SECTION AU104
LEASES AND PURCHASE AGREEMENTS

AU104.1 Leases and power purchase agreements. On-site photovoltaic systems that are leased by the end-use customer (tenant or owner) or that supply electricity to the end-use customer through a power purchase agreement (PPA) shall be permitted to satisfy the requirement provided the system meets all other requirement criteria.

CE263-19 Part III

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
RB103.5 Community solar facility. Where a *community solar facility* is used as an alternative to an on-site photovoltaic system, the *community solar facility* shall provide energy ~~savings~~ benefits directly to the building that would otherwise have been required to have an on-site photovoltaic system. The energy ~~savings~~ benefits shall be allocated from the total resource of the *community solar facility* in a manner demonstrated to be equivalent to the ~~reductions in energy consumption~~ generation of energy that would have resulted from the on-site photovoltaic system that is otherwise required. The *community solar facility* shall provide the required energy ~~savings~~ benefits to the dedicated *building* for a period not less than twenty years. The energy ~~savings~~ benefits shall not be attributed to other purposes and shall not be transferred to other buildings or property.

Committee Reason: The proposal is needed, it the future, it does need work and "future proofing". The modification offers a clarification and there is consensus it was needed (Vote: 7-4).

Assembly Action: **None**

CE263-19 Part III

Individual Consideration Agenda

Public Comment 1:

IRC®: AU103.2 (New)

Proponents:
Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests As Modified by Public Comment

Further modify as follows:

2018 International Residential Code

AU103.2 Photovoltaic (PV) system sizing requirement. Minimum installed capacity of PV systems shall be determined by using one of the two methods in this section, either prescriptive PV sizing in Section AU103.2.1 or performance PV sizing in Section AU103.2.2. Buildings with *conditioned floor area* of 4,500 square feet or greater shall use the performance PV sizing approach in Section AU103.2.2. <u>Where the simulated performance alternative of Section N1105 is used for compliance, the PV system capacity provided in accordance with this section shall not be included in the analysis or shall be the same in the *standard reference design* and the *proposed design*. Where the energy rating index of Section N1106 is used for compliance, the PV system capacity provided in accordance with this section shall not be used to show compliance with the maximum energy rating index of Section N1106.4 but shall be permitted to be included in an energy rating index for other purposes.</u>

Commenter's Reason: This public comment is provided in the event that CE263-19-Part 3 is not disapproved at the public hearing. There is at least one significant concern that is addressed by this public comment. It is related to clarifying that mandated PV capacity should not be used as a basis for making trade-offs that decrease the building performance and thus negate the benefits of adding the mandated PV to a building (the same should also apply to voluntary use of renewable energy generation for the same reason). Renewable energy is not free and is not an unlimited resource. The ability to use it to minimize non-renewable energy use requires that energy conservation not be sacrificed. This public comment is aimed specifically at that concern. At a minimum, CE263-19-Part 3 should be modified to address this concern or be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
It is not clear that the public comment would add any additional cost to the original proposal's cost inrease. It will, however, prevent mandated PV (if adopted) from being subsidized by weakening the building's energy conservation measures through trade-offs in the ERI and performance simulation paths. Consequently, this PC will tend to decrease cost of building operation and maximize the benefits of PV.

Public Comment# 1768

Public Comment 2:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it has the potential to create substantial problems for jurisdictions that choose to adopt the new Appendix. This proposal, if adopted by a jurisdiction, appears to attempt to establish a mandatory requirement to install a certain amount of solar generation in each building (or acquire an amount of “community solar generation”), regardless of the energy efficiency measures installed or the cost-effectiveness. We agree with the Commercial Committee that this proposal should be disapproved. Even though the IECC-Residential Committee approved Parts 2 and 3, it acknowledged in its reason that “it does need work.” The proposal raises a significant number of questions and will lead to confusion. CE263 prioritizes one electric generation technology (Solar PV) over all others, it introduces new concepts that are not adequately defined, and it creates uncertainty in several areas of the code. This proposal would bring about a major change in the scope and operation of the IECC, and as such, it should be more carefully developed and vetted before being added to the IECC.

We fully support on-site renewable generation as an important technology that should be incorporated in buildings, where appropriate. However, we believe that in a building energy conservation code like the IECC, solar and other renewable energy generation technologies should be designed to meet remaining energy requirements, only after installing all reasonable energy efficiency measures. In other words, renewable energy should not replace reasonable energy efficiency measures -- energy efficiency should be optimized first, before turning to renewable electric generation. Utilizing solar energy to offset inefficient building energy use is wasteful and such energy could be better used for other purposes. Moreover, solar is not the only renewable technology in the arsenal. Therefore, it is important to carefully design any renewable requirements in the code. This code proposal does not meet this standard:

- **CE263 fails to improve energy efficiency.** As noted above, CE263 does not seek to improve efficiency at all, but simply requires a certain amount of solar. We think this is effectively “putting the cart before the horse.” In our view, an appendix to add a substantial renewable energy requirement to a building energy efficiency program should first optimize and maximize building energy efficiency.

- **RE223 is a far preferable approach to CE263.** A good example of an appendix that first substantially increases building energy efficiency and then adds a substantial complementary renewable energy requirement is RE223, which we support instead of CE263. (RE223 requires substantial additional energy efficiency in the form of an ERI in the 40s, includes a strong envelope backstop, and then adds sufficient renewable generation to approach net zero.)

- **CE263 fails to provide sufficient technical justification to support the amount of solar required.** The proposal does not demonstrate why the minimum amount of solar required under the proposal is reasonable. CE263 Parts 2 and 3 include two methods for determining the size of the PV system required. Under the prescriptive PV sizing method (RB103.2.1), the size is calculated based on the conditioned floor area. Under the performance PV sizing method (RB103.2.2), the system is sized to "meet at least 75 percent of the building's total electrical energy use …" The basis for and feasibility of both of these approaches is unclear. Nor have the two approaches been shown to produce comparable or reasonable results.

- **CE263 prioritizes one technology over all others and fails to provide clarity as to when the requirements do not apply due to "infeasibility."** CE263 sets a clear preference for promoting solar photovoltaics instead of energy efficiency or any other renewable energy. Rather than requiring a more inclusive list of renewable energy resources for new buildings, CE263 requires an "on-site solar photovoltaic system," with three exceptions. One exception is for on- or off-site community solar, and another exception allows the code official to ignore the requirements where "infeasible." The other exception, which would allow the use of "alternative on-site renewable energy systems such as wind energy systems," will only apply if approved by the code official. The preference for one technology over any others in this new section is problematic. To the extent that renewable energy is to be required for all new buildings, all renewable resources should be on a level playing field, to the extent possible. Moreover, the exception for "infeasibility" to be determined by the code official would likely create enforcement nightmares.

- **CE263 treats leased photovoltaic systems in the same manner as systems that are part of the real property.** Section RB104.1 would allow a leased system (or a power purchase agreement) to meet the requirement for on-site power, even though the tenant may move out or the owner may sell the building, taking the lease with them. Leased systems (often treated as personal property) are simply not equivalent to permanent renewable energy systems that are part of the real property and should not be treated as such in the code. This is a potentially huge loophole that could allow builders, owners and lessors to step around this requirement. Moreover, these provisions pose issues for code officials, who will be required to review and interpret these agreements.

- **The provisions in CE263 for community solar are problematic and confusing.** First, the definition of community solar is far too broad. "A facility that generates electrical energy with a solar photovoltaic system, is qualified as a community energy facility, and allocates bill credits to customers under state and local utility statutes and rules." This definition could be read to include utility "green tariff" programs, or renewable systems that may be located across the country. Whether that was the intent of the definition or not should be made clear. Second, section RB103.5 confuses energy savings with energy generation. We note that even though the Committee attempted to fix these problems, the modifications only confuse matters more. The modified RB103.5 requires a community solar facility to "provide energy benefits directly to the building that would otherwise have been required to have an on-site photovoltaic system." The production of renewable energy does not actually save any energy, and it is not clear what "energy benefits" are, since that term is not defined anywhere in the IECC.

  An on-site or community-based photovoltaic system produces energy during daylight hours – some of which will be used to offset electricity purchases from the utility, and some of which will presumably be sold back to the utility. Should electricity sold back to the utility count as "energy benefits," even though the electricity was not being used by the building during these times? We are concerned that treating all energy produced as "energy saved" or "energy benefits" does not accurately portray the true impact of photovoltaic systems. The proposal also does not explain how on-site renewable energy will be valued in comparison with energy use. What method should be used to accurately estimate solar energy production for the specific home? These are all important issues that could have a major impact on builders and homeowners.

- **CE263 creates uncertainty regarding the treatment of renewables in base code compliance paths**. Section R405 (Simulated Performance Alternative) has never allowed on-site generation as a trade-off against energy efficiency, but we are concerned that someone may try to construe the addition of this appendix as allowing such trade-offs. We note that the IECC-Commercial Committee recommended disapproval of CE263 Part 1 for several reasons, including the risk that it "appears to trade off renewables for efficiency in C407 [performance path]". Another concern is how renewable energy under the new appendix will be treated under the ERI. There does not appear to be a provision to prevent double-counting this energy and also using it under the ERI to improve the ERI score.

CE263 would introduce a host of new problems for jurisdictions that adopt the new appendix and should be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1516

Public Comment 3:

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests Disapprove

Commenter's Reason: This should be disapproved for the following reasons:

-It is picking one technology as the primary "winner". There are other renewable energy technologies on the market.

-Exception 3 only allows the use of community solar facilities, and not any other type of community renewable energy production systems.

-It increases the burden on the code official to determine if there are "practical challenges" to install PV, or whether an alternative on-site renewable energy system satisfies the purpose and intent, or to review contracts with community solar facilities. It provides no guidance as to what is meant by "limited rooftop availability" (5%? 90%) or shading (X% of the roof is shaded for X% of daylight hours?).

-Under the prescriptive sizing method, it does not account for the space needed on the roof to meet 1.0 Watts/square foot and to meet the fire code clearance requirements.

-Under the performance sizing method, which is required for larger houses ($\geq$ 4,500 square feet), it encourages the installation of fossil fuel equipment, as the requirement is to size the panel to meet 75% of the building's annual electric usage. The fewer electric end-uses, the smaller the panel has to be.

-It encourages poor design. Under RB 103.3, systems that face due East (90 degrees clockwise from true north) or Northwest (300 degrees from true north) are allowed to comply. As shown in the EIA article from 2014, https://www.eia.gov/todayinenergy/detail.php?id=18871, fixed panels facing due south have the highest annual output, while panels facing east or west have much lower output (at the same tilt angle). In addition, tilt angle also can affect output, as shown at https://www.civicsolar.com/article/solar-array-tilt-angle-and-energy-output. Proper tilt is close to the latitude of the home, but this proposal has no tilt angle requirements, so panels can be at sub-optimal angles and still qualify.

-It requires a 20 year contract with a community solar facility, which may be too long for many home owners, who would be more comfortable with shorter-term commitments.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproved will mean that there is no change to the code.

Public Comment# 1356

CE264-19

IECC®: AX 100 (New), AX101 (New), AX102 (New), AX103 (New), AX104 (New), TABLE AX104.1 (New), AX104.1 (New), AX104.2 (New), AX104.2.1 (New), AX104.2.2 (New), AX104.2.3 (New), TABLE AX104.2 (New)

Proposed Change as Submitted

Proponents: David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

2018 International Energy Conservation Code

Add new text as follows:

AX 100
ZERO CODE RENEWABLE ENERGY STANDARD

AX101 **PURPOSE** The purpose of the Zero Code Renewable Energy Appendix is to supplement the International Energy Conservation Code and require renewable energy systems of adequate capacity to achieve zero-net-carbon.

AX102 **SCOPE** This appendix applies to new buildings that are addressed by the International Energy Conservation Code.

Exceptions:

1.Single-family houses, multifamily structures of three stories or fewer above grade in height, manufactured homes (mobile homes), and manufactured houses (modular).
2.Buildings that use neither electricity nor fossil fuel.

Add new definition as follows:

AX103 **Definitions** The following definitions supplement or modify the definitions in the International Energy Conservation Code.

ADJUSTED OFF-SITE RENEWABLE ENERGY. The amount of energy production from off-site renewable energy systems that may be used to offset building energy.

BUILDING ENERGY. All energy consumed at the building site as measured at the site boundary. Contributions from on-site or off-site renewable energy systems shall not be considered when determining the building energy.

ENERGY UTILIZATION INTENSITY(EUI). The site energy for either the baseline building or the proposed building divided by the gross conditioned floor area plus any semi-heated floor area of the building. For the baseline building, the EUI can be divided between regulated energy use and unregulated energy use.

OFF-SITE RENEWABLE ENERGY SYSTEM. Renewable energy system not located on the building project.

ON-SITE RENEWABLE ENERGY SYSTEM. Renewable energy systems on the building project.

RENEWABLE ENERGY SYSTEM. Photovoltaic, solar thermal, geothermal energy, and wind systems used to generate energy.

ZERO ENERGY PERFORMANCE INDEX($zEPI_{PB,EE}$). The ratio of the proposed building EUI without renewables to the baseline building EUI, expressed as a percentage.

SEMI-HEATED SPACE. An enclosed space within a building that is heated by a heating system whose output capacity is greater than or equal to 3.4 Btu/h*ft^2 of floor area but is not a conditioned space.

Add new text as follows:

AX104 **Minimum renewable energy** On-site renewable energy systems shall be installed or off-site renewable energy shall be procured to offset the building energy.

$RE_{onsite}+RE_{offsite}\geq E_{building}$

where

RE_{onsite} = annual site energy production from on-site renewable energy systems (see Section AX104.2)

$RE_{offsite}$ = adjusted annual site energy production from off-site renewable energy systems that may be credited against building energy use (see Section AX104.3)

$E_{building}$ = building energy use without consideration of renewable energy systems.

When Section C401.2 (2) is used for compliance with the International Energy Conservation Code, building energy shall be determined by multiplying the gross conditioned floor area plus the gross semi-heated floor area of the proposed building by an EUI selected from Table AX104.1. Use a weighted average for mixed-use buildings.

When Section C401.2 (1) or C401.2 (3) is used for compliance with the International Energy Conservation Code, building energy shall be determined from energy simulations.

TABLE AX104.1 ENERGY UTILIZATION INTENSITY FOR BUILDING TYPES AND CLIMATES (kBtu/ftÂ²-Y)

	Climate Zone																
Building Area Type	0A/ 1A	0B/ 1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
kBtu/ftÂ²-y																	
Multifamily (R-2)	43	45	41	41	43	42	36	45	43	41	47	46	41	53	48	53	59
Healthcare/hospital (I-2)	119	120	119	113	116	109	106	116	109	106	118	110	105	126	116	131	142
Hotel/motel (R-1)	73	76	73	68	70	67	65	69	66	65	71	68	65	77	72	81	89
Office (B)	31	32	30	29	29	28	25	28	27	25	29	28	25	33	30	32	36
Restaurant (A-2)	389	426	411	408	444	420	395	483	437	457	531	484	484	589	538	644	750
Retail (M)	46	50	45	46	44	44	37	48	44	44	52	50	46	60	52	64	77
School (E)	42	46	42	40	40	39	36	39	40	40	39	43	37	44	40	45	54
Warehouse (S)	9	12	9	11	12	11	10	17	13	14	23	17	15	32	23	32	32
All others	55	58	54	53	53	51	48	54	52	51	57	54	50	63	57	65	73

AX104.1 Calculation of On-Site Renewable Energy The annual energy production from on-site renewable energy systems shall be determined using the PVWatts software or other software approved by the code official.

AX104.2 Off-Site Renewable Energy Off-site energy shall comply with Sections AX104.2.1 and AX104.2.2

AX104.2.1 Qualifying off-site procurement methods. The following are considered qualifying off-site renewable energy procurement methods:

1. Community Renewables: an offsite renewable energy system for which the owner has purchased or leased renewable energy capacity along with other subscribers.
2. Renewable Energy Investment Fund: an entity that installs renewable energy capacity on behalf of the owner.
3. Virtual Power Purchase Agreement: a power purchase agreement for off-site renewable energy where the owner agrees to purchase renewable energy output at a fixed price schedule.
4. Direct Ownership: an offsite renewable energy system owned by the building project owner.
5. Direct Access to Wholesale Market: an agreement between the owner and a renewable energy developer to purchase renewable energy.
6. Green Retail Tariffs: a program by the retail electricity provider to provide 100 percent renewable energy to the owner.
7. Unbundled Renewable Energy Certificates (RECs): certificates purchased by the owner representing the environmental benefits of renewable energy generation that are sold separately from the electric power.

AX104.2.2 Requirements for all procurement methods. The following requirements shall apply to all *off-site renewable energy* procurement methods.

1. The building owner shall sign a legally binding contract to procure qualifying *off-site renewable energy*.
2. The procurement contract shall have duration of not less than 15 years and shall be structured to survive a partial or full transfer of ownership of the property.
3. RECs and other environmental attributes associated with the procured *off-site renewable energy* shall be assigned to the building project for the duration of the contract.
4. The *renewable energy* generating source shall be photovoltaic systems, solar thermal power plants, geothermal power plants, and/or wind turbines.
5. The generation source shall be located where the energy can be delivered to the building site by the same utility or distribution entity; the same ISO or RTO; or within integrated ISOâ€™s (electric coordination council).
6. The *off-site renewable* energy producer shall maintain transparent accounting that clearly assigns production to the building. Records on power sent to or purchased by the building shall be retained by the building owner and made available for inspection by the code official upon request.

AX104.2.3 Adjusted Off-Site Renewable Energy. The process for calculating the adjusted *off-site renewable energy* is shown in the following equation:

$$RE_{offsite} = \sum_{i=1}^{n} PF_i \cdot RE_i = PF_1 \cdot RE_1 + PF_2 \cdot RE_2 + \cdots + PF_n \cdot RE_n$$

where

$RE_{offsite}$ = Adjusted off-site renewable energy

PF_i = Procurement factor for the i^{th} renewable energy procurement method or class taken from Table AX104.2.

RE_i = Annual energy production for the i^{th} renewable energy procurement method or class

n = The number of renewable energy procurement options or classes considered

TABLE AX104.2 Default Off-Site Renewable Energy Procurement Methods, Classes, and Coefficients

Class	*Procurement Factor (PF)*	*Procurement Options*	*Additional Requirements (see also XXX4.2.2)*
1	0.75	Community Solar	
		REIFs	Entity must be managed to prevent fraud or misuse of funds.
		Virtual PPA	
		Self-Owned Off-Site	Provisions shall prevent the generation from being sold separately from the building.
2	0.55	Green Retail Tariffs	The offering shall not include the purchase of unbundled RECs.
		Direct Access	The offering shall not include the purchase of unbundled RECs.
3	0.20	Unbundled RECs	The vintage of the RECs shall align with building energy use.

Reason: The new appendix deals with renewable energy and creates a path to a Zero energy design approach, similar to the zEPI that is already found in the 2015 IgCC. It is designed to build on top of the IECC which already sets the minimum energy efficiency requirement. By putting this information in an appendix, jurisdictions will have the option of adoption of these provisions in order to establish Zero as the energy target they wish to achieve.

Cost Impact: The code change proposal will decrease the cost of construction
The overall cost of construction and operation of buildings constructed using the Zero Annex will be lower than other comparable buildings.

CE264-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Submitted**

Committee Reason: A lot of jurisdictions need a tool, and without something like this in the code they do not have it. Provides a really important framework, simple calculation methodology. When you have it available in the IECC it has broad availability for adoption. (Vote: 9-6).

Assembly Action: **None**

CE264-19

Individual Consideration Agenda

Public Comment 1:

IECC®: AX104.1 (New)

Proponents:
Jonathan Humble, FAIA, NCARB, LEED BD+C, representing Himself (jhumble@steel.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

AX104.1 Calculation of On-Site Renewable Energy The annual energy production from on-site renewable energy systems shall be determined using ~~the PVWatts software or other~~ software approved by the code official.

Commenter's Reason: This public comment proposes to delete language for the following reasons:
Codes establish a mechanism for effective regulation of building construction. When codes are adopted by units of government they provide the legal framework for the regulation of public health, safety and welfare in construction. However, when national model codes cite proprietary resources this represents a closed code document. This is not acceptable in the ICC family of codes.

The specific reference to “PVWatts software” [1] fails to mention the source and edition of the software. This is an important observation, as without a date specific edition the user and enforcer of the code are without guidance as to which edition to use in the context of the regulation. In addition, this also sets up a conflict where multiple parties, such as the code official and the design professional, may argue who has authority over that choice of edition. Either way, placing any second tier proprietary document into the code does not serve the code users and enforcers well.

But this software was developed by an arm of the U.S. Government and it is free to download and use, therefore it is critical we have something, right? This is often referred to as “open source software” however, it: 1) is developed by a single source entity, 2) has no edition date, 3) is not consensus developed, and 4) can be modified at any time by the government agency who oversees and maintains this software as shown on the US-DOE/NREL web page and the associated PVWatts technical report [4]. All of these subjects place this specific software in the category as proprietary. Similar programs that have been proposed for consideration by ICC, but were disapproved because they were proprietary, include: RESCheck [2] and COMCheck[3]. As a result, there is precedence in removing the specific reference to “PVWatts software”.

For the benefit of code officials, there are other software simulation products [4] available that perform either the same or similar functions. Additional software sources, beyond the list below, are also shown in the paper identified in bibliography item #4.

1) Hybrid Optimization Model for Electric Renewables (HOMER), by the National Renewable Energy Laboratory, Lakewood, CO

See: https://www.osti.gov/biblio/269387-homer-hybrid-optimization-model-electric-renewable

2) PVsyst photovoltaic software, Route du Bois-de-Bay, 107, 1242 Stigny, Swizerland

See: https://www.pvsyst.com/

3) System Advisor Model (SAM), by the National Renewable Energy Laboratory, Lakewood, CO

See: https://sam.nrel.gov

Bibliography:
[1] Dobos, Aron P., “PVWatts Version 5 Manual”, US Department of Energy, National Renewable Energy Laboratory, September 4, 2014, Technical Report NREL/TP-6A20-62641, Contract DE-AC36-08GO28308.

https://www.nrel.gov/docs/fy14osti/62641.pdf

[2] US-DOE, “RESCheck Building Energy Code Compliance Software”, US Department of Energy, Building Energy Code Program, Washington, DC (Various editions).

https://www.energycodes.gov/rescheck

[3] US-DOE, “COMCheck Building Energy Code Compliance Software”, US Department of Energy, Building Energy Code Program, Washington, DC (Various editions).

https://www.energycodes.gov/comcheck

[4] Umar, N., Bora, B. Banerjee, C., Panwar, B.S., “Comparison of different PV power simulation softwares: case study on performance analysis of 1MW gtrid-connected PV solar power plant”, International Journal of engineering Science Invention (IJESI), ISSN(Online): 2319-6734, ISSN (Pring): 2319-6726, Volume 7, Issue 7, Ver II, July 2018, Pages 11-24.
https://www.researchgate.net/publication/326919529_Comparison_of_different_PV_power_simulation_softwares_case_study_on_performance_analysis_of_1_MW_grid-connected_PV_solar_power_plant

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction

The public comment does not modify the technical content therefore there is no change to the cost of construction.

Staff Analysis: Section A104.1 of the original proposal contains a reference to a software tool; PVWatts software. Although this software tool is not a conventional referenced standard, since it can be used to determine code compliance, it should have been subject to the requirements for a referenced standard in Council Policy 28.. This software tool was not submitted for staff review prior to the CAH. A staff analysis was not available for PVWatts software at the CAH.

Public Comment# 1711

Public Comment 2:

Proponents:
David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

requests As Submitted

Commenter's Reason: Public Comment in support of AS for CE264-19 (Zero Code Renewable Energy Appendix) to the IECC.
As stated in the Purpose section of the Appendix it is a voluntary supplement to the IECC. It allows an adopting jurisdiction to require renewable the energy needed to achieve a zero-net-carbon design for new construction. The renewable energy would be above and beyond all the elements required within the IECC, because it replaces none of them and changes none of them.

The Appendix will offer communities an above code standard for design that will significantly impact the use of carbon-emitting power demands by new buildings within its scope. (Single-family, multi-family three stories or less, manufactured homes and houses and buildings that use neither electricity nor fossil fuels are exempt from compliance to the Appendix.)

The Appendix depends on the IECC to determine the path of compliance that an owner and its design team may choose: performance or prescriptive. It adds to those options multiple methods for satisfying the renewable energy requirement: on-site renewable energy and off-site renewable energy. When using off-site renewable energy the building owner can either procure the renewable energy from a system they own or purchase the renewable energy and its' associated renewable energy credits (RECs), from a variety of sources.

There were three items in the Appendix that were discussed during the hearings:

- IgCC Discussion about the inclusion of a similar proposal within the IgCC which is based on ASHRAE 189.1. Any such adoption by ASHRAE 189.1 into the IgCC would not become part of the ICC codes until 2024 at the earliest and would delay the use of Zero Code Renewable Energy Appendix approach by the ICC. Also, the 189.1 proposal is not as stringent as what is being proposed for the Appendix. The current 189.1 proposal requires about half as much renewable energy. Furthermore, not all the off-site procurement options in the Appendix are recognized by the current 189.1 proposal. The 189.1 proposal only recognizes community solar, vPPAs and self-owned.

- EUI As demonstrated in the following review of the use and application of the Appendix (see section: How to Enforce and Comply with the ZCREA), the EUI values in Table AX104.1 of the Appendix are used *solely* to establish the renewable energy requirement when the prescriptive path is used to comply with the IECC, based on type and climate zone. The performance of the design is based strictly on the energy efficiency requirements of the IECC. The Appendix encourages more efficient design and on-site renewable energy.

- Cost of Construction Today the cost of designing a building and its systems for heightened service and performance to an owner are often "value engineered" out of the design. Adoption of this Appendix will require renewable energy sources and will encourage additional energy efficiency so the renewable energy requirement can be smaller. Measuring the absolute cost of construction and the operation of a building are integral to good design decisions. The Appendix will supports good design decisions.

Attached is a document that clearly explains the paths of enforcement and compliance available, as well as the methods used in the Appendix to determine the renewable energy requirement.

We urge the membership to support the code change CE264-19 As Submitted (AS).

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
The overall cost of construction and operation of buildings constructed using the Zero Annex will be lower than other comparable buildings.

Staff Analysis: Section A104.1 of the original proposal contains a reference to a software tool; PVWatts software. Although this software tool is not a conventional referenced standard, since it can be used to determine code compliance, it should have been subject to the requirements for a referenced standard in Council Policy 28.. This software tool was not submitted for staff review prior to the CAH. A staff analysis was not available for PVWatts software at the CAH.

Public Comment# 1502

Public Comment 3:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: We support renewable generation as an important technology that should be incorporated into buildings. We also support establishing a net zero appendix in the energy code that would include renewable generation for jurisdictions to consider. As a result, we would like to support this proposal but have reluctantly concluded that it needs more work before it can reasonably be implemented and therefore should be disapproved and/or significantly modified. Our biggest concern is that the proposal fails to include any energy efficiency improvement in what purports to be a “net zero” compliance path.

In our view, in a building energy conservation code, energy efficiency should be optimized first, before turning to renewable electric generation. Utilizing renewable energy to offset inefficient building energy use is wasteful, and with a more efficient building the same energy could be better used for other purposes. Renewable energy generation technologies should not replace energy efficiency that can be reasonably achieved. Instead, renewable energy should meet remaining building energy needs to achieve net zero, only after installing all cost-effective energy efficiency measures.

This proposal also faces other challenges – it needs more technical support/justification, it requires building code officials to exercise authority or judgment in areas that are typically outside the scope or training of these officials, and it includes a laundry list of complicated renewable compliance options that will likely be difficult to review and enforce. Although this proposal attempts to cover many of the issues that are raised when a jurisdiction requires renewable energy for new buildings, it unfortunately raises additional issues that necessitate further consideration. If this proposal were adopted, we think that additional improvements would be necessary in future code cycles to address these issues and to make the proposal more useable.

To elaborate further on some of our concerns regarding the provisions of CE264:

- **CE264 fails to improve energy efficiency first.** As we understand the proponent’s reason, CE264 does not seek to improve energy efficiency, but instead takes the amount of efficiency already required by the code as a given and then requires sufficient solar or other renewable energy to get to a “zero-net-carbon” building. In our view, a net zero energy code appendix should first optimize and maximize building energy efficiency. Simply papering over a less efficient building with excess renewable generation is a big missed opportunity.

  Optimizing energy efficiency first is particularly important when the appendix is entitled “Zero Code Renewable Energy Standard” and the purpose is to achieve “zero-net-carbon.” If the new appendix is going to call the building “net zero,” then the appendix should require considerably more efficiency than the base code. Moreover, we are concerned that interested parties may incorrectly interpret this appendix as setting an optimal amount of energy efficiency, and possibly locking in place the current commercial efficiency requirements.

- **CE264 lacks sufficient supporting technical analysis for such a far-reaching proposal.** It is important to keep in mind that if Appendix AX is adopted by a jurisdiction, it becomes part of the mandatory commercial energy code. It is thus important that the requirements in the new appendix be vetted to at least the same level as any other code change proposal. Unfortunately, no analysis is provided in the proposal that shows that the EUIs in Table AX104.1 are set at appropriate levels for each occupancy type. Nor is there any justification for how the default off-site renewable energy procurement factors in Table AX104.2 were determined. Without sufficient supporting analysis, it will be difficult for jurisdictions to adopt this appendix.

- **CE264 requires code officials to make legal and accounting determinations.** While the IECC has historically dealt primarily with the use and conservation of energy at the building site, CE264 would require verification of several issues beyond the building site. For example, Section AX104.2.2 requires a building owner to “sign a legally binding contract,” for qualifying off-site renewable energy, and that contract “shall have duration of not less than 15 years and shall be structured to survive a partial or full transfer of ownership of the property.” Similarly, Section AX104.2.2(6) requires off-site renewable energy producers to maintain “transparent accounting that clearly assigns production to the building,” and must make records available to the building code official upon request. Leaving aside the issue of code officials also being proficient in accounting, this language appears to establish ongoing review and enforcement authority, well beyond the issuance of a certificate of occupancy. It is not clear how this requirement could be enforced once a building is occupied.

- **CE264 is unclear about whether and how performance path compliance in the base code would be affected.** Section AX104 requires renewable energy systems to “offset the building energy.” And where the performance path is selected, “building energy shall be determined from energy simulations.” The commercial performance path in Section C407 currently allows on-site renewable energy to be counted as a reduction in energy cost (limited to 5% of the total energy cost) for code compliance purposes. If new Appendix AX is adopted by a jurisdiction, would code users claim that some or all of the on-site renewable energy could also be used to offset energy-saving features under the simulated performance path or would a building need to demonstrate compliance with both Section C407 and Appendix AX, independently of each other?

While we are very sympathetic to the goals of the proposal, we think it is important to get this issue right. These types of issues in the proposal, if not corrected, may make the proposed appendix very difficult for interested jurisdictions to adopt and enforce and could impede future efforts to promote net zero buildings that incorporate renewable energy.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Staff Analysis: Section A104.1 of the original proposal contains a reference to a software tool; PVWatts software. Although this software tool is not a conventional referenced standard, since it can be used to determine code compliance, it should have been subject to the requirements for a referenced standard in Council Policy 28.. This software tool was not submitted for staff review prior to the CAH. A staff analysis was not available for PVWatts software at the CAH.

Public Comment# 1758

Public Comment 4:

Proponents:

Duane Jonlin, Seattle Department of Construction and Inspections, representing Seattle Department of Construction and Inspections (duane.jonlin@seattle.gov)

requests Disapprove

Commenter's Reason: Please disapprove the “Zero Code” appendix.
This proposal’s most serious flaw is that, if the appendix were actually to be adopted by some jurisdiction, buildings in that jurisdiction would be required to implement the *least* cost-effective means of reducing the energy use and carbon footprint of buildings. In virtually every case, improved efficiency provides a far greater return on investment than renewable energy.

Many aspects of building energy efficiency, particularly the building envelope, will remain unchanged for generations to come, whereas rooftop solar can be easily added in the future, and off-site renewables can be purchased at any time. If we’re going to incorporate a very high-performance pathway in the IECC, let’s ensure that it provides the biggest bang for the buck possible. As one potential path, the 2030 Challenge target for the years 2020 – 2025, to which hundreds of architectural firms have already committed, is an 80% reduction below the existing average. This approach is outlined in the Architecture 2030 website as follows, noting that adding renewables is the *last* step:

1. Establish an EUI baseline and target using the Zero Tool

2. Apply low/no cost passive design strategies to achieve maximum energy efficiency.

3. Integrate energy efficient technology and systems.

4. Incorporate on-site and/or off-site renewable energy to meet the remaining energy demands.

A further concern is that the proposal contains technical flaws:

- The table EUIs are extremely low for some building types (hospital, office) and extremely high for others (restaurant), leading me to believe that any such proposal needs more careful vetting before actually entering the IECC.
- There is inconsistent code language used in scoping and definitions.
- Code officials are required to track and verify purchasing of off-site renewables, something few building departments are equipped to do

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Staff Analysis: Section A104.1 of the original proposal contains a reference to a software tool; PVWatts software. Although this software tool is not a conventional referenced standard, since it can be used to determine code compliance, it should have been subject to the requirements for a referenced standard in Council Policy 28.. This software tool was not submitted for staff review prior to the CAH. A staff analysis was not available for PVWatts software at the CAH.

Public Comment# 1987

Public Comment 5:

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests Disapprove

Commenter's Reason: I understand there is a need for some guidance for jurisdictions who want to get to zero, but there are some technical issues that this proposal contains.
This proposal contains requirements for semi-heated spaces. which does not currently reside in the IECC.

It contains utilizing RECs, which may be difficult to find enough green RECs for this to work.

The values that were used for Table AX104.1 were not explained as to where they came from.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Staff Analysis: Section A104.1 of the original proposal contains a reference to a software tool; PVWatts software. Although this software tool is not a conventional referenced standard, since it can be used to determine code compliance, it should have been subject to the requirements for a referenced standard in Council Policy 28.. This software tool was not submitted for staff review prior to the CAH. A staff analysis was not available for PVWatts software at the CAH.

Public Comment# 2082

Public Comment 6:

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests Disapprove

Commenter's Reason: There are many problems with this proposal as submitted and it should be disapproved for the following reasons:
-It contains the terms "zero energy" and "zero code". The term "zero energy" is more suited for a misleading marketing brochure, rather than an IECC Appendix or an ICC code. All buildings use energy, and the use of a term like "zero energy", while appealing, is not accurate and can mislead consumers and businesses.

-It does not define the term "zero net carbon", which is in the purpose section.

-The proposed definition for "renewable energy system" conflicts with the current definition of renewable energy sources found in "on-site renewable energy" as well as the approved definition for "renewable energy resources" shown in CE-31.

-In Table AX104.1, the values for "All others" building area types would include energy-intensive facilities such as data centers, full service grocery stores, laundromats, etc. These values are likely to be far too low for energy-intensive facilities.

-Section AX104.2.1 contains vague and incorrect terms that will lead to enforcement issues. For example, it says "Renewable Energy Investment Fund: an entity that installs renewable energy capacity on behalf of the owner". Does that mean that a private company like Solar City or Sun Run is a "renewable energy investment fund"? What if the system is installed by a government agency on behalf of the building? Or installed by a local utility?

If a building has "direct access to wholesale market", they sign a contract with an Electric Wholesale Generator or Independent Power Producer that sell into the market. They do not sign a contract with a "renewable energy generator".

-Section AX104.2.2 has language that is vague and not enforceable. For example, in Line 2, how is a code official supposed to determine whether a procurement contract is "structured to survive a partial or full transfer of ownership of the property"? Line 4 with the proposed definitions of renewable energy will conflict with state laws. In Line 6, it says that the off-site renewable energy producer "shall maintain transparent accounting that clearly assigns production to the building". How is a code official supposed to determine if they have "transparent accounting"? Also, what if the off-site producer is located in a different jurisdiction from the building?

-Table AX104.2 also has vague and unenforceable language. For REIFs, the table says "Entity must be managed to prevent fraud or misuse of funds". How is a code official supposed to enforce that, especially if the REIF is a national or global entity? It also says for a self-owned off-site system, "Provisions shall prevent the generation form being sold separately from the building". There are times when the system is producing maximum energy and the building is using a minimal amount (e.g., sunny mild weekend day). Why shouldn't the system be allowed to sell the excess power to the grid, or to another end-user?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval will mean that there is no change to the code.

Staff Analysis: Section A104.1 of the original proposal contains a reference to a software tool; PVWatts software. Although this software tool is not a conventional referenced standard, since it can be used to determine code compliance, it should have been subject to the requirements for a referenced standard in Council Policy 28.. This software tool was not submitted for staff review prior to the CAH. A staff analysis was not available for PVWatts software at the CAH.

Public Comment# 1364

CE265-19

IECC®: (New), C406.1, C406.10 (New)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Add new definition as follows:

ENERGY STORAGE SYSTEM (ESS). One or more devices, assembled together, capable of storing electrical, thermal, or mechanical energy in order to supply electrical energy at a future time.

Revise as follows:

C406.1 Requirements. Buildings shall comply with one or more of the following:

1. More efficient HVAC performance in accordance with Section C406.2.
2. Reduced lighting power in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4.
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High-efficiency service water heating in accordance with Section C406.7.
7. Enhanced envelope performance in accordance with Section C406.8.
8. Reduced air infiltration in accordance with Section C406.9
9. On-site *energy storage system* installed in accordance with Section C406.10

Add new text as follows:

C406.10 On-site energy storage system (ESS). An on-site energy storage system with a storage capacity of at least 50 kWh that is not part of an emergency power system shall be installed. The system shall be capable of interacting with the electric grid or on-site renewable energy system or both.

Reason: According to the US Energy Information Administration (https://www.eia.gov/analysis/studies/electricity/batterystorage/), at the end of 2017, there were 708 MW and 867 MWh of large scale energy storage systems in operation in the United States. Several states have enacted policies that require large-scale installations of energy storage systems (over 1,000 MW) to support the growth of renewable electric generation systems on the grid and at buildings.
In states with aggressive renewable portfolio standards, energy storage systems are needed to help balance the grid, especially in times of very high supply of renewable energy and low demand (e.g., "the duck curve").

Several utilities throughout the US are providing incentives to customers for installing energy storage systems, based on a minimum capacity. Typically, the minimum capacity requirement has been on the order of 50 kWh or 50 kW for a certain number of hours of discharge.

The definition is needed for clarity to support the for new langauage for Energy Storage Systems in Section C406.
This is the same definition that is used in the latest version of the *International Fire Code*.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is one of several additional efficiency options that a building owner or designer can choose from in Section C406. Based on the data from the EIA report, the range of costs for an installed energy storage system ranges from $500 to $2500 per kWh, depending on the battery size, battery chemistry, and safety code requirements. Battery prices are declining, which will reduce these costs significantly over the next several years. In addition, state and utility incentives in parts of the US significantly reduce the initial costs.

CE265-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: All other points are relational to building size, this doesn't fit with the structure, it must be modeled to be in this table, this point does not represent .25% building energy cost as other points do (Vote: 8-7).

Assembly Action: **None**

CE265-19

Individual Consideration Agenda

Public Comment 1:

IECC®: C406.10 (New)

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

C406.10 On-site *energy storage system* (ESS). An on-site *energy storage system* with a storage capacity of at least 50 kWh that is not part of an emergency power system shall be installed. The system shall be capable of interacting with the electric grid or *on-site renewable energy* system or both.

Energy efficiency credit: On-site *energy storage systems* shall be assigned 1 credit in all building types located in all climate zones.

Commenter's Reason: This modification improves the proposal by:
-Providing information for the credit calculations that were approved in CE 218. Electrical energy storage systems will provide the same service or services in all buildings located in any climate zone, which is the reason for the same credit for all building types and all climate zones.

-Encouraging the use of new technology, while improving building energy efficiency. While larger on-site energy storage systems could provide more benefit to the building and/or the grid, it was decided that keeping the points at a minimum level would ensure that other energy efficiency measures would have to be taken to obtain the necessary number of credits in Section C406.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment simply assigns the credit (for a building's energy efficiency credit determination) when the option to install an on-site energy storage system (ESS) is chosen. Because installation of an on-site energy storage system (ESS) is not required, there is no impact to the cost of construction.

Public Comment# 1365
