ENERGY COMPLETE MONOGRAPH

CODE CHANGES AND PUBLIC COMMENTS TO THE 2023 IECC COMMERCIAL, IECC RESIDENTIAL, IRC CH. 11 PUBLIC COMMENT DRAFT #2

ICC
INTERNATIONAL CODE COUNCIL®

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INTRODUCTION

Following an extensive review and feedback process, on March 4, 2021 the Code Council Board (Board) released a new framework to address energy efficiency. This new framework includes a revised process for the development of the energy provisions with a new scope and intent and optional requirements aimed at achieving net zero energy buildings presently and by 2030. This framework includes using the Code Council's American National Standards Institute (ANSI) approved standards process to update the energy provisions contained in the IECC, Chapter 11 of the IRC and Chapter 15 of the International Code Council Performance Code (ICC PC). The results of this process will be the publication of the energy provisions in the 2024 IECC, IRC and ICC PC as part of the family of I-Codes in the fall of 2023.

The following has occurred since the March 4, 2021 release:

- June 22, 2021: Board appoints two new committees: Commercial Energy Code Consensus Committee and Residential Energy Code Consensus Committee following a Call for Committee members on March 19, 2021 and an application deadline of April 22, 2021.
- July 16, 2021: cdpACCESS opened for Public Input code change submissions, with a deadline of October 12, 2021.
- November 2021 to June 30, 2022 the IECC Residential Consensus Committee with recommendations from 6 Subcommittees took action on approximately 200 code change proposals.
- The Committee Action Report for the IECC Residential was released July 5, 2022 along with the initial ballot to the IECC-Residential committee. Ballot #1 was due on August 5, 2022. The report of Ballot #1 and the release of the Recirculation ballot #2 were issued on August 5, 2022. The Recirculation ballot #2 was collected on August 23, 2022. The report of Ballot #2 and the release of the Recirculation ballot #3 were issued on August 24, 2022. The Recirculation ballot #3 was collected on September 7, 2022. The results of Recirculation ballot #3 were posted on September 8, 2022. There were 16 proposals that received negative ballots from at least 1/3 of the committee. These items were placed on the agenda for a meeting of the IECC Residential Consensus Committee on September 26-27. The Consensus committee heard proposed modifications to resolve the negative ballots and voted on these proposals. An absentee ballot was distributed on September 28 and was collected on October 12, 2022. The results of the balloting were posted on October 17. Items that received a 2/3 affirmative vote as a result of the balloting process were included in the IECC-R Public Comment Draft #1.
- The IECC-C Public Comment Draft #1 was posted for comment in energy.cdpaccess on September 6, 2022. Public Comments were due on October 21, 2022. The IECC-R Public Comment Draft #1 was posted for comment in energy.cdpaccess on November 1, 2022. Public Comments were due on December 16, 2022.
- December 2022 to April 27, 2023 the IECC Commercial Consensus Committee with recommendations from 5 Subcommittees took action on approximately 246 proposals and 28 committee proposals. During that same time period the IECC Residential Consensus Committee with recommendations 6 Subcommittees took action on approximately 434 proposals and 12 committee proposals.
- The Committee Action Report for the IECC Commercial was released on April 28, 2023 along with the initial ballot to the IECC-C committee. Ballot #1 was due on May 26, 2023. The report of Ballot #1 and the release of Recirculation ballot #2 were issued on May 27, 2023. The Recirculation ballot #2 was collected on June 12, 2023. The results of the balloting concluded that all proposals included in the IECC-C Committee Action Report received a 2/3 affirmative vote and would be included in the IECC-C Public Comment Draft #2. The Committee Action Report for the IECC Residential was released on May 1, 2023 along with the initial ballot to the IECC-C committee. Ballot #1 was due on May 30, 2023. The report of Ballot #1 and the release of Recirculation ballot #2 were issued on May 31, 2023. The Recirculation ballot #2 was collected on June 14, 2023. The results of Recirculation ballot #2 were posted on June 15, 2023. There was 1 proposal that received negative ballots from at least 1/3 of the committee. This item and a committee proposal were placed on the agenda for a meeting of the IECC Residential Consensus Committee on June 29, 2023. The Consensus committee heard proposed modifications to resolve the negative ballots and voted on these proposals. An absentee ballot was distributed on June 30 and will be collected on July 14. Items that received a 2/3 affirmative vote as a result of the balloting process will be included in the IECC-R Public Comment Draft #2. The items that receive 2/3 affirmative vote from the June 29 IECC-R meeting and absentee ballot will be included in Public Comment Draft #2 and open for comment separately for 30 days.

As noted previously, the update process will follow the Code Council's standards development procedures entitled the "ICC Consensus Procedures" (ICC CP). The current version was approved by ANSI on August 2, 2021. Further to this process and in accordance with Section 3.1(c) of the ICC CP, the Board has adopted the "IECC Committee Procedures" for the development of the energy provisions of the 2024 editions and future editions. See document links on page iii.

In accordance with Section 8.2 of the ICC CP, the 2021 edition of the energy provisions (with the Board approved scope and intent) was used as the Initial Draft in order to solicit Public Input in the form of code change submittals. Following the deadline of October 12th, the proposed code change submittals were compiled, published and posted. The publication of these changes constitutes neither endorsement nor question of them but is in accordance with established procedures so that any interested individuals may make their views known to the relevant Subcommittee, Consensus Committee and others similarly interested. In furtherance of this purpose, the Subcommittees and Consensus Committees will hold open virtual meetings as noted below for the purpose of receiving comments and arguments for or against such proposed changes. Those who are interested in speaking on any of the published changes are expected to participate at these meetings.

This compilation of code change proposals is available in electronic form only.

SUBCOMMITTEES AND CONSENSUS COMMITTEES

Subcommittees
In accordance with Section 6 of the ICC Consensus Procedures, Subcommittees have been established and approved by the Consensus Committees following a public notice and application process. The objective of Subcommittees is to provide for broad participation and develop consensus on an issue(s) and report the findings to the Consensus Committee for review and final determination. Voting members are comprised of both Consensus Committee members and interested parties.

Consensus Committees
The Board appointed Consensus Committees will determine the final code content of the energy provisions in accordance with the ICC Consensus Procedures.

All Subcommittee and Consensus Committee meetings are open meetings to all participants (voting and non-voting) with adequate public notice provided in accordance with the ICC Consensus Procedures.

ANTITRUST COMPLIANCE

ICC brings together numerous government officials and industry members to participate in the code and standard development process. ICC provides basic guidance on the antitrust laws that may be applicable to these and other activities sponsored by ICC ("ICC Activities"). Click here to view ICC's policy on Antitrust Compliance.

ANALYSIS STATEMENTS

Code changes may contain an "analysis" that appears after the proponent's reason. These comments do not advocate action by the Subcommittees or Consensus Committees for or against a proposal. The purpose of such comments is to identify pertinent information that is relevant to the consideration of the proposed change by the Subcommittees, Consensus Committees and interested parties. Staff analyses customarily identify such things as: conflicts and duplication within a proposed change and with other proposed changes and/or current code text; deficiencies in proposed text and/or substantiation; text problems such as wording defects and vagueness; background information on the development of current text; and staff's review of proposed new reference standards for compliance with procedures. Lack of an analysis indicates neither support for, nor opposition to a proposal.

NEW REFERENCE STANDARDS

Reference standards provide a very important role in ICC's Codes. As stipulated in Sections C108 and R108 of the IECC and Section R102.4 of the IRC, "….standards referenced in this code……shall be considered as part of the requirements of this code to the prescribed extent of each such reference…".

The I-Code process includes criteria for staff to evaluate the non-technical aspects of the standard, such as mandatory language and a consensus process for development. As an extension of the code, the code change submittal process for proposed new reference standards (a standard not currently referenced in one of the I-Codes) requires that the proponent identify the title and edition of the new standard as well as making the standard available for review. This is typically done in one of three ways:

1. The proponent secures a copy of the standard from the Standards Developing Organization (SDO) and sends it to staff for record retention. The proponent also requests that the SDO execute an ICC "Permission to Post Form", provided by the proponent, that allows ICC to post the standard on a password protected website for both staff and the Consensus Committees.
2. The proponent contacts the SDO and is informed that the standard is available on their website for free download. The download is typically specific only to the individual downloading the standard (in other words it cannot be sent electronically to another person). In addition, ICC administration will obtain a copy of the standard for internal purposes by accessing the SDO's website to download the standard.
3. The SDO tells the proponent the standard is available on their website for free access in a "read-only" format. The proponent provides ICC with the link to access the standard and ICC administration confirms that the standard is available in "read-only" format.

Where necessary, ICC will work with proponents and SDO's to help secure the standard in a reviewable format. It is still the responsibility of the proponent to contact the SDO to determine how the standard can be provided to support its potential inclusion in the code.

Proposed new reference standards must be completed and readily available in a timely fashion in order to facilitate the Consensus Committee approval process. New standards which are approved by the Consensus Committee will be listed in the "Referenced Standard" chapter of the applicable code(s).

REFERENCED STANDARDS UPDATES

Updates to currently referenced energy standards in the 2021 IECC, IRC and ICC PC will be considered by the Administrative Code Development Committee in the 2022 Group B Cycle of the ICC Code Development Process. Public Comment Draft #2 Proposals that reference updated standards that were not included in the 2022 Group B Cycle will be acted on by the Consensus Committee as new reference standards.

In accordance with I-Code procedures, an updated standard to the energy provisions of the IECC, IRC, and ICC PC must be finalized and published by December 1, 2023. If the standard update is not finalized and published by December 1, 2023, the affected energy provisions will be revised to reference the previously listed year edition of the standard and an errata issued.

PROPONENT CONTACT INFORMATION

In accordance with procedures, proponents are under no obligation to provide an email address for their posted proposal. For most of the code change proposals, an email address for the proponent has been provided. In an effort to continue to provide for proponent's privacy and at the same time allow an initial contact between an interested party and the proponent, we will be utilizing energy.cdpACCESS to allow an interested party to initiate contact with the proponent without identifying the proponent's email address. The process is follows:

- Interested party logs into energy.cdpACCESS and searches for the subject code change.
- Interested party locates the button "Contact the Proponent" to request that energy.cdpACCESS contact the proponent, providing the interested party's name and email address.

- Energy.cdpACCESS uses the proponent email address on file and sends a notification to the proponent indicating the name of the interested party and their email address and that the interested party would like to discuss the code change.
- The interested party receives an email noting that the energy.cdpACCESS system has sent the request to the proponent.
- It is up to the proponent to determine if they would like to respond and contact the interested party.
- The proponent is under no obligation to respond to the energy.cdpACCESS request for contact or to contact the interested party. The proponent's contact information is not revealed to the interested party as part of this initial contact.

CODE CHANGE SUBMITTALS WITH TABLES

Staff is aware that some of the code change proposals with tables may require additional formatting. In an effort to post these code changes as soon as practical in order to start the discussions at the Subcommittee level, the decision was made to post these proposals now and staff will continue to reformat the tables and re-post when reformatted. All interested parties who have signed up for the email distribution list for notifications (see below) will be notified when the code changes are re-posted.

ICC ENERGY WEBSITES/DOCUMENT POSTINGS

ICC websites are used extensively for access to documents which support the update of ICC's Codes. This current update of the energy provisions is no different. Postings include:

- This code change document
- Code change errata, if any, will be posted
- The "IECC Committee Procedures" previously mentioned will be posted
- Process information such as a flowchart of the key steps currently under development will be posted
- Additional documents/information to support the process will be posted

Links to websites:

- "Leading the Way to Energy Efficiency"
- Commercial: Commercial Energy Consensus Committee
- Residential: Residential Energy Consensus Committee

Users are encouraged to periodically review the websites.

ICC CONSENSUS PROCEDURES

Click here to download the current ICC Consensus Procedures

ICC ENERGY SECRETARIAT/EMAIL DISTRIBUTION LIST

The ICC Secretariat is Kristopher Stenger, AIA, CBO, LEED AP Director of Energy Programs at kstenger@iccsafe.org. Be sure to contact Kris in order to be placed on the email distribution list in order to receive timely meeting information, notices, etc.

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CE2D-1-23

IECC CE: C101.2.1

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code[CE Project] R3

Delete without substitution:

~~C101.2.1 Appendices.~~

~~Provisions in the appendices shall not apply unless specifically adopted.~~

Reason Statement:

Appendices are non-mandatory and should not be referred to in the body of code requirements. Other comments on appendices help clarify the informative nature of IECC appendices.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The deletion is essentially editorial.

CE2D-1-23

CE2D-2-23

IECC CE: SECTION 202

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

IECC2024D3RECE_CE_Ch02_SecC202_DefSUBSTANTIAL_IMPROVEMENT SUBSTANTIAL IMPROVEMENT. Any *repair*, reconstruction, rehabilitation, *alteration*, *addition* or other improvement of a *building* or structure, the cost of which equals or is more than 50 percent of the market value of the structure before the improvement. Where the structure has sustained substantial damage, as defined in the International Building Code, any repairs are considered *substantial improvement* regardless of the actual *repair* work performed. *Substantial improvement* does not include the following:

1. Improvement of a building ordered by the *code official* ~~required~~ to correct health, sanitary or safety code violations ~~ordered by the *code official*~~.
2. *Alteration* of a *historic building* where the *alteration* will not affect the designation as a *historic building*.

Reason Statement:

Edited for clarity.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Editorial.

CE2D-2-23

CE2D-3-23

IECC CE: SECTION 202

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

IECC2024D3RECE_CE_Ch02_SecC202_DefWALL_ABOVE_GRADE 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, ~~mechanical equipment penetrations~~, and skylight shafts.

Reason Statement:

Note that the code does not define "equipment." A pipe that passes through a wall is not part of the wall, but it could be considered equipment.

Why was this only proposed for mechanical equipment? There are other potential penetrating types of equipment.

The definition of wall does not need to be changed to regulate openings in the wall; that can be done in the text.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This does not require or prohibit any installation; no costs are associated.

CE2D-3-23

CE2D-4-23

IECC CE: 202 (New)

Proponents:

Daniel Carroll, representing Department of State (daniel.carroll@dos.ny.gov); Hendrik Shank, representing NYS Dept. of State (hendrikus.shank@dos.ny.gov)

2024 International Energy Code[CE Project] R3

Revise as follows:

202 Emitance.

EMITTANCE. The ratio of the radiant heat flux emitted by a specimen ~~to that emitted by a blackbody at the same temperature and under the same conditions~~ measured on a scale from 0 to 1, where a value of 1 indicates perfect emission.

Reason Statement:

Possible Errata: This definition was changed in the residential provisions and should be coordinated in the commercial provisions.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Editorial Coordination/Errata

CE2D-4-23

CE2D-5-23

IECC CE: SECTION 202

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

IECC2024D3RECE_CE_Ch02_SecC202_DefHIGH_CAPACITY_GAS_FIRED_WATER_HEATER HIGH-CAPACITY GAS-FIRED WATER HEATER. Gas-fired instantaneous water heaters listed to CSA/ANSI Z21.10.3 and having input ratings~~ with a rated input ~~greater than 200,000 Btu/h (58.6 kW). ~~and not less than 4,000 Btu/h per gallon (310 W per litre) of stored water, and gas-fired storage water heaters with a rated input both greater than 105,000 Btu/h (30.8 kW) and less than 4,000 Btu/h per gallon (310 W per litre) of stored water.~~

Reason Statement:

This definition should be fully consistent with North American consensus standards (Z21.10.3) and not impose the proposed additional requirements that would restrict product availability.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The definition language is clarifying and for consistency with available listed water heating products.

CE2D-5-23

CE2D-6-23

IECC CE: SECTION 202

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

IECC2024D3RECE_CE_Ch02_SecC202_DefGREEN_RETAIL_TARIFF GREEN RETAIL TARIFF. An electricity-rate structure qualified under applicable statutes or rules contracted by an electricity service provider to the *building* project *owner* to provide electricity generated with 100 percent ~~*renewable energy resources*~~ <u>renewable energy</u> without the purchase of unbundled RECS.

Reason Statement:

It's unreasonable to tie the definition of green retail tariff to the 'only-used-in-one-place-ever-in-a-draft-model-code' definition of *renewable energy resources*.

As written, a green retail tariff could not include Green-e compliant renewable energy products because they do not meet the sketchy definition we have for *renewable energy resources*.

Cost Impact:

The code change proposal will decrease the cost of construction.

More options for compliance should provide cost relief.

CE2D-6-23

CE2D-7-23

IECC CE: TABLE C402.1.3

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

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

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/IES 90.1 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 C402.1.2.
c.	R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted not less than 32 inches on center vertically and not less than 48 inches 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 R-value requirements for above-grade mass walls .
e.	“Mass floors” shall be in accordance withSection C402.1.3.6.
f.	“Mass walls” shall be in accordance withSection C402.1.3.6.
g.	The first value is for perimeter insulation and the second value is for full, under-slab insulation. Perimeter insulation and full-slab insulation components shall be installed in accordance with Section C402.2.4 .
h.	The first value is *cavity insulation*; the second value is *continuous insulation*. Therefore, “R-0+R-12ci” means R-12 *continuous insulation* and no *cavity insulation*; “R-13+R-3.8ci” means R-13 *cavity insulation* and R-3.8 *continuous insulation*; “R-20” means R-20 *cavity insulation* and no *continuous insulation*. R-13, R-20, and R-27 *cavity insulation* as used in this table apply to a nominal 4-inch (101 mm), 6-inch (152 mm), and 8-inch (203 mm) deep wood or cold-formed steel stud cavities, respectively.
~~i.~~	~~Where the required R-value in Table C402.1.3 is met by using continuous insulation such that cavity insulation is not required, the wall assembly framing is permitted to be spaced at any spacing.~~

Reason Statement:

Framing is permitted to be spaced at any distance regardless of what the energy code says. This footnote is meaningless.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

no fiscal impact.

CE2D-7-23

CE2D-8-23

IECC CE: C402.2.1.3

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C402.2.1.3 Minimum thickness of tapered insulation.

The ~~minimum~~ thickness of tapered above-deck roof insulation at its lowest point, gutter edge, roof drain or scupper, shall be not less than 1 inch (25 mm).

Reason Statement:

"Minimum" is redundant with "not less than."

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Editorial.

CE2D-8-23

CE2D-9-23

IECC CE: C402.6.1.3, C402.6.2, C406.2.1.3

Proponents:

Theresa Weston, representing Air Barrier Association of America (ABAA) (holtweston88@gmail.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C402.6.2 Air leakage compliance.

Air leakage of the *building* thermal envelope shall be tested by an *approved* third party in accordance with C402.6.2.1. The measured air leakage shall not be greater than 0.35 cfm/ft (1.8 L/s x m) of the *building* thermal envelope area at a pressure differential of 0.3 inch water gauge (75 Pa) with the calculated *building* thermal envelope surface area being the sum of the above- and below-grade *building* thermal envelope.

Exceptions: Add optional paragraph text here

1.	Where the measured *air leakage* rate is greater than 0.35 cfm/ft^2 (1.8 L/s x m^2) but is not greater than 0.45 cfm/ft^2 (2.3 L/s x m^2), the *approved* third party shall perform a diagnostic evaluation using smoke tracer or infrared imaging. The evaluation shall be conducted while the *building* is pressurized or depressurized along with a visual inspection of the *air barrier* in accordance with ASTM E1186. All identified leaks shall be sealed where such sealing can be made without damaging existing *building* components. A report specifying the corrective actions taken to seal leaks shall be deemed to establish compliance with the requirements of this section where submitted to the *code official* and the *building owner*. Where the measured *air leakage* rate is greater than 0.45 cfm/ft^2 (2.3 L/s x m^2), corrective actions must be made to the *building* and an additional test completed for which the results are 0.45 cfm/ft^2 (2.3 L/s x m^2), or less.
2.	Buildings in *Climate Zone* 2B.
3.	Buildings larger than 25,000 square feet (2300 m^2) floor area in Climate Zones 0 through 4, other than Group R and I occupancies, that comply with C402.6.2.3
4.	As an alternative, buildings or portions of *building*, containing Group R-2 and I-1 occupancies, shall be permitted to be tested by an *approved* third party in accordance with C402.6.2.2. The reported *air leakage* of the *building* thermal envelope shall not be greater than 0.27 cfm/ft^2 (1.4 L/s x m^2) of the *testing unit enclosure area* at a pressure differential of 0.2 inch water gauge (50 Pa).

~~C402.6.2 Reserved (Potentially move C40213 Air leakage compliance here)~~.

~~Reserved.~~

C406.2.1.3 E03 Reduced air leakage.

Energy credits shall be achieved where tested *building air leakage* is not less than 10 percent less than the maximum leakage permitted by Section ~~C402.5.2~~ C402.6.2 provided the *building* is tested in accordance with the applicable method in Section ~~C402.5.2~~ C402.6.2. Energy credits achieved for measure E03 shall be determined as follows:

$$EC_{E03} = EC_B \text{ X } EC_{adj}$$

(Equation 4-13)

EC_{E03}= Energy ~~effi-ciency~~ efficiency credits achieved for envelope leakage reduction
EC_B= C406.2.1.3 credits from Tables C406.2(1) through C406.2(9)
EC_{adj}= Ls/EC_a
Ls = Leakage savings fraction: the lessor of [(Lr-Lm)/Lr] or 0.8
Lr = Maximum leakage permitted for tested *buildings*, by occupancy group, in accordance with Secction ~~C402.5.2~~ C402.6.2
Lm = Measured leakage in accordance with Section ~~C402.5.2.1~~ C402.6.2.1 or ~~C402.5.2.2~~ C402.6.2.2
EC_a= Energy Credit alignment factor: 0.37 for whole *building* tests in accordance with Section ~~C402.5.2.1~~ C402.6.2.1 or 0.25 for dwelling and *sleeping unit* enclosure tests in accordance with Section ~~C402.5.2.2~~ C402.6.2.2.

Reason Statement:

This is errata on the numbering of sections related to air leakage:

- Renumbers the current (in draft) Section C402.6.1.3 to C402.6.2. In the draft C402.6.2 is titled "Reserved" and it is stated that "potentially move C402.1.3 Air leakage compliance her". The correct numbering is to move C402.6.1.3 to this place.

- corrects the air leakage section numbers referenced in Section C406.2.1.3

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This proposal is errata on section numbering only.

CE2D-9-23

CE2D-10-23

IECC CE: C402.6.2.3, C405.13.5, C407.5.1.2

Proponents:

Shane Hoeper, representing SEHPCAC

2024 International Energy Code[CE Project] R3

Revise as follows:

C402.6.2.3 Building thermal envelope design and construction verification criteria.

Where Section C402.6.2.1 and C402.6.2.2 are not applicable 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 C402.6.1.
2.	Inspection of continuous *air barrier* components and assemblies shall be conducted during construction to verify compliance with the requirements of <u>Section</u> C402.6.2.3.1 or C402.6.2.3.2. The *air barrier* shall ~~remain accessible~~ <u>be provided with access</u> for inspection and *repair*.
3.	A final inspection report shall be provided for inspections completed by the *registered design professional* or *approved* agency. The inspection report shall be provided to the *building owner* or *owner*'s authorized agent and the *code official*. The report shall identify deficiencies found during inspection and details of corrective measures taken.

C405.13.5 Graphical energy report.

A permanent and readily ~~accessible~~ <u>available</u> reporting mechanism ~~with ready access~~ shall be provided in the *building* ~~that is accessible has~~ <u>for access by</u> *building* operation and management personnel. The reporting mechanism shall have the capability to graphically provide the electrical energy consumption for each end-use category required by Section C405.13.2 not less than every hour, day, month and year for the previous 36 months. The graphical report shall incorporate natural gas interval data or the ability to enter gas utility bills into the report.

C407.5.1.2 Testing required by software vendors.

Prior to approval, software tools shall be tested by the software vendor in accordance with ASHRAE Standard 140, except Sections 7 and 8. During testing, hidden inputs that are not normally ~~accessible~~ <u>available</u> to the user shall be permitted to avoid introducing source code changes strictly used for testing. Software vendors shall publish, on a publicly available website, the following ASHRAE Standard 140 test results, input files, and modeler reports for each tested version of a software tool:

1.	Test results demonstrating the software tool was tested in accordance with ASHRAE Standard 140 and that meet or exceed the values for “The Minimum Number of Range Cases within the Test Group to Pass” for all test groups in ASHRAE Standard 140, Table A3-14.
2.	Test results of the performance analysis tool and input files used for generating the ASHRAE Standard 140 test cases along with the results of the other performance analysis tools included in ASHRAE Standard 140, Annexes B8 and B16.

3.	The modeler report in ASHRAE Standard 140, Annex A2, Attachment A2.7. Report Blocks A and G shall be completed for results exceeding the maximum or falling below the minimum of the reference values shown in ASHRAE Standard 140 Table A3-1 through Table A3-13, and Report Blocks A and E shall be completed for any omitted results.

Reason Statement:

Because the term ‘accessible’ is most commonly understood as requiring access for persons with disabilities we are making the changes to delete the word accessible from the remaining codes and replace it with other words, defined terms or phrases that are not attributed to requiring access for the physically disabled. Many of the codes use the defined term ‘access (to)’ or ‘ready access (to)’ for access by maintenance and service personnel or fire departments. This proposal provides clarity and consistency in the remaining codes where those coordination modifications missed or came in as part of new code changes.

This a correlation piece for proposals over the last couple of cycles. This effort was started by the CACs in 2015/16 code change cycle, and continued in 2018/19. This proposal is to provide coordination with the action taken with -P84-15, M2-15, RB2-16, F12-16, CE137-16 Part 1, CE29-19 Part 1 and 2 . G1-21 Part 1 was disapproved; however Part 2 through 7 were approved

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Editorial. Will not change the cost of construction

CE2D-10-23

CE2D-11-23

IECC CE: C403.3

Proponents:

Richard Lord, representing Carrier Corporation (richard.lord@carrier.com)

2024 International Energy Code[CE Project] R3

C403.3 Heating and cooling equipment efficiencies.

Heating and cooling equipment installed in mechanical systems shall be sized in accordance with Section C403.3.1 and shall be not less efficient in the use of energy than as specified in Section C403.3.2.

Reason Statement:

This is just editorial changes to the tables that were not modified in the public review but do need some fixing.

The requirements for before 1/1/2023 should be deleted because the date has already passed and just show the after 1/1/2023 requirements.

Also for footnote c the following change should be made.

c. DOE 10 CFR 430 Subpart B Appendix M1 includes the test procedure updates effective 1/1/2023 ~~that will be incorporated~~ <u>are documented</u> in AHRI 210/240—2023.

Bibliography:

Current table aligns with ASHRAE 90.1-2022 but the IECC will be published in 2022 so there is no need to shown the before 2023 requirements.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Editorial. No cost impact.

CE2D-11-23

CE2D-12-23

IECC CE: C403.3.2

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C403.3.2 HVAC equipment performance requirements.

Equipment shall meet the minimum efficiency requirements of Tables C403.3.2(1) through C403.3.2(16) when tested and rated in accordance with the applicable test procedure. Plate-type liquid-to-liquid heat exchangers shall meet the minimum requirements of AHRI 400. 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. ~~Efficiency values and metrics in tables shall be equal to the values and metrics shown in ASHRAE 90.1-2022.~~

Reason Statement:

Table values should stand alone and not require the AHJ to enforce ASHRAE appliance and equipment standards as implied by the new language. Regardless, the DOE federal minimum efficiencies, adopted through ASHRAE Standard 90.1 should serve as the table minimums and do not need to be referenced back to ASHRAE.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The deleted language is superfluous to meeting federally-regulated efficiency requirements and is, therefore, redundant.

CE2D-12-23

CE2D-13-23

IECC CE: C403.3.2

Proponents:

Richard Lord, representing Carrier Corporation (richard.lord@carrier.com)

2024 International Energy Code[CE Project] R3

C403.3.2 HVAC equipment performance requirements.

Equipment shall meet the minimum efficiency requirements of Tables C403.3.2(1) through C403.3.2(16) when tested and rated in accordance with the applicable test procedure. Plate-type liquid-to-liquid heat exchangers shall meet the minimum requirements of AHRI 400. 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. <u>Efficiency values and metrics in tables shall be equal to the values and metrics shown in ASHRAE 90.1-2022.</u>

Reason Statement:

The note c in table C403.3.2(1) is incorrect and needs the following editorial correction.

c. DOE 10 CFR 430 Subpart B Appendix M1 includes the test procedure updates effective 1/1/2023 ~~that will be incorporated~~ <u>documented</u> in AHRI 210/240—2023.

The AHRI 210/240-2023 has already been published in 2022. The -2023 is the name of the standard and not the year of publication. This is confussing.

Bibliography:

AHRI 210/240-2023 was published in 2022. The -2023 just means the standard goes into effect on 1/1/2023

The AHRI approach to call the standard AHRI 210/240-2023 is confusing as the standard was published in 2022 and the 2023 is the effective date or name of the standard.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

No impact on cost.

CE2D-13-23

CE2D-14-23

IECC CE: C403.3.2

Proponents:

Richard Lord, representing Carrier Corporation (richard.lord@carrier.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C403.3.2 HVAC equipment performance requirements.

Equipment shall meet the minimum efficiency requirements of Tables C403.3.2(1) through C403.3.2(16) when tested and rated in accordance with the applicable test procedure. Plate-type liquid-to-liquid heat exchangers shall meet the minimum requirements of AHRI 400. 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. Efficiency values and metrics in tables shall be equal to or more efficient than the values and metrics shown in ~~ASHRAE 90.1-2022~~ in tables C403.3.2(1) through C403.3.2(16)

Reason Statement:

The requirements only require the efficiencies to be equal to the table minimum values, but it should be acceptable to be more efficient.

Should not use greater than because some metrics like chiller kw/ton are more efficient with lower numbers and others are more efficiency with higher numbers.

Bibliography:

Just a clarification.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

No impact on cost.

CE2D-14-23

CE2D-15-23

IECC CE: C403.3.2

Proponents:

Richard Lord, representing Carrier Corporation (richard.lord@carrier.com)

2024 International Energy Code[CE Project] R3

C403.3.2 HVAC equipment performance requirements.

Equipment shall meet the minimum efficiency requirements of Tables C403.3.2(1) through C403.3.2(16) when tested and rated in accordance with the applicable test procedure. Plate-type liquid-to-liquid heat exchangers shall meet the minimum requirements of AHRI 400. 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. <u>Efficiency values and metrics in tables shall be equal to the values and metrics shown in ASHRAE 90.1-2022.</u>

Reason Statement:

I see that the staff is going to harmonize with ASHRAE 90.1-2022 which was modified to improve readability. In addition to these changes also eliminate any requirements for before 1/1/2023 as the date is in the past.

Bibliography:

Just an editorial suggested change.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

No cost impact.

CE2D-15-23

CE2D-16-23

IECC CE: C403.3.2

Proponents:

Richard Lord, representing Carrier Corporation (richard.lord@carrier.com)

2024 International Energy Code[CE Project] R3

C403.3.2 HVAC equipment performance requirements.

Equipment shall meet the minimum efficiency requirements of Tables C403.3.2(1) through C403.3.2(16) when tested and rated in accordance with the applicable test procedure. Plate-type liquid-to-liquid heat exchangers shall meet the minimum requirements of AHRI 400. 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. <u>Efficiency values and metrics in tables shall be equal to the values and metrics shown in ASHRAE 90.1-2022.</u>

Reason Statement:

In table C403.3.2(1) the requirements for before 1/1/2023 are shown. There is no need to show these requirements as the date has already passed.

Bibliography:

Table as currently written alligns with ASHRAE 90.1, but no need to show the before 1/1/2023

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

No impact on cost

CE2D-16-23

CE2D-17-23

IECC CE: TABLE C403.3.2(13), TABLE C403.3.2(12)

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

TABLE C403.3.2(13) ELECTRICALLY OPERATED D X-DOAS UNITS, SINGLE-PACKAGE AND REMOTE CONDENSER, WITH ENERGY RECOVERY—MINIMUM EFFICIENCY REQUIREMENTS

a.	Chapter 6 contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.
b.	~~For minimum efficiency compliance purposes~~, ~~open~~ Open loop systems ~~shall be~~ are rated using closed-loop test conditions.

TABLE C403.3.2(12) ELECTRICALLY OPERATED DX-DOAS UNITS, SINGLE-PACKAGE AND REMOTE CONDENSER, WITHOUT ENERGY RECOVERY—MINIMUM EFFICIENCY REQUIREMENTS

a.	Chapter 6 contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.
b.	~~For minimum efficiency compliance purposes~~, ~~open~~ Open loop systems ~~shall be~~ are rated using closed-loop test conditions.

Reason Statement:

Footnote should not contain requirements. The purpose of the tables are to identify 'minimum efficiency,' so it does not need to be repeated in the footnote.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Editorial.

CE2D-17-23

CE2D-18-23

IECC CE: C403.3.2

Proponents:

Richard Lord, representing Carrier Corporation (richard.lord@carrier.com)

2024 International Energy Code[CE Project] R3

C403.3.2 HVAC equipment performance requirements.

Equipment shall meet the minimum efficiency requirements of Tables C403.3.2(1) through C403.3.2(16) when tested and rated in accordance with the applicable test procedure. Plate-type liquid-to-liquid heat exchangers shall meet the minimum requirements of AHRI 400. 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. <u>Efficiency values and metrics in tables shall be equal to the values and metrics shown in ASHRAE 90.1-2022.</u>

Reason Statement:

In the table C403.3.2(3) the capacity range for the water cooled electrically operated centrifugal is missing and ≥150 and <300 tons needs to be added

Bibliography:

Just an editorial to add the missing capacity category for water cooled centrifugals.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Just an editorial correction

CE2D-18-23

CE2D-19-23

IECC CE: TABLE C403.3.2(6)

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

TABLE C403.3.2(6) GAS- AND OIL-FIRED BOILERS—MINIMUM EFFICIENCY REQUIREMENTS [i]
For SI: 1 British thermal unit per hour = 0.2931 W.

a.	Chapter 6 contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.
b.	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.
c.	E_c = Combustion efficiency (100 percent less flue losses).
d.	E_t = Thermal efficiency.
e.	Maximum capacity—minimum and maximum ratings as provided for and allowed by the unit’s controls.
f.	Includes oil-fired (residual).
g.	Boilers shall not be equipped with a constant burning pilot light.
h.	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.
i.	Prior to March 2, 2022, for natural draft ~~very large~~ gas-fired steam commercial packaged boilers, a ~~minimum~~ thermal efficiency level of 77 percent or greater is permitted ~~and meets Federal commercial packaged boiler energy conservation standards~~

Reason Statement:

"*Very large*" is poor code language. What is 'very? What is large? Similarly, '*minimum*' has minimal acceptable application in code.

Whether the equipment meets "*Federal commercial packaged boiler energy conservation standards*" is commentary and not a requirement and should be deleted.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Editorial

CE2D-19-23

CE2D-20-23

IECC CE: C403.3.2

Proponents:

Richard Lord, representing Carrier Corporation (richard.lord@carrier.com)

2024 International Energy Code[CE Project] R3

C403.3.2 HVAC equipment performance requirements.

Equipment shall meet the minimum efficiency requirements of Tables C403.3.2(1) through C403.3.2(16) when tested and rated in accordance with the applicable test procedure. Plate-type liquid-to-liquid heat exchangers shall meet the minimum requirements of AHRI 400. 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. Efficiency values and metrics in tables shall be equal to the values and metrics shown in ASHRAE 90.1-2022.

Reason Statement:

Staff has noted that the table needs to be updated. There are errors in the existing table with duplicate IEER values.

When adopting the 90.1 table 6.8.1-8 eliminate the requirements before 1/1/2023 and also the 2014 AHRI 1230-2014 addendum 1 reference because the new AHRI 1230-2021 goes into effect on 1/1/2024 which will be the effective date for the IECC 2024 standard.

Bibliography:

Suggest changes as the table is need of update.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

No cost impact.

CE2D-20-23

CE2D-21-23

IECC CE: C403.3.2

Proponents:

Richard Lord, representing Carrier Corporation (richard.lord@carrier.com)

2024 International Energy Code[CE Project] R3

C403.3.2 HVAC equipment performance requirements.

Equipment shall meet the minimum efficiency requirements of Tables C403.3.2(1) through C403.3.2(16) when tested and rated in accordance with the applicable test procedure. Plate-type liquid-to-liquid heat exchangers shall meet the minimum requirements of AHRI 400. 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. <u>Efficiency values and metrics in tables shall be equal to the values and metrics shown in ASHRAE 90.1-2022.</u>

Reason Statement:

Staff has noted that the table needs to be updated. There are errors in the existing table with duplicate IEER values.

When adopting the 90.1 table 6.8.1-9 eliminate the requirements before 1/1/2023 and also the 2014 AHRI 1230-2014 addendum 1 reference because the new AHRI 1230-2021 goes into effect on 1/1/2024 which will be the effective date for the IECC 2024 standard.

Bibliography:

Editorial updates

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

No cost impact

CE2D-21-23

CE2D-22-23

IECC CE: C403.4.6

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com); James Yeoman, representing City of Orem (jlyeoman@orem.org); Vladimir Kochkin, representing NAHB (vkochkin@nahb.org)

2024 International Energy Code[CE Project] R3

Revise as follows:

C403.4.6 Demand responsive controls.

Electric heating and cooling systems shall be provided with demand responsive controls capable of executing the following actions in response to a *demand response signal*:

1.	Automatically increasing the *zone* operating cooling set point by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C), and 4°F (2°C).
2.	Automatically decreasing the *zone* operating heating set point by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C), and 4°F (2°C).

Where a *demand response signal* is not available the heating and cooling system controls shall be capable of performing all other functions. Where thermostats are controlled by direct digital control including, but not limited to, an energy management system, the system shall be capable of *demand responsive control* and capable of adjusting all thermal set-points to comply. The demand responsive controls shall comply with either Section C403.4.6.1 or Section C403.4.6.2
Exceptions:

1.	Group I occupancies
2.	Group H occupancies
3.	Controls serving *data center* systems
4.	Occupancies or applications requiring precision in indoor temperature control as *approved* by the *code official*
5.	Buildings that comply with Load Management measure G02 in Section C406.3.3
<u>6.</u>	<u>Group R-2 occupancies.</u>

Reason Statement:

Demand responsive controls – a component of grid-interactive efficient buildings (GEBs) - are intended to manage electric grid operations. They directly benefit electric utility (EU) operators, allowing them to manage demand and costs.

In many locations EUs have automatic demand responsive (ADR) programs whereby the EU pays building owners to install and use demand responsive controls for HVAC systems. The EUs do this because it benefits their businesses. The controls can also benefit building owners who opt into the program by aligning their demand for electricity with optimal times for rate and lowering their overall demand.

Nominally, even EU customers who do not participate in ADR programs still benefit because – theoretically – the reduced operating costs of the EU can be passed on in the form of lower rates for all customers. This is fair, because all EU customers pay the fares that are used to subsidize the ADR program.

This is equity – everyone pays and everyone benefits.

This is also how a market works. Vendors incent actions on the part of purchasers, so the vendor can be more efficient and more profitable.

In some places the EU does not have an ADR program and it does not incentivize its customers to provide and install ADR controls because that would be a waste of the EU's money. Generally, wasting money is considered a bad thing.

It is disappointing then, that the IECC-C consensus committee is proposing to waste the money of every building owner who is required by Section C403.4.6 to install demand responsive controls even where no ADR program exists.

According to PNNL, *" … the incremental cost of upgrading from a standard programmable thermostat to a smart thermostat with DR controls is anywhere between $100 and $200."*[1] (Digression; thermostats are easily replaced in the future, no reconstruction of a building is needed). In a 200-unit apartment or condominium building, where no ADR program exists, $20,000 to $40,000 would be wasted on demand responsive controls required by the 2024 IECC.

It is not equity to make people pay for things they do not receive.

It is also not equity for the IECC-C to require the owners of new buildings to provide and install demand responsive controls when the existing building owners in the EU service area were paid by the EU to install and use those ADR controls.

In this case, the owners of a new 200-unit affordable housing complex could be spending the aforementioned $20,000 to $40,000 for the demand responsive controls required by the IECC-C while the existing luxury condominiums just down the road have had those same controls paid for by the EU, which will pass those costs on to all customers in the service area – including the owners of new buildings who are required to provide their own controls, but must also pay the EU's rates into which the costs of subsidizing owners' abilities to participate in the ADR program were factored.

That is the opposite of equity – paying to put in demand responsive controls in your own building and paying a higher EU rate to pay for the demand responsive controls that went into someone else's building.

If everyone will benefit from demand responsive controls,[2] then everyone should pay for demand responsive controls, (equity, right?), and the only two mechanisms that can make that work are taxes or the rates paid by EU customers. Neither of these mechanisms are the purview of an energy code development committee.

Frankly, the IECC-C is in an ethically remote location on this topic.

Whether it's the number of votes on the consensus committee by EUs, the electric industry broadly, and general interests who are contractors or grantees of EUs, or the end-justifies-the-means approach taken by the Department of Energy and its contractors on grid management, there are too many folks willing to do some wrong to try and create a right.

That is wrong.

This comment will be resolved by adding an exception for R-2 occupancies to Section C403.4.6. Note that many of the reasons the original proponents of these provisions gave for excepting Group I occupancies can be applicable in R-2 occupancies. This proposed resolution is consistent with the original reason for the requirements.

[1] https://www.energycodes.gov/sites/default/files/2021-10/TechBrief_GEB_Oct2021.pdf

[2] https://gebroadmap.lbl.gov/A%20National%20Roadmap%20for%20GEBs%20-%20Final.pdf

Cost Impact:

The code change proposal will decrease the cost of construction.

This will return the decision as to whether ADR controls will be provided to the dwelling unit owner, which is the only equitable position.

CE2D-22-23

CE2D-23-23

IECC CE: C403.7.1

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C403.7.1 Demand control ventilation.

Demand control *ventilation* (DCV) shall be provided for the following:

1.	Spaces with *ventilation* provided by single-zone systems where an air-side economizer is provided in accordance with Section C403.5.
2.	Spaces larger than 250 square feet (23.2 m^2) in climate zones 5A, 6, 7, and 8 and spaces larger than 500 square feet (46.5 m^2) in other climate zones which have a design occupant load of 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 are served by systems with one or more of the following: 2.1 An air-side economizer. 2.2 Automatic modulating control of the outdoor air damper. 2.3 A design outdoor airflow greater than 3,000 cfm (1416 L/s)

Exceptions:

1.	Spaces served by systems with energy recovery in accordance with Section C403.7.4.2 and that have a floor area less than: 1.1 6000 square feet (2600 m^2) in climate zone 3C. 1.2 2000 square feet (190 m^2) in climate zones 1A, 3B, and 4B. 1.3 1000 square feet (90 m^2) in climate zones 2A, 2B, 3A, 4A, 4C, 5 and 6. 1.4 400 square feet (40 m^2) in climate zones 7 and 8.
2.	Multiple-zone systems without direct digital control of individual zones communicating with a central control panel.
3.	Spaces served by multiple-zone systems with a system design outdoor airflow less than 750 cfm (354 L/s).

<table>
<tr><td>4.</td><td colspan="2">Spaces where more 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.</td></tr>
<tr><td>5.</td><td colspan="2">Spaces with one of the following occupancy classifications as defined in Table 403.3.1.1 of the International Mechanical Code: correctional cells, education laboratories, barber, beauty and nail salons, and bowling alley seating areas.</td></tr>
<tr><td>6.</td><td colspan="2">Spaces where the registered design professional <s>demonstrates</s> <u>provides </u>an engineered ventilation system design that <s>complies with the following</s>:
<table><tr><td>6.1</td><td><s>It prevents</s> <u>Prevents</u> the maximum concentration of contaminants from <s>exceeding</s> <u>being more than </u>that obtainable by the required rate of outdoor air ventilation, and</td></tr><tr><td>6.2</td><td><s>It allows</s> <u>Allows </u>the required minimum design rate of outdoor air to be reduced by no less than 15 percent.</td></tr></table></td></tr>
</table>

Reason Statement:

This may require further edits with SME input.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Editorial

CE2D-23-23

CE2D-24-23

IECC CE: C403.7.8, C403.7.8.1

Proponents:

Michael Jouaneh, representing Lutron Electronics Co., Inc. (mjouaneh@lutron.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C403.7.8 Occupied standby controls.

Occupied-standby controls, in accordance with C403.7.8.1, shall be required for each *zone* of a system ~~that complies with~~ in the following spaces:

~~1.~~	~~All spaces served by the *zone* are required to have occupant sensor lighting controls in accordance with C405.2.1.~~
~~2.~~	~~ASHRAE Standard 62.1 Ventilation Rate Procedure allows the ventilation air to be reduced to zero in all spaces served by the zone during occupied standby mode. Spaces meeting these criteria include:~~

~~2.~~1	Post-secondary classrooms/lecture/training rooms
~~2.~~2	Conference/meeting/multipurpose rooms
~~2.~~3	Lounges/breakrooms
~~2.~~4	Enclosed offices
~~2.~~5	Open plan office areas
~~2.~~6	Corridors

Exception: Zones that are part of a Multiple zone system without *automatic* zone flow control dampers.

C403.7.8.1 Occupied Standby Zone Controls.

Within five (~~5~~20) minutes of all spaces in that *zone* entering *occupied-standby mode*, the *zone* control shall operate as follows:

1.	Active heating set point shall be setback by not less than 1°F (0.55°C).
2.	Active cooling set point shall be setup by not less than 1°F(0.55°C).
3.	All airflow supplied to the *zone* shall be shut off whenever the space temperature is between the active heating and cooling set points.
4.	Multiple *zone* systems shall comply with C403.7.8.1.1

Reason Statement:

This suggestion provides clarity for the project team to determine which spaces that are the ones where occupied standby controls would be required by simply listing the spaces not referring to another standard and another section of this code for the project team to determine which spaces would need this functionality. Also changing within 5 minutes to within 20 minutes aligns with the lighting control requirements. If the timeout periods are aligned, it will make it easier for the mechanical system to use the information from the lighting control system if needed.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

No change to cost effectiveness.

CE2D-24-23

CE2D-25-23

IECC CE: C403.7.8

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C403.7.8 Occupied standby controls.

Occupied-standby controls, in accordance with C403.7.8.1, shall be required for each *zone* of a system that complies with the following:

1.	All spaces served by the *zone* are required to have occupant sensor lighting controls in accordance with <u>Section</u> C405.2.1.
2.	~~ASHRAE Standard 62.1 Ventilation Rate Procedure allows the ventilation air to be reduced to zero in all spaces served by the zone during occupied standby mode. Spaces meeting these criteria include:~~

~~2.1~~	~~Post-secondary classrooms/lecture/training rooms~~
~~2.2~~	~~Conference/meeting/multipurpose rooms~~
~~2.3~~	~~Lounges/breakrooms~~
~~2.4~~	~~Enclosed offices~~
~~2.5~~	~~Open plan office areas~~
~~2.6~~	~~Corridors~~

~~**Exception:** Zones that are part of a Multiple zone system without *automatic* zone flow control dampers.~~

Reason Statement:

Item 2 does not contain a requirement; it's all explanatory material.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Primarily editorial.

CE2D-25-23

CE2D-26-23

IECC CE: TABLE C404.2

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

TABLE C404.2 MINIMUM PERFORMANCE OF WATER-HEATING EQUIPMENT
For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2, °C = [(°F) – 32]/1.8, 1 British thermal unit per hour = 0.2931 W, 1 gallon = 3.785 L, 1 British thermal unit per hour per gallon = 0.078 W/L.

a. Thermal efficiency (Et) is a minimum requirement, while standby loss is a maximum requirement. In the standby loss equation, V is the rated volume in gallons and Q is the nameplate input rate in Btu/h. Vm is the measured volume in the tank in gallons. Standby loss for electric water heaters is in terms of %/h and denoted by the term “S,” and standby loss for gas and oil water heaters is in terms of Btu/h and denoted by the term “SL” Draw pattern (DP) refers to the water draw profile in the Uniform Energy Factor (UEF) test. UEF and Energy Factor (EF) are minimum requirements. In the UEF standard equations, Vr refers to the rated volume in gallons.
b. Chapter 6 contains a complete specification, including the year version, of the referenced test procedure.
c. A tabletop water heater is a storage water heater that is enclosed in a rectangular cabinet with a flat top surface not more than three feet (0.91 m) in height and has a ratio of input capacity (Btu/h) to tank volume (gal) < 4000.
d. Water heaters or gas pool heaters in this category are regulated as consumer products by the USDOE as defined in 10 CFR 430.
e. Storage water heaters have a ratio of input capacity (Btu/h) to tank volume (gal)<4000.
f. Efficiency requirements for electric storage water heaters ≤ 12 kW apply to both electric resistance and heat pump water heaters. There are no minimum efficiency requirements for electric heat pump water heaters greater than 12kW or for gas heat pump water heaters.
g. A grid-enabled water heater is an electric resistance water heater that meets all of the following:
1. Has a rated storage tank volume of more than 75 gallons (284 L).
2. Is manufactured on or after April 16, 2015.
3. Is equipped at the point of manufacture with an activation lock.
4. Bears a permanent label applied by the manufacturer that complies with all of the following:
4.1 Is made of material not adversely affected by water.
4.2 Is attached by means of non-water soluble adhesive
4.3 Advises purchasers and end-users of the intended and appropriate use of the product with the following notice printed in 16.5 point Arial Narrow Bold font: "IMPORTANT INFORMATION: This water heater is intended only for use as a part of an electric thermal storage or demand response program. It will not provide adequate hot water unless enrolled in such a program and activated by your utility company or another program operator. Confirm the availability of a program in your local area before purchasing or installing this product."
h. Instantaneous water heaters and hot water supply boilers have an input capacity (Btu/h) divided by storage volume (gal) ≥ 4000 Btu/h-gal.
i. Electric instantaneous water heaters with input capacity >12 kW and ≤58.6 kW that have either (1) a storage volume >2 gal(7.6L); or (2) is designed to provide outlet hot water at temperatures greater than 180°F(82ºC); or (3) uses three-phase power has no efficiency standard.
j. Gas storage water heaters with input capacity >75,000 Btu/h (21.98 kW) and ≤105,000 Btu/h (30.77 kW) must comply with the requirements for the >105,000 Btu/h (30.77 kW) if the water heater either (1) has a storage volume >120 gal (454L); (2) is designed to provide outlet hot water at temperatures greater than 180°F (82ºC); or (3) uses three-phase power.
k. Refer to Section C404.2.1 for additional requirements for gas storage and instantaneous water heaters and gas hot-water supply boilers.l. Oil storage water heaters with input capacity>105,000 Btu/h (30.77 kW) and ≤140,000 Btu/h (41.03 kW) must comply with the requirements for the >140,000 Btu/h (41.03 kW) if the water heater either (1) has a storage volume > 120 gal(454L); (2) is designed to provide outlet hot water at temperatures greater than 180ºF (82ºC); or (3) uses three-phase power.
l.Water heaters and hot water supply boilers ~~having~~ <u>with</u> more than 140 gallons (530L) of storage capacity need not meet the standby loss requirement ~~if~~ <u>where</u>: (1) The tank surface area is thermally insulated to R-12.5 or more; (2) ~~a~~ <u>there is no </u>standing pilot light ~~is not~~

~~used~~; and (3) for gas or oil-fired ~~storage~~ water ~~heaers~~ heaters, ~~they have~~ the heater is equipped with a fire damper or fan-assisted combustion.

Reason Statement:

Editorial.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Editorial.

CE2D-26-23

CE2D-27-23

IECC CE: C404.2.1

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C404.2.1 High input service water-heating systems.

Gas-fired *water heaters* installed in new buildings where the total input capacity provided by *high-capacity gas-fired water heaters* is 1,000,000 Btu/h (293 kW) or greater shall comply with either or both of the following requirements.

1.	Where a singular piece of *high-capacity gas-fired water heater* is installed, the *water heater*
2.	Where multiple pieces of *high-capacity gas-fired water heaters* are connected to the same service water-heating system, the combined input-capacity-weighted-average thermal efficiency, Et, shall not be less than 90 percent and a minimum of 30 percent of the input to the *high-capacity gas-fired water heaters* in the service water-heating system shall have a thermal efficiency of not less than 92 percent.

Exceptions:

1.	The input rating of water heaters installed in individual dwelling units shall not be required to be included in the total input rating of service water-heating equipment for a *building*.
2.	The input rating of water heaters with an input rating of not greater than 105,000 Btu/h (30.8 kW) shall not be required to be included in the total input rating of service water-heating equipment for a *building*.
3.	~~Where not less than 25 percent of the annual service water heating requirement is provided by *on-site renewable energy* or site-recovered energy, the minimum thermal efficiency requirements of this section shall not apply. *On-site renewable energy* used to meet Sections C405.15.1 or C406.3.1 shall not be used to meet this exception.~~

Reason Statement:

Exception 3 is unjustified and is unenforceable since annual service water heater use is variable depending upon occupancy and the inability to monitor and control for energy source utilization over an annual cycle.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The change returns the requirements to enforceable provisions and does not affect cost of construction.

CE2D-27-23

CE2D-28-23

IECC CE: TABLE C403.3.2(6)

Proponents:

Richard Lord, representing Carrier Corporation (richard.lord@carrier.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

TABLE C403.3.2(6) GAS- AND OIL-FIRED BOILERS—MINIMUM EFFICIENCY REQUIREMENTS [i]
For SI: 1 British thermal unit per hour = 0.2931 W.

a.	Chapter 6 contains a complete specification of the referenced standards, which include test procedures, including the reference year version of the test procedure.
b.	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.
c.	E_c = Combustion efficiency (100 percent less flue losses).
d.	E_t = Thermal efficiency.
e.	Maximum capacity—minimum and maximum ratings as provided for and allowed by the unit's controls.
f.	Includes oil-fired (residual).
g.	Boilers shall not be equipped with a constant burning pilot light.
h.	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.
i.	<u>This table is a replica of ASHRAE 90.1 Table 6.8.1-6 Gas- and Oil-Fired Boilers—Minimum Efficiency Requirements</u>

Reason Statement:

The note i change is not needed as the date of 2/2/2022 is in the past.

Go back to the original text to reference ASHRAE 90.1-2022 but double check the formating.

Bibliography:

Proposed change is not required. It is in the past.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

No impact on cost.

CE2D-28-23

CE2D-29-23

IECC CE: C405.13.8

Proponents:

Bryan Holland, representing National Electrical Manufacturers Association (NEMA) (bryan.holland@nema.org)

2024 International Energy Code[CE Project] R3

Revise as follows:

C405.13.8 Plan for disclosure.

~~C405.13.8~~ C401.4 Plan for disclosure.
The plan for annual energy use data gathering and disclosure shall include the following:

<table>
<tr><td>1.</td><td>Property information including:<table><tr><td>1.1</td><td>Address</td></tr><tr><td>1.2</td><td>Gross floor area</td></tr><tr><td>1.3</td><td>Year occupied</td></tr><tr><td>1.4</td><td>Occupancy classifications, with respective floor areas</td></tr></table></td></tr>
<tr><td>2.</td><td>Total annual building site energy use by unit area as collected or documented through Section C405.13~~.5~~ and Section ~~C405.13.6~~ C403.18 sources, separated by energy type and fuel type.</td></tr>
<tr><td>3.</td><td>Annual site generated renewable energy by unit area .</td></tr>
</table>

Reason Statement:

Plan for disclosure section does not belong in the Energy Monitoring section because it has nothing to do with how energy is monitored. It is more appropriate to be in in the General (C401) section.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This is an editorial change.

CE2D-29-23

CE2D-30-23

IECC CE: C405.13.2, TABLE C405.13.2, C405.13.3, C405.13.5, C405.13.6, C405.13.7

Proponents:

Bryan Holland, representing National Electrical Manufacturers Association (NEMA) (bryan.holland@nema.org)

2024 International Energy Code[CE Project] R3

Revise as follows:

C405.13.2 End-use metering categories.

C405.13.2 End-use <u>electric</u> metering categories.
Meters or other *approved* measurement devices shall be provided to collect energy use data for each end-use category indicated in Table C405.13.2. 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 C405.13.2 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 (232 m^2) where a dedicated source meter complying with Section C405.13.3 is provided.

TABLE C405.13.2 ELECTRICAL ENERGY USE CATEGORIES
Portions of table not shown remain unchanged.

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 load	Any single load that is not included in an 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.
Electric vehicle charging	*Electric vehicle* charging loads that are powered through the *building*'s electrical service.

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.
Electric hot water heating for uses other than space conditioning	Electricity used to generate hot water. **Exception:** Electric water heating with design capacity that is less than 10 percent of building service rating

C405.13.3 Meters.

C405.13.3 Electrical 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 C405.13.4. Source meters shall be allowed to be any digital-type meter. Lighting, HVAC or other *building* systems that can self-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 C405.13.4 and C405.13.5.Non-intrusive load monitoring (NILM) packages that extract energy consumption data from detailed electric waveform analysis shall be permitted to substitute for individual meters if the equivalent data is available for collection in Section C405.13.4 and reporting in Section C405.13.5.

C405.13.5 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 electrical energy consumption for each end-use category required by Section C405.13.2 not less than every hour, day, month and year for the previous 36 months. ~~The graphical report shall incorporate natural gas interval data or the ability to enter gas utility bills into the report.~~

~~C405.13.6 Non-electrical energy~~.

~~Consumption of non-electrical fuel or energy sources including district heating or cooling shall be metered in accordance with Section C405.13.2 and C405.13.3.~~

C405.13.7 Renewable energy.

~~C405.13.7~~ C405.13.6 Renewable energy.

On-site electrical renewable energy sources shall be metered with not less reporting frequency than non-renewable energy systems in accordance with Section C405.13.3.

Reason Statement:

It is confusing and illogical to include non-electrical monitoring requirements embedded in the electrical monitoring requirements in the Electrical Power and Lighting Systems section. Including non-electrical metering requirements with the electrical requirements will make it difficult for the design, specification, construction, and AHJ professionals to use the code because they practice in different Master Specification divisions than the electrical professionals. The professionals practicing in the non-electrical division will not find the non-electrical monitoring requirements if they are placed in the Electrical Power and Lighting Systems section of the code. Therefore, the non-electrical monitoring requirements must be moved to another section.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This is an editorial change.

CE2D-31-23

IECC CE: C405.13.2, TABLE C405.13.2

Proponents:

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

2024 International Energy Code[CE Project] R3

Revise as follows:

C405.13.2 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 C405.13.2. 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 C405.13.2 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 (232 m^2) where a dedicated source meter complying with Section C405.13.3 is provided.

<u>4. Energy used to recharge or refuel vehicles that are used for on-road and off-site transportation purposes shall not be metered or shall be excluded from building energy usage summations, calculations, simulations, or analysis.</u>

TABLE C405.13.2 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 load	Any single load that is not included in an 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.
Electric vehicle charging	*Electric vehicle* charging loads <u>for on-site transportation purposes</u> that are powered through the *building*'s electrical service.

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.
Electric hot water heating for uses other than space conditioning	Electricity used to generate hot water. **Exception:** Electric water heating with design capacity that is less than 10 percent of building service rating

Reason Statement:

There is a difference between transportation energy used for building and *on-site* purposes (e.g., warehouse forklifts, mobility devices at health care facilities, mobile repair equipment, etc.) and transportation used for *off-site* purposes (commuter vehicles, fleet delivery vehicles, etc.). In the first case, the transportation energy is being used by the building for building functions. In the 2nd case, the building is merely purchasing the energy (electricity, natural gas, propane, gasoline, diesel fuel, etc.) and transferring the energy to the vehicle to be used off-site.

The energy being transferred is not being used by the energy and should not be metered or should be excluded from any calculations or analysis.

The proposed revised language will ensure that only energy used and controlled by the building is metered. The language will create consistency with the other codes and standards and is inclusive of all forms of transportation energy and associated emissions. Below are examples of how off-site transportation energy is excluded:

From ASHRAE 90.1-2022:
Chapter 12, Energy Cost Budget Method
"Exception to 12.5.1: Energy used to recharge or refuel vehicles that are used for off-site transportation purposes shall not be modeled for the *design energy cost* or the *energy cost budget*."

Normative Appendix G
"Exception to G1.2.2: Energy used to recharge or refuel vehicles that are used for off-site transportation purposes shall not be modeled in the *baseline building performance* or the *proposed building performance*."

From the International Energy Conservation Code 2021:
IECC 2021 Commercial Section C407 Total Building Performance
"C407.1 Scope. This section establishes criteria for compliance using total building performance. The following systems and loads shall be included...
Exception: Energy used to recharge or refuel vehicles that are used for on-road and off-site transportation purposes."

IECC 2021 Residential Section R406 Energy Rating Index
"R406.4 Energy Rating Index. The Energy Rating Index (ERI) shall be determined...
Energy used to recharge or refuel a vehicle used for transportation on roads that are not on the building site shall not be included in the ERI reference design or the rated design."

Bibliography:

ASHRAE 90.1-2022 (I-P) Standard 90.1-2022 (I-P Edition) -- *Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings,* January 2023, https://www.techstreet.com/ashrae/standards/ashrae-90-1-2022-i-p?product_id=2522082

International Code Council *2021 International Energy Conservation Code* (IECC), December 2020, https://shop.iccsafe.org/2021-international-energy-conservation-coder.html

Cost Impact:

The code change proposal will decrease the cost of construction.

This will reduce costs as the proposed change requires only on-site transportation energy is metered.

CE2D-31-23

CE2D-32-23

IECC CE: C405.13.2

Proponents:

Shannon Corcoran, representing American Gas Association (corcoransm@att.net)

2024 International Energy Code[CE Project] R3

Revise as follows:

C405.13.2 End-use <u>electric</u> metering categories.

Meters or other *approved* measurement devices shall be provided to collect energy use data for each end-use category indicated in Table C405.13.2. 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 C405.13.2 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 (232 m^2) where a dedicated source meter complying with Section C405.13.3 is provided.

Reason Statement:

These proposed revisions require sub-metering for both electric and gas utilities. Currently, most natural gas utilities throughout the United States will not be able to provide such “utility interval data” in the near future. Some natural gas utilities may be ready in the next few years to provide such hourly interval data.

Available natural gas submetering devices are usually not as sophisticated as standard utility metering devices, and they do not incorporate the necessary metering compensations. These simple submetering devices may not provide the very specific temperature / pressure / indexing corrections approved and required for all utility meters.

There may be significant discrepancies in meter readings between customer submeters and utility meters, thus creating confusion.

Lastly, the cost for customers to install natural gas submetering for hourly interval monitoring could be very expensive. Natural Gas submetering devices that can provide such interval monitoring are very sophisticated and expensive.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The proposal does not increase or decrease the cost of construction from the 2021 edition of the code

CE2D-33-23

IECC CE: C405.13.2, TABLE C405.13.2, C405.13.3, C405.13.6

Proponents:

Renee Lani, representing American Public Gas Association (rlani@apga.org)

2024 International Energy Code[CE Project] R3

Revise as follows:

C405.13.2 End-use electric metering categories.

Meters or other *approved* measurement devices shall be provided to collect energy use data for each end-use category indicated in Table C405.13.2. 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 C405.13.2 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 (232 m^2) where a dedicated source meter complying with Section C405.13.3 is provided.

TABLE C405.13.2 ELECTRICAL 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 load	Any single load that is not included in an 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.
Electric vehicle charging	*Electric vehicle* charging loads that are powered through the *building*'s electrical service.
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.

Electric hot water heating <u>for uses other than space conditioning</u>	Electricity used to generate hot water. **Exception:** Electric water heating with design capacity that is less than 10 percent of building service rating

C405.13.3 <u>Electrical</u> 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 C405.13.4. Source meters shall be allowed to be any digital-type meter. Lighting, HVAC or other *building* systems that can self-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 C405.13.4 and C405.13.5.Non-intrusive load monitoring (NILM) packages that extract energy consumption data from detailed electric waveform analysis shall be permitted to substitute for individual meters if the equivalent data is available for collection in Section C405.13.4 and reporting in Section C405.13.5.

C405.13.6 Non-electrical energy ~~metering~~.

Consumption of non-electrical fuel or energy sources including district heating or cooling shall be <u>automatically</u> metered ~~in accordance with Section C405.13.2 and C405.13.3.~~ <u>or a method developed for usage calculation annually or more frequently from energy bills. Natural gas usage shall be monitored through on site interval metering or from utility interval data, as available.</u>

Reason Statement:

APGA appreciates the opportunity to provide IECC-C Committee this input. APGA is the national trade association for approximately 1,000 communities across the U.S. that own and operate their own retail natural gas distribution entities. They include municipal gas distribution systems, public utility districts, county districts, and other public agencies, all locally accountable to the citizens they serve. Public gas systems focus on providing safe, reliable, resilient, and affordable natural gas service to their customers. APGA members serve their communities by providing sustainable and clean energy to be used for cooking, clothes drying, and space and water heating, as well as for various commercial and industrial applications.

APGA is very concerned with this proposal, as it assumes that all natural gas utilities have the same metering capabilities. APGA represents utilities of all shapes and sizes, and most of our members have not deployed advanced metering technology that can meter in the way the IECC hopes to collect data. Furthermore, because of their small size, APGA's members may not have the resources to help implement such metering programs. Instead, APGA suggests that the metering be limited to electric metering only, as advanced electric metering technology is much more prevalent these days.

Cost Impact:

The code change proposal will decrease the cost of construction.

This proposal will decrease the cost of construction, as it will not reduce the cost of metering equipment that may not even be permitted by law/regulation or useable by the local utility.

CE2D-33-23

CE2D-34-23

IECC CE: C405.13.3, C405.13.6

Proponents:

Kevin Duell, representing NW Natural (kevin.duell@nwnatural.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C405.13.3 Electrical 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 C405.13.4. Source meters shall be allowed to be any digital-type meter. Lighting, HVAC or other *building* systems that can self-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 C405.13.4 and C405.13.5.Non-intrusive load monitoring (NILM) packages that extract energy consumption data from detailed electric waveform analysis shall be permitted to substitute for individual meters if the equivalent data is available for collection in Section C405.13.4 and reporting in Section C405.13.5.

C405.13.6 Non-electrical energy.

Consumption of non-electrical fuel or energy sources including district heating or cooling shall be metered in accordance with Section C405.13.2 and C405.13.3, or by a method developed for usage calculation annually or more frequently from energy bills.

Reason Statement:

The predominant, standard meter type – the 'diaphragm' meter – typically has a minimum resolution of about 1 therm. That might provide hourly data for a large building but could leave a smaller building with a longer interval. Rotary meters can have finer resolution, but they have minimum flow requirements that are too high for small loads, again leaving out smaller buildings.

Simple gas submeters aren't as accurate as standard utility meters. Combining these with standard utility meters could lead to discrepancies between the two types of meters, leaving building owners with no useful information.

Also, natural gas submetering costs more than standard utility metering.

For these reasons, please revert changes added from CED1-30-22 as indicated in the changes from this proposal.

Cost Impact:

The code change proposal will decrease the cost of construction.

Gas submeters can be expensive, so this will lower the cost of construction.

CE2D-34-23

CE2D-35-23

IECC CE: SECTION C401

Proponents:

quincy davis, representing Weifield Group (quincyd@mac.com)

2024 International Energy Code[CE Project] R3

SECTION C401 — GENERAL

Reason Statement:

By adjusting the minimum requirement to 16 amps, the owner gains flexibility in providing car charging services to employees while avoiding excessive power consumption and the associated costs of electrical vehicle charging. This modification allows for a more balanced approach, offering a suitable charging solution that meets the needs of users without incurring unnecessary expenses related to higher amperage charging stations.

Bibliography:

My Name is Quincy Davis and I am the person who researched this topic and the ideas are my own.

Cost Impact:

The code change proposal will decrease the cost of construction.

This proposal offers both cost savings and power efficiency, providing relief to an already burdened power grid.

Through comprehensive analysis using our estimating software, I have evaluated various scenarios and determined potential construction savings ranging from 50% to 65%. Additionally, the power consumption can be reduced by approximately 66%.

The construction savings can be attributed to several factors:

1. Smaller transformers: With the lower ampere requirement, smaller transformers can be utilized, resulting in reduced costs.
2. Smaller electrical distribution equipment: The need for smaller electrical distribution equipment arises from the lower ampere rating, leading to cost savings in this area.
3. Smaller copper wire size: The reduced amperage allows for the use of smaller copper wire sizes, which can significantly lower material costs.
4. Smaller raceways: As the ampere requirement decreases, smaller raceways can be employed, resulting in cost savings during installation.

Furthermore, by transitioning from 40-amp dual head chargers (priced between $5,000 and $12,000) to 16-amp dual head chargers (priced between $2,000 and $6,000), significant cost savings can be achieved.

From the consumer perspective, this change yields power consumption reduction and subsequent savings on utility bills.

Overall, this proposal not only reduces construction costs but also promotes power efficiency, resulting in benefits for both building owners and consumers..

CE2D-35-23

CE2D-36-23

IECC CE: C405.14.5

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code[CE Project] R3

Delete without substitution:

~~C405.14.5 System and circuit capacity~~.

~~The system and circuit capacity shall comply with C405.14.5.1 and C405.14.5.2.~~

Reason Statement:

Requirements for electrical system capacity to serve EV charging goes beyond minimum building energy requirements presents multiple problems:

- It addresses an intent to facilitate EV charging, which is not contributing to building energy savings,
- It would subsidize non-building energy use (without address end use efficiency),
- If EV charging is implemented, it would increase building energy consumption and full fuel cycle energy consumption from the electrical grid upstream and increase associated full fuel cycle emission.
- If EV charging is not implemented, it would impose stranded asset costs and increase overall building costs unnecesarily.

These requirements do not belong in a minimum energy efficiency code and would be more properly proposed to a “stretch” or “green” building code.

Cost Impact:

The code change proposal will decrease the cost of construction.

Deletion of these requirements will reduce construction costs and avoid potential stranded asset costs where EV charging at the building is not implemented.

CE2D-36-23

CE2D-37-23 Part I

IECC CE: C405.14.5.2

Proponents:

quincy davis, representing Weifield Group (quincyd@mac.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C405.14.5.2 Circuit Capacity.

The branch circuit serving each EV capable space, EV ready space, and EVSE space shall comply with one of the following:

1.	Have a rated capacity not less than ~~15~~ 16 amperesor the nameplate rating of the equipment, whichever is larger .
2.	Meets the requirements of Section C405.14.5.3.2.

CE2D-37-23 Part I

CE2D-37-23 Part II

IECC RE: R404.7.4, R404.7.5

Proponents:

quincy davis, representing Weifield Group (quincyd@mac.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R404.7.4 EVSE spaces.

An installed *EVSE* with multiple output connections shall be permitted to serve multiple *EVSE spaces*. Each *EVSE* serving either a single *EVSE space* or multiple *EVSE spaces* shall comply with the following:

1.	Be served by an electrical distribution system in accordance with Section R404.7.5
2.	Have a nameplate charging capacity of not less than ~~6.2~~3.3 kVA (or ~~30~~16A at 208/240V) per *EVSE space* served. Where an *EVSE* serves three or more *EVSE spaces* and is controlled by an energy management system in accordance with Section R404.7.5, the nameplate charging capacity shall be not less than 2.1 kVA per *EVSE space* served.
3.	Be located within 6 feet (1828 mm) of each *EVSE space* it serves.
4.	Be installed in accordance with NFPA 70 and be *listed* and *labeled* in accordance with UL 2202 or UL 2594.

R404.7.5 Electrical distribution system capacity.

The branch circuits and electrical distribution system serving each *EV capable space, EV ready space* and *EVSE space* used to comply with Section R404.7.1 comply with one of the following:

1.	Sized for a calculated EV charging load of not less than ~~6.2~~3.3 kVA per *EVSE, EV ready*, or *EV capable space*. Where a circuit is shared or managed it shall be in accordance with NFPA 70.
2.	The capacity of the electrical distribution system and each branch circuit serving multiple *EVSE spaces, EV ready spaces*, or *EV capable spaces* designed to be controlled by an energy management system in accordance with NFPA 70, shall be sized for a calculated EV charging load of not less than 2.1 kVA per space. Where an energy management system is used to control EV charging loads for the purposes of this section, it shall not be configured to turn off electrical power to *EVSE* or *EV ready spaces* used to comply with Section R404.7.1.

Reason Statement:

By adjusting the minimum requirement to 16 amps, the owner gains flexibility in providing car charging services to employees while avoiding excessive power consumption and the associated costs of electrical vehicle charging. This modification allows for a more balanced approach, offering a suitable charging solution that meets the needs of users without incurring unnecessary expenses related to higher amperage charging stations.

Cost Impact:

The code change proposal will decrease the cost of construction.

The code change proposal will decrease the cost of construction.

This proposal offers both cost savings and power efficiency, providing relief to an already burdened power grid.

Through comprehensive analysis using our estimating software, I have evaluated various scenarios and determined potential construction savings ranging from 50% to 65%. Additionally, the power consumption can be reduced by approximately 66%.

The construction savings can be attributed to several factors:

1. Smaller transformers: With the lower ampere requirement, smaller transformers can be utilized, resulting in reduced costs.
2. Smaller electrical distribution equipment: The need for smaller electrical distribution equipment arises from the lower ampere rating, leading to cost savings in this area.
3. Smaller copper wire size: The reduced amperage allows for the use of smaller copper wire sizes, which can significantly lower material costs.
4. Smaller raceways: As the ampere requirement decreases, smaller raceways can be employed, resulting in cost savings during installation.

Furthermore, by transitioning from 40-amp dual head chargers (priced between $5,000 and $12,000) to 16-amp dual head chargers (priced between $2,000 and $6,000), significant cost savings can be achieved.

From the consumer perspective, this change yields power consumption reduction and subsequent savings on utility bills.

Overall, this proposal not only reduces construction costs but also promotes power efficiency, resulting in benefits for both building owners and consumers..

CE2D-37-23 Part II

CE2D-38-23

IECC CE: C405.16.2.4

Proponents:

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

2024 International Energy Code[CE Project] R3

Revise as follows:

C405.16.2.4 ESS-ready minimum system capacity.

Compliance with ESS-ready requirements in Sections C405.16.2.1 through C405.16.2.3 shall be based on a minimum total energy capacity and minimum rated power capacity as follows:

1.	ESS rated energy capacity (kWh) ≥ gross *conditioned floor area* of the three largest floors (ft^2) x 0.0008 kWh/ft^2
2.	ESS rated power capacity (~~kWh~~ <u>kW</u>) ≥ gross *conditioned floor area* of the three largest floors (ft^2) x 0.0002 ~~kWh~~ <u>kW</u>/ft^2

Reason Statement:

This proposed change corrects the units used in the equation (kW is the correct unit for power, as kWh is the unit of energy).

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This is only an editorial correction.

CE2D-38-23

CE2D-39-23

IECC CE: C405.2.1 (New)

Proponents:

Aaron McEwin, representing Jordan & Skala Engineers (amcewin@jordanskala.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C405.2.1 Occupant sensor controls.

Occupant sensor controls shall be installed to control lights in the following space types:

1.	Classrooms/lecture/training rooms.
2.	Conference/meeting/multipurpose rooms.
3.	Copy/print rooms.
4.	Lounges/breakrooms.
5.	Enclosed offices.
6.	Open plan office areas.
7.	Restrooms.
8.	Storage rooms.
9.	Locker rooms.
~~10.~~	~~Corridors~~
~~11~~10.	Warehouse storage areas.
~~12~~11.	Other spaces 300 square feet (28 m^2) or less that are enclosed by floor-to-ceiling height partitions.

Reason Statement:

Corridor and Exit Passageway are defined in the 2021 International Building Code.

Corridor. An enclosed exit access component that defines and provides a path of egress.

Exit Passageway. An exit component that is separated from other interior spaces of a building or structure by fire-resistance construction and opening protectives, and provides for a protected path of egress travel in a horizontal direction to an exit or the exit discharge.

This is in conflict with C405.2 Exception 2. Interior exit stairways, interior exit ramps and exit passageways.

Bibliography:

2021 International Building Code - Definitions 'Corridor' and 'Exit Passageway'

Cost Impact:

The code change proposal will decrease the cost of construction.

This will decrease the need for occupancy controls in corridors, thus reducing construction cost.

CE2D-39-23

CE2D-40-23

IECC CE: C405.2.10.1, C405.2.10.2

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C405.2.10.1 Sleeping units and dwelling units in hotels, motels, and vacation timeshare properties.

Sleeping units and dwelling units in hotels, motels and vacation timeshare properties shall be provided with the following:

1.	~~At least~~ Not less than two 125V, 15- and 20- amp switched receptacles ~~per~~ in each room, except for bathrooms, kitchens, foyers, hallways, and closets.
2.	Lighting controls that automatically turn off all lighting and switched receptacles within 20 minutes after all occupants have left the unit.

Exception: *Automatic* shutoff is not required where *captive key override* controls all lighting and switched receptacles in units with 5 or fewer permanently installed lights and switched receptacles.

C405.2.10.2 Sleeping units in congregate living facilities.

Sleeping units in congregate living facilities shall be provided with the following controls:

1.	Lighting in bathrooms shall be controlled by an *occupant sensor control* that automatically turns lights off within 20 minutes after all occupants have left the space.
2.	Each unit shall have a *manual* control by the entrance that turns off all lighting and switched receptacles in the unit, except for lighting in bathrooms and kitchens. The *manual* control shall be clearly *labeled*.

Reason Statement:

Item 1 = editorial. Item 2 = mitigating a hazardous condition.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

No additional requirements proposed.

CE2D-40-23

CE2D-41-23

IECC CE: C405.2.10.2

Proponents:

Bryan Holland, representing National Electrical Manufacturers Association (NEMA) (bryan.holland@nema.org)

2024 International Energy Code[CE Project] R3

Revise as follows:

C405.2.10.2 Sleeping units in congregate living facilities.

Sleeping units in congregate living facilities shall be provided with the following controls:

1.	Lighting in bathrooms shall be controlled by an *occupant sensor control* that automatically turns lights off within 20 minutes after all occupants have left the space.
2.	Each unit shall have a *manual* control by the entrance that turns off all lighting and switched receptacles in the unit, except for lighting in bathrooms. The *manual* control shall be ~~clearly labeled~~ *permanently marked*.

Reason Statement:

The term "labeled" is a defined term that is not used in this context. Changing to "permanently marked" is consistent with other codes in identifying the purpose of a device's function. This fixes the issue of the subjectivity of using the word "clearly".

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This change is editorial in nature.

CE2D-41-23

CE2D-42-23

IECC CE: C405.2.3.1

Proponents:

Michael Jouaneh, representing Lutron Electronics Co., Inc. (mjouaneh@lutron.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C405.2.3.1 Dimming control function.

Spaces required to have dimming control shall be provided with *manual* controls that allow lights to be dimmed from full output to 10 percent of full power or lower with continuous dimming, as well as turning lights off. *Manual* control shall be provided within each room to dim lights.

~~**Exception:** *Manual* dimming control is not required in spaces where *high-end trim* lighting controls are provided with comply with the following:~~

Reason Statement:

Removing the exception would save more energy as dimmers save energy beyond the energy savings from high-end trim. High-end trim caps the lighting below full light output, typically set to 80% of full light output savings 20% in lighting energy (and occupants cannot detect the lower lighting level as the first 20% of lights dimming from 100% full light output is not noticeable by the human eye). When dimmers are used in spaces that have a high-end trim (this is very common), they allow the occupants to adjust the lighting levels to what's appropriate for the task at hand, from the high-end trim level to OFF. This will allow for additional energy savings beyond high-end trim. The more you dim, the more you save.

Cost Impact:

The code change proposal will decrease the cost of construction.

This will decrease the cost of construction as the cost of suppling dimmers is less expensive than the cost of lighting control system that can provide high-end trim.

CE2D-42-23

CE2D-43-23

IECC CE: C405.2.3.1

Proponents:

Michael Jouaneh, representing Lutron Electronics Co., Inc. (mjouaneh@lutron.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C405.2.3.1 Dimming control function.

Spaces required to have dimming control shall be provided with *manual* controls that allow lights to be dimmed from full output to 10 percent of full power or lower with continuous dimming, as well as turning lights off. *Manual* control shall be provided within each room to dim lights.

Exception: *Manual* dimming control is not required in spaces where *high-end trim* lighting controls are provided which comply with section C408.3.1.4.

Reason Statement:

I prefer the exception be removed entirely as it eliminates the use of additional energy savings from using dimmers in these spaces. But if this exception remains in the code, it should be fixed so that the high-end trim is set up per section C408.3.1.4. I think this was an error in the PDC1 draft.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

no change.

CE2D-43-23

CE2D-44-23

IECC CE: C405.2.8

Proponents:

Tim Peglow, representing self (tpeglow@mdanderson.org)

2024 International Energy Code[CE Project] R3

Revise as follows:

C405.2.8 Demand responsive lighting controls.

Interior general lighting in group B, E, M, and S occupancies shall have demand responsive controls complying with C405.2.8.1 in not less than 75 percent of the interior floor area.

Exceptions:

1.	Where the combined interior floor area of group B, E, M, and S occupancies is less than 10,000 square feet.
2.	*Buildings* where a *demand response signal* is not available from a controlling entity other than the *owner*.
3.	Parking garages 4. Ambulatory Care Facilities

Reason Statement:

Ambulatory care facilities by the nature of the care delivered should be exempt from demand response programs for lighting. Ambulatory surgery lighting should not be reduced due to a demand response event.

Cost Impact:

The code change proposal will decrease the cost of construction.

This added exemption will reduce cost of construction in an ambulatory surgery facility.

CE2D-44-23

CE2D-45-23

IECC CE: C405.2.8, C405.2.8.1

Proponents:

Harold Jepsen, representing Legrand (harold.jepsen@legrand.us)

2024 International Energy Code[CE Project] R3

Revise as follows:

C405.2.8 Demand responsive lighting controls.

Interior *general lighting* in group B, E, M, and S occupancies shall have *demand responsive controls* complying with C405.2.8.1 in not less than 75 percent of the interior floor area.

Exceptions:

1.	*Buildings* where ~~Where~~ the combined interior floor area ~~of group B,E,M, and S occupancies~~ is less than 10,000 square feet.
2.	*Buildings* where a *demand response signal* is not available from a controlling entity other than the *owner*.
3.	Parking garages

C405.2.8.1 Demand responsive lighting controls function.

Demand responsive controlled lighting ~~controls~~ shall be capable of the following:

1.	Automatically reducing the output of ~~demand responsive~~ controlled lighting to 80 percent or less of full power or light output upon receipt of a *demand response signal*.
2.	Where *high-end trim* has been set, automatically reducing the output of controlled lighting to 80 percent or less of the *high-end trim* set point upon receipt of a *demand response signal*.
3.	Dimming controlled lighting~~s~~ gradually and continuously over a period of not longer than 15 minutes to ~~get to~~achieve their demand response setpoint.
4.	Returning controlled lighting~~s~~ to their normal operational settings at the end of the *demand response signal*~~event~~.

Exception: Warehouse and retail *building* storage ~~*building*~~ areas shall be permitted to switch off 25 percent or more of *general lighting* power rather than dimming.

Reason Statement:

These changes are editorial to provide greater clarity to the provision requirements. These changes align language with defined terms, removes language redundancy, italicizes defined terms, and improves parallel language structure for clarity. The stringency, intent or application of the code is not altered with these changes.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

These changes are editorial and for greater clarity.

CE2D-45-23

CE2D-46-23

IECC CE: C405.2.8

Proponents:

Glenn Heinmiller, representing International Association of Lighting Designers (glenn@lampartners.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C405.2.8 Demand responsive lighting controls.

Interior general lighting in group B, E, M, and S occupancies shall ~~have~~ be controlled by demand responsive controls complying with C405.2.8.1 that control the lighting in not less than 75 percent of the interior floor area.

Exceptions:

1.	Where the combined interior floor area of group B, E, M, and S occupancies is less than 10,000 square feet.
2.	*Buildings* where a *demand response signal* is not available from a controlling entity other than the *owner*.
3.	Parking garages

Reason Statement:

This is an editorial revision for clarity.

1. The general lighting does not "have" controls. It is controlled by the controls.
2. The controls are not "in" the floor area. They are controlling the lighting in the floor area.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

editorial change for clarity

CE2D-46-23

CE2D-47-23

IECC CE: C405.3.1

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C405.3.1 Total connected interior lighting power.

The total connected interior lighting power shall be determined in accordance with Equation 4-9.

$$TCLP = [LVL + BLL + LED + TRK + Other]$$

(Equation 4-9)
where:

TCLP = Total connected lighting power (watts).

LVL = For luminaires with lamps connected directly to *building* power, such as line voltage lamps, the rated wattage of the lamp.

BLL = For luminaires incorporating a ballast or transformer, the rated input wattage of the ballast or transformer when operating that lamp.

LED = For light-emitting diode luminaires with either integral or remote drivers, the rated wattage of the luminaire.

TRK = For lighting track, cable conductor, rail conductor, and plug-in busway systems that allow the addition and relocation of luminaires without rewiring, the wattage shall be one of the following:

1.	The specified wattage of the luminaires, but not less than 8 W per linear foot (25 W/lin m).
2.	The wattage limit of the permanent current-limiting devices protecting the system.
3.	The wattage limit of the transformer supplying the system.

Other = The wattage of all other luminaires and lighting sources not covered previously and associated with interior lighting verified by data supplied by the manufacturer or other *approved* sources.

The connected power associated with the following lighting equipment and applications is not included in calculating total connected lighting power.

1.	Emergency lighting that is automatically off during normal operations.
2.	Lighting in spaces specifically designed for use by occupants with special lighting needs, including those with visual impairment and other medical and age-related issues.
3.	Mirror lighting in makeup or dressing areas used for video broadcasting, video or film recording, or live theatrical and music performance.

4.	Task lighting for medical and dental purposes that is in addition to *general lighting*.
5.	Display lighting for exhibits in galleries, museums and monuments that is in addition to *general lighting*.
6.	Lighting in any location that is specifically used for video broadcasting, video or film recording, or live theatrical and music performance.
7.	Lighting for photographic processes.
8.	Lighting integral to equipment or instrumentation and installed by the manufacturer.
9.	Task lighting for plant growth or maintenance.
10.	Advertising signage or directional signage.
11.	Lighting for food warming.
12.	Lighting equipment that is for sale.
13.	Lighting demonstration equipment in lighting education facilities.
14.	Lighting *approved* because of safety considerations.
15.	Lighting in retail display windows, provided that the display area is enclosed by ceiling-height partitions.
16.	Furniture-mounted supplemental task lighting that is controlled by automatic shutoff.
17.	Exit signs.
18.	Antimicrobial lighting used for the sole purpose of disinfecting a space.
19.	Lighting in sleeping units and dwelling units.
20.	For exit access and exit stairways, ~~exit stairways~~ ~~and their~~ including landings, where the applicable ~~building~~ code ~~or life safety code~~ requires ~~a minimum~~ an illuminance of 10 footcandles or more on the walking surface, the power in excess of the allowed power calculated according to C405.3.2.2, is not included.

Reason Statement:

Edited for clarity.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Editorial.

CE2D-48-23

IECC CE: C405.3.3

Proponents:

Michael Jouaneh, representing Lutron Electronics Co., Inc. (mjouaneh@lutron.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C405.3.3 Lighting power for sleeping units and dwelling units.

Sleeping units in Group I-2 occupancies that are patient rooms shall comply with C405.3.1 and C405.3.2. For all other sleeping units and dwelling units, permanently installed lighting including lighting integrated into range hoods and exhaust fans, shall be provided by lamps <u>capable of operating</u> with an efficacy of not less than 65 lm/W or luminaires <u>capable of operating</u> with an efficacy of not less than 45 lm/W.

Exceptions:

1.	Lighting integral to other appliances.
2.	Antimicrobial lighting used for the sole purpose of disinfecting.
3.	Luminaires with an input rating of less than 3W.

Reason Statement:

Efficacy changes in most light sources depending on the setting the lighting is operating in. Most lighting is dimmable (changes in intensity), and some allow for changes in color temperature and/or hue (e.g., color tunable lighting that can change the lighting from white light to red or blue etc.). Efficacy of the lighting changes depending on these settings. Particularly with color tunable lighting, which can meet the efficacy thresholds when operating in white but may be below the threshold when operating in a specific color like blue. So, this added phrase "capable of operating" allows dynamic lighting to comply especially color tunable lighting. Also, this change will make the commercial code consistent with the residential code for this same requirement.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Editorial.

CE2D-48-23

CE2D-49-23

IECC CE: C405.3.3

Proponents:

Mike Moore, representing Broan-NuTone (mmoore@statorllc.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C405.3.3 Lighting power for sleeping units and dwelling units.

~~No less than 90 percent of the permanently~~ Sleeping units in Group I-2 occupancies that are patient rooms shall comply with C405.3.1 and C405.3.2. For all other sleeping units and dwelling units, permanently installed lighting serving sleeping units and dwelling units ~~including lighting integrated into range hoods and exhaust fans~~, 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.

Exceptions:

1.	~~Lighting integral to other appliances a kitchen appliance or exhaust hood~~ Appliance lamps.
2.	Antimicrobial lighting used for the sole purpose of disinfecting.
3.	General service lamps complying with DOE 10 CFR 430.32.
~~3~~4.	Luminaires with a ~~an~~ rated electrical input ~~rating~~ of not greater than 3.0 watts ~~Watts~~.

Reason Statement:

This proposed modification aligns Section C405.3.3 with the the most recent version of IECC-R R404.1*, which was modified based on the IECC-R Consensus Committee's approval of RED1-330-22, as modified, by a vote of 30-1-0. This action was taken by the IECC-R Consensus Committee to align with DOE's recently established minimum efficacy requirements for “general service lamps” within 10 CFR 403.2. Presumably, an IECC requirement for lighting efficacy that differs from the federal requirement qualifies as a preemption of federal law, which is illegal. If the IECC contains provisions that violate federal law, its adoption can be expected to be challenged. Citing this reason, jurisdictions may opt to skip this version of the code entirely. These proposed modifications are intended to avoid this outcome by aligning this section with federal law. Additionally, exception 1 is modified to except “appliance lamps,” which are exempted from the definition of “general service lamps” (and their associated minimum efficacy requirements) in 10 CFR 430.2, presumably because of challenges with specifying high-efficacy lamps in high-temperature environments, and/or the extensive paybacks associated with their specification.

*The draft of the 2024 IRC Chapter 11 Public Comment Draft #1 showing in legislative format the proposals that appear within the Committee Action Report of the Public Comments/Code Changes to Public Comment Draft #1.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This proposal is intended to align the IECC-C Section C405.3.3 lighting efficacy requirements with federal law. There is therefore no effect on construction costs.

CE2D-49-23

CE2D-50-23

IECC CE: TABLE C406.1.1(2)

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code[CE Project] R3

Delete without substitution:

~~TABLE C406.1.1(2) LIMIT TO ENERGY EFFICIENCY CREDIT CARRYOVER FROM RENEWABLE AND LOAD MANAGEMENT CREDITS~~

Reason Statement:

Credit values are unsubstantiated by transparent and reviewable analysis and calculations. As such, there is no sound justification for the limits.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Deletion of these limits is unlikely to affect cost of construction.

CE2D-50-23

CE2D-51-23

IECC CE: TABLE C406.1.1(2)

Proponents:

Laura Petrillo-Groh, representing Air-Conditioning, Heating, and Refrigeration Institute (lpetrillo-groh@ahrinet.org); Vladimir Kochkin, representing NAHB (vkochkin@nahb.org); Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com); Andrew Klein, representing BOMA International (andrew@asklein.com); Robert Ross, representing Self (robertross1952@gmail.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

TABLE C406.1.1(2) LIMIT TO ENERGY EFFICIENCY CREDIT CARRYOVER FROM RENEWABLE AND LOAD MANAGEMENT CREDITS

-	CLIMATE ZONE															
BUILDING OCCUPANCY GROUP	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A
R-2, R-4, AND I-1	~~5~~12	~~5~~18	~~5~~18	~~5~~18	~~520~~	~~5~~6	5	~~5~~24	~~5~~19	5	~~5~~22	~~5~~18	5	5	~~5~~19	5
I-2	1627	~~14~~25	~~11~~21	~~8~~18	~~6~~15	~~5~~13	5	~~5~~10	~~5~~6	~~5~~8	~~5~~14	~~5~~10	~~6~~17	~~15~~26	~~18~~29	~~10~~2
R-1	~~7~~23	~~5~~20	~~8~~25	~~5~~20	~~19~~36	~~5~~23	~~13~~32	~~20~~40	~~20~~41	~~5~~24	~~20~~41	~~20~~42	~~5~~17	~~16~~37	~~18~~41	5
B	~~7~~22	~~5~~21	~~5~~21	~~8~~24	~~6~~23	~~6~~23	~~5~~14	~~10~~26	~~14~~31	~~5~~23	~~21~~39	~~15~~34	~~5~~19	~~16~~35	~~26~~45	5
A-2	~~18~~36	~~16~~34	~~14~~32	~~15~~33	~~13~~32	~~9~~28	~~5~~11	~~5~~23	~~11~~32	5	~~5~~23	~~5~~23	5	~~5~~16	~~7~~26	5
M	5	5	~~5~~9	5	~~5~~18	~~5~~16	5	5	~~5~~20	5	5	5	5	5	5	5
E	~~13~~27	~~13~~27	~~18~~32	~~16~~30	~~17~~32	~~14~~28	~~6~~21	~~20~~35	~~25~~40	~~9~~25	~~26~~43	~~13~~29	~~7~~23	~~15~~32	~~10~~27	~~5~~1
S-1 AND S-2	~~5~~8	~~5~~8	5	5	5	5	5	5	~~5~~13	5	~~5~~17	~~5~~20	5	~~14~~35	~~5~~23	5
All Other	5	5	5	5	~~5~~7	5	5	~~5~~7	~~5~~17	5	~~5~~10	57	5	~~5~~6	~~5~~11	5

Reason Statement:

This proposal modifies TABLE C406.1.1(2) Limit to Energy Efficiency Credit Carryover from Renewable and Load Management Credits to ensure that IECC 2024 has a pathway for minimum efficiency products in the event Sections C406.1.1.1 and C502.3.7.1 are not deleted.

In response to IECC Public Comment Draft Ballot #1 and #2, AHRI and its members, respectfully opposed the Proposed Revisions to Section C406.1.1.1 of the Energy Code, requiring new buildings using fossil fuels for space or water heating equipment, with certain exemptions, to increase the total energy credits required by 1.25. AHRI also opposed the additions to Section C502.3.7.1, requiring additions using fossil fuels for space or water heating equipment, with certain exemptions, to achieve 67.5 percent of the number of efficiency credits (a higher threshold than was proposed in Public Draft 1).

Increasing the base energy credits in TABLE C406.1.1(1) *Energy Credit Requirements by Building Occupancy Group* without appropriately increasing offsets in TABLE C406.1.1(2) *Limit to Energy Efficiency Credit Carryover from Renewable and Load Management Credits*, creates the same federal preemption problem that necessitated the creation of TABLE C406.1.1(2), in the first place (in CED1-190-22). This proposal rectifies the creation of a legally invalid code by increasing the surplus table to offset the impact of the 1.25x multiplier.

To establish values in this table, the spreadsheet created by Pacific Northwest National Laboratory (PNNL) during the development of CED1-190-22 was modified to calculate the impact of the 1.25 multiplier. The surplus credit table numbers were modified to ensure that energy efficiency credit requirements could be met without using higher efficiency Energy Policy Act-covered (EPACT) equipment. This methodology ensures a pathway for preempted equipment in the 2024 IECC – a critical legal requirement.

Details on AHRI's concerns with the creation of a legally invalid code created by CECD-18-22, were submitted in code proposal 1643. The calculation worksheet has been provided to ICC staff. Refer to the table starting on cell B96 (highlighted green) on the tab title "Carry-overCurrentPC-1.25x."

Additional supporting information posted at the following link https://www.iccsafe.org/wp-content/uploads/Proposal-IECC-C-1726-supporting-documentation-ahri.xlsx

Cost Impact:

The code change proposal will decrease the cost of construction.

This proposal will help offset the cost compliance for buildings which need fossil fuel space and/or water heating equipment.

CE2D-51-23

CE2D-52-23

IECC CE: C406.1.1.1, C406.1.1.2, C502.3.7.1

Proponents:

Emily Lorenz, representing self (emilyblorenz@gmail.com); Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com); Robert Ross, representing Self (robertross1952@gmail.com); Martha VanGeem, representing Masonry Alliance for Codes and Standards (martha.vangeem@gmail.com); James Yeoman, representing City of Orem (jlyeoman@orem.org)

2024 International Energy Code[CE Project] R3

Delete without substitution:

~~C406.1.1.1 Buildings without heat pumps.~~

~~Buildings using purchased energy that is not electricity for space heating or service water heating, buildings with electric storage water heaters that are not heat pumps and buildings with total heat pump space heating capacity less than the space heating load at heating design conditions calculated in accordance with Section C403.1.1 shall comply with measures from C406.2 to achieve not less than 1.25 multiplied by the number of required efficiency credits from Table C406.1.1 based on building occupancy group and climate zone. Where a project contains multiple occupancies, credits in Table C406.1.1 from each building occupancy shall be multiplied by 1.25 and weighted by the gross conditioned floor area to determine the weighted average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for purposes of Section C406.~~
~~Exceptions: 1.Portions of buildings devoted to manufacturing or industrial use. 2. Buildings complying with all of the following: 2.1The building's peak heating load calculated in accordance with Section C403.1.1 is greater than the building's peak cooling load calculated in accordance with Section C403.1.1. 2.2The building's total heat pump space heating capacity is not less than 50 percent of the building's space heating load at heating design conditions calculated in accordance with Section C403.1.1. 2.3Any energy source other than electricity or on-site renewable energy is used for space heating only when a heat pump cannot provide the necessary heating energy to satisfy the thermostat setting. 2.4Electric resistance heat is used only in accordance with Section C403.4.1.1. 3.Low-energy buildings complying with Section C402.1.1.1. 4.Portions of buildings in Utility and Miscellaneous Group U, Storage Group S, Factory Group F, or High-Hazard Group H.~~

Revise as follows:

C406.1.1.2 Building Core/Shell and Build-Out Construction.

Where separate permits are issued for core and shell buildings and build-out construction, compliance shall be in accordance with the following requirements. 1.Core and shell buildings or portions of buildings shall comply with one of the following: 1.1.Where the permit includes a central HVAC system or service water heating system with chillers, heat pumps, boilers, service water heating equipment, or loop pumping systems with heat rejection, the project shall achieve not less than 50 percent of the energy credits required by Section C406.1.1 ~~and C406.1.1.1~~ in accordance with Section C406.2.

1.	Alternatively, the project shall achieve not less than 33 percent of the energy credits required by Section C406.1.1 ~~and C406.1.1~~.

2.	For core and shell *buildings* or portions of *buildings* the energy credits achieved shall be subject to the following adjustments:		
	2.1.	Lighting measure credits shall be determined only for areas with final lighting installed.	
	2.2.	Where HVAC or *service water heating* systems are designed to serve the entire *building*, full HVAC or *service water heating* measure credits shall be achieved.	
	2.3.	Where HVAC or *service water heating* systems are designed to serve individual areas, HVAC or *service water heating* measure credits achieved shall be reduced in proportion to the floor area with final HVAC systems or final *service water heating* systems installed.	
3.	Build-out construction shall be deemed to comply with Section C406.1 where either:		
	3.1.	Where heating and cooling generation are provided by a previously installed central system, the energy credits achieved in accordance with Section C406.2 under the build-out project are not less than 33 percent of the credits required by Section C406.1.1~~ and C406.1.1.1~~.	
	3.2.	Where heating and cooling generation are provided by an HVAC system installed in the build out, the energy credits achieved in accordance with Section C406.2 under the build-out project are not less than 50 percent of the credits required by Section C406.1.1~~ and C406.1.1.1~~.	
	3.3.	Where the core and shell *building* was *approved* in accordance with C407 under 2021 IECC or later.	

Delete without substitution:

~~C502.3.7.1 Additions not served by heat pumps~~.

~~Additions using purchased energy that is not electricity for space heating or service water heating , additions served by electric storage water heaters that are not heat pumps and additions served by total heat pump space heating capacity less than the peak space heating load at heating design conditions calculated in accordance with Section C403.1.1 shall comply with measures from Sections C406.2 and C406.3 to achieve not less than 67.5 percent of the number of required efficiency credits from Table C406.1.1 based on building occupancy group and climate zone . Where a project contains multiple occupancies, credits in Table C406.1.1 from each building occupancy shall be weighted by the gross conditioned floor area to determine the weighted average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for purposes of this section. Alterations to the existing building that are not part of an addition , but permitted with an addition, may be used to achieve the required credits.~~

~~**Exceptions:**~~

1.	Buildings in Utility and Miscellaneous Group U, Storage Group S, Factory Group F, or High-Hazard Group H.
2.	Additions less than 1,000 ft^2 (92 m^2) and less than 50 percent of existing floor area.
3.	Additions that do not include the *addition* or replacement of equipment covered by Tables C403.3.2(1) through C403.3.2(16) or Section C404.2.
4.	Additions that do not contain *conditioned space*.
5.	Where the *addition* alone or the existing *building* and *addition* together comply with Section C407.

6.	Additions complying with all of the following:	
	6.1	The *addition*'s peak heating load calculated in accordance with Section C403.1.1 is greater than the *addition*'s peak cooling load calculated in accordance with Section C403.1.1.
	6.2	The *addition*'s total heat pump space heating capacity serving the *addition* is not less than 50 percent of the *addition*'s space heating load at heating design conditions calculated in accordance with Section C403.1.1.
	6.3	Any energy source other than electricity or *on-site renewable energy* is used for space heating serving the *addition* only when a heat pump cannot provide the necessary heating energy to satisfy the *thermostat* setting.
	6.4	Electric resistance heat serving the *addition* is used only in accordance with Section C403.4.1.1.
7.	Low-energy buildings complying with Section C402.1.1.1.	

Reason Statement:

We request the deletion of these sections, C406.1.1.1 and C502.3.7.1, that were added through CECD1-18-22

We have learned through the development of the energy-credit section of the code, that as our buildings (and codes) get more complicated, not all technologies and energy-efficiency strategies will result in cost-effective energy savings in all building types and climate zones. Hence why, in the energy-credit section, different energy-efficiency measures are worth different points (or tenths of a percent of energy savings) depending on the climate zone and occupancy class of a commercial building.

Electric heat pumps are certainly one tool available to improve the energy efficiency of commercial buildings. However, they are not the only tool that will that will move all buildings toward net zero operational energy use. Incentivizing or requiring their use in the energy codes does not guarantee that buildings will use less energy nor emit fewer greenhouse gas emissions. There are three main reasons why this proposal is technically flawed, will not result in cost-effective energy savings in all cases, and should be deleted. These reasons are:

- Electric heat pumps are only cost-effective in certain climate zones and for certain building types.
- Proposed code language singles out one technology and energy type by increasing complexity and cost without justification of energy savings.
- Proposed code language is overly complicated and confusing.

Limited cost effectiveness

This proposal requires a 25% increase in total energy credits for new buildings (with some exemptions) that use fuels other than electricity for space or water heating. There is no technical justification for this 25% increase. Where a heat pump is not used, it has not been shown that it is cost effective to have to earn 25% more energy credits for the required building types in every climate zone. *If* electric heat pumps were shown to save 25% more energy than other space heating technologies, and *if* the 25% increase in credits were related to heating and cooling, then *maybe* this proposal would be justified.

In a 2020 study by ACEEE, Nadel and Perry looked at costs and payback periods for electrifying space heating in existing commercial buildings. One of their main conclusions was that "While substantial energy savings and emissions reductions opportunities are available, **the economics of conversions are challenging absent improved system efficiencies, reduced system costs, financial incentives, and/or a price on carbon emissions**." [**emphasis** added]

Cost effectiveness varied widely when evaluating various technologies, building types, and climate zones. As an example, across all analysis (technologies, building types, and climate zones), 27% of floor area had a simple payback of 10 years or less (Nadel and Perry 2020). They state that "**economics are highly site-specific**, and finding adequate exterior space to locate outdoor units can be a challenge in high-rise buildings." [**emphasis** added]

In terms of the likelihood of electrification of commercial space heating, Nadel and Perry note that "is likely to proceed very slowly without policy support. While electrification would reduce GHG emissions and provide other societal benefits, such as improved health (due to reduced emissions of multiple pollutants), **there are significant additional costs."** [**emphasis** added]

In Deason et al. (2018), the authors also conclude that **economics are the primary challenge to electrification** of space heating, water heating, and cooking in residential and commercial buildings. In terms of technology, Deason et al. (2018) note that "cold-climate heat pump technologies have made considerable progress, and are now viable in nearly all U.S. climates. Still, there are some places where the current crop of heat pump technologies is not suitable."

In terms of recommendations for where paybacks are more reasonable with regard to installing electric heat pumps, Nadel and Perry recommend geographic locations and climate zones "with better paybacks are a good place to start. These include much of **the southern United States, the "hot" Mountain region, and the Pacific region**, where space heating needs are modest." [**emphasis** added] For building types and occupancies that are more cost-effective, they note that these include "**certain building types with long operating hours**, such as healthcare, malls and retail, food service, lodging, grocery stores, and offices." [**emphasis** added] As a final caveat, the authors state "these are just tendencies; **the economics of conversion [to electric heat pump] will vary from site to site depending on energy use, costs, and other factors**." [**emphasis** added]

For these reasons, it is known that electric heat pumps are only cost-effective in certain climate zones and for certain building types. Thus, these sections, which require either their use or a penalty, are flawed and should be deleted.

Preferential treatment

The IECC provides options across technologies, construction methods, designs, and climate zones by allowing alternatives or exceptions. This proposal is basically a penalty for any building that isn't using electric heat pumps. **This violates this long-standing structure by applying a penalty for not using a technology type that is not yet commonly used in all building designs and climate zones. Moreover, the penalty is applied to all other credits, not just the credits for heating and cooling.**

In the current language, this penalty is applied across most building types and climate zones without a nuanced analysis where electric heat pumps are most cost effective. The justification for requiring the use of electric heat pumps is partly based on the argument that electricity emits fewer greenhouse gas emissions than fossil fuel heating equipment, however, there was no reference or source provided to justify this claim. It may be true in many locations, however, in some states and jurisdictions, electricity GHG emissions may be greater than those from natural gas usage. The proponent's reasoning statement says:

"it is prudent to allow for flexibility in the model code with an exception for buildings with heat pump heating capacity of more than half of the building's peak heating demand, so long as other heating sources are not the primary heating source."

It is agreed that it is "prudent to allow flexibility," but this proposal does not achieve flexibility. It mandates the use of one technology over others (by penalizing all other systems). In addition, where the heat pump cannot meet the load required, this proposal requires the installation of (a.) a heat pump and another heating system, which can be costly, or (b.) more energy credits, which is also not cost justified or justified on an energy use (or savings) basis.

The current structure of the code is that If heat pumps are the cost-effective heating and cooling equipment, then more energy efficiency credits could be provided for using them.

This proposed code language singles out one technology and energy type, which increases complexity and cost without justification of energy savings, and should be deleted.

Complicated language

Section C406 of the 2024 of the IECC is a significantly revised section this cycle, based on an in-depth analysis by PNNL. **The energy credits section is already complicated** and challenging to explain to users. The committee relied on the PNNL analysis for energy savings that are consistent across energy credits. When the committee agreed on the technical methodology, consensus was easier even though individual pieces and parts are controversial. **These sections were not based on the methodology and energy savings used for the other energy credits**.

The overlay factor of 25% for heat pumps makes these sections and language even more complicated. This can result in lack of compliance and enforcement. This proposal will delay adoption of this code because of the above reasons, including lack of technical justification for required building types and climate zones. It could also result in the deletion of the entire Section C406 upon adoption by a jurisdiction, because that is an easier amendment.

Section C406.1.1.1 of the proposed code should be deleted because it is overly complicated and confusing, which may delay adoption of the 2024 IECC.

Bibliography:

Nadel, S., and C. Perry. 2020. *Electrifying Space Heating in Existing Commercial Buildings: Opportunities and Challenges*. Washington, DC: American Council for an Energy-Efficient Economy. aceee.org/research-report/b2004

Deason, J., M. Wei, G. Leventis, S. Smith, and L. Scwartz. 2018. *Electrification of buildings and industry in the United States: Drivers, barriers, prospects, and policy approaches*. Berkeley, CA: Ernest Orlando Lawrence Berkeley National Laboratory. https://eta-publications.lbl.gov/sites/default/files/electrification_of_buildings_and_industry_final_0.pdf

Cost Impact:

The code change proposal will decrease the cost of construction.

If this section is deleted, the cost of construction will be reduced by not requiring installation of two heating systems (in some climate zones).

CE2D-52-23

CE2D-53-23

IECC CE: CHAPTER 4 [CE], SECTION C406, C406.1, C406.1.1, C406.1.1.1, TABLE C406.1.1(2), C406.1.1.2, C406.1.2, TABLE C406.1.2, C406.1.4, C406.1.5, C406.2, TABLE C406.2(1), TABLE 406.2(2), TABLE 406.2(3), TABLE 406.2(4), TABLE 406.2(5), TABLE 406.2(6), TABLE 406.2(7), TABLE 406.2(8), TABLE 406.2(9), C406.2.1, C406.2.1.1, C406.2.1.3, C406.2.1.6, C406.2.2, C406.2.2.1, C406.2.2.2, C406.2.2.3, C406.2.2.5, TABLE C406.2.2.5, C406.2.3, C406.2.3.1, C406.2.3.1.1, C406.2.3.1.2, C406.2.3.1.3, C406.2.3.2, C406.2.3.3, C406.2.3.4, C406.2.3.5, TABLE C406.2.3.5, C406.2.3.6, C406.2.5, C406.2.5.2, C406.2.5.3, C406.2.5.3.1, C406.2.5.3.2, C406.2.5.3.3, C406.2.5.4, TABLE C406.2.5.4, C406.2.5.5, C406.2.5.6, C406.2.6, C406.2.6.1, C406.2.6.2, TABLE C406.2.6.2(1), C406.2.6.3, C406.3, C406.3.1, C406.3.2, C406.3.3, TABLE C406.3.3, C406.3.4, C406.3.5, C406.3.6, C406.3.7, TABLE C406.3.7, C406.3.8

Proponents:

Shannon Corcoran, representing American Gas Association

2024 International Energy Code[CE Project] R3

CHAPTER 4 [CE] COMMERCIAL ENERGY EFFICIENCY

SECTION C406 ADDITIONAL EFFICIENCY, RENEWABLE, AND LOAD MANAGEMENT REQUIREMENTS.

Staff note: proposed code changes to existing C406 having been removed by CEPI-193-21 are not incorporated into this draft

C406.1 Compliance.

Buildings shall comply as follows:

1.	*Buildings* with greater than 2000 square feet (190 m^2) of *conditioned floor area* shall comply with Section C406.1.1.
2.	*Buildings* with greater than 5000 square feet (465 m^2) of *conditioned floor area* shall comply with Sections C406.1.1 and C406.1.2.
3.	Build-out construction greater than 1000 square feet (93 m^2) of *conditioned floor area* that does not have final lighting or final HVAC systems installed under a prior building permit shall comply with Section C406.1.3.

Exceptions: Core and shell *buildings* where no less than 20 percent of the *net floor area* is without final lighting or final HVAC that comply with all of thefollowing:

1.	*Buildings* with greater than 5000 (465 m^2) of *conditioned floor area* shall comply with Section C406.1.2.
2.	Portions of the *building* where the *net floor area* is without final lighting or final HVAC shall comply with Section C406.1.3
3.	Portions of the *building* where the *net floor area* has final lighting and final HVAC systems shall comply with C406.1.1.

C406.1.1 Additional energy efficiency credit requirements.

Buildings shall comply with measures from C406.2 to achieve not less than the number of required efficiency credits from Table C406.1.1(1) based on *building* occupancy group and *climate zone*.
Where a project contains multiple occupancies, credits in Table C406.1.1(1) from each *building* occupancy shall be weighted by the

gross *conditioned floor area* to determine the weighted average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for purposes of SectionC406.

Exceptions:

1.	Portions of buildings devoted to manufacturing or industrial use.
2.	Where a *building* achieves more renewable and load management credits in Section C406.3 than are required in Section C406.1. to reduce the required energy efficiency credits as follows: $EEC_{red} = EEC_{tbl} - \{the\ lesser\ of: (SRLM_{lim} , \quad SRLM_{adj} \times [RLM$ EEC_{red} = Reduced required energy efficiency credits EEC_{tbl} = Required energy efficiency credits from Table C406.1.1(1) $SRLM_{lim}$ = Surplus renewable and load management credit limit from Table C406.1.1(2) $SRLM_{adj}$ = 1.0 for all-electric or all-renewable buildings (excluding emergency generation) 0.7 for buildings with fossil fuel generation) RLM_{ach} = Achieved renewable and load management credits from Section C406.3 RLM_{req} = Required renewable and load management credits from Section C406.1.2

Revise as follows:

C406.1.1.1 ~~Buildings without heat pumps~~.

~~Buildings using purchased energy that is not electricity for space heating or service water heating, buildings with electric storage water heaters that are not heat pumps and buildings with total heat pump space heating capacity less than the space heating load at heating design conditions calculated in accordance with Section C403.1.1 shall comply with measures from C406.2 to achieve not less than 1.25 multiplied by the number of required efficiency credits from Table C406.1.1 based on building occupancy group and climate zone. Where a project contains multiple occupancies, credits in Table C406.1.1 from each building occupancy shall be multiplied by 1.25 and weighted by the gross conditioned floor area to determine the weighted average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for purposes of Section C406.~~

~~Exceptions: 1.Portions of buildings devoted to manufacturing or industrial use. 2. Buildings complying with all of the following: 2.1The building's peak heating load calculated in accordance with Section C403.1.1 is greater than the building's peak cooling load calculated in accordance with Section C403.1.1. 2.2The building's total heat pump space heating capacity is not less than 50 percent of the building's space heating load at heating design conditions calculated in accordance with Section C403.1.1. 2.3Any energy source other than electricity or on-site renewable energy is used for space heating only when a heat pump cannot provide the necessary heating energy to satisfy the thermostat setting. 2.4Electric resistance heat is used only in accordance with Section C403.4.1.1. 3.Low-energy buildings complying with Section C402.1.1.1. 4.Portions of buildings in Utility and Miscellaneous Group U, Storage Group S, Factory Group F, or High-Hazard Group H.~~

C406.1.1.1 Buildings without heat pumps.

Buildings using purchased energy that is not electricity for space heating or service water heating, buildings with electric storage water heaters that are not heat pumps and buildings with total heat pump space heating capacity less than the space heating load at heating design conditions calculated in accordance with Section C403.1.1 shall comply with measures from C406.2 to achieve not less than 1.25 multiplied by the number of required efficiency credits from Table C406.1.1 based on building occupancy group and climate zone. Where a project contains multiple occupancies, credits in Table C406.1.1 from each building occupancy shall be multiplied by 1.25 and weighted by the gross conditioned floor area to determine the weighted average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for purposes of Section C406.

Exceptions:

1.	Portions of buildings devoted to manufacturing or industrial use.	
2.	Buildings complying with all of the following:	
	2.1.	The building’s peak heating load calculated in accordance with Section C403.1.1 is greater than the building’s peak cooling load calculated in accordance with Section C403.1.1.
	2.2.	The building’s total heat pump space heating capacity is not less than 50 percent of the building’s space heating load at heating design conditions calculated in accordance with Section C403.1.1.
	2.3.	Any energy source other than electricity or on-site renewable energy is used for space heating only when a heat pump cannot provide the necessary heating energy to satisfy the thermostat setting.
	2.4.	Electric resistance heat is used only in accordance with Section C403.4.1.1.
3.	Low-energy buildings complying with Section C402.1.1.1.	
4.	Portions of buildings in Utility and Miscellaneous Group U, Storage Group S, Factory Group F, or High-Hazard Group H.	

TABLE C406.1.1(2) LIMIT TO ENERGY EFFICIENCY CREDIT CARRYOVER FROM RENEWABLE AND LOAD MANAGEMENT CREDITS

Revise as follows:

C406.1.1.2 Building Core/Shell and Build-Out Construction.

Where separate permits are issued for core and shell buildings and build-outconstruction, compliance shall be in accordance with the following requirements.

1.	Core and shell buildings or portions of buildings shall comply with one of the following:	
	1.1.	Where the permit includes a central HVAC system or service water heating system with chillers, heat pumps, boilers, service water heating equipment, or loop pumping systems with heat rejection, the project shall achieve not less than 50 percent of the energy credits required by Sections C406.1.1 and C406.1.1.1 in accordance with Section C406.2.
	1.2.	Alternatively, the project shall achieve not less than 33 percent of the energy credits required by Sections C406.1.1 and C406.1.1.
2.	For core and shell *buildings* or portions of *buildings* the energy credits achieved shall be subject to the following adjustments:	
	2.1.	Lighting measure credits shall be determined only for areas with final lighting installed.
	2.2.	Where HVAC or *service water heating* systems are designed to serve the entire *building*, full HVAC or *service water heating* measure credits shall be achieved.
	2.3.	Where HVAC or *service water heating* systems are designed to serve individual areas, HVAC or *service water heating* measure credits achievedshall be reduced in proportion to the floor area with final HVAC systems or final *service water heating* systems installed.

3.	Build-out construction shall be deemed to comply with Section C406.1 where either: 3.1. Where heating and cooling generation are provided by a previously installed central system, the energy credits achieved in accordance with Section C406.2 under the build-out project are not less than 33 percent of the credits required by Section C406.1.1 and C406.1.1.1. 3.2. Where heating and cooling generation are provided by an HVAC system installed in the build out, the energy credits achieved in accordance with Section C406.2 under the build-out project are not less than 50 percent of the credits required by Section C406.1.1 and C406.1.1.1. 3.3. Where the core and shell *building* was *approved* in accordance with C407 under 2021 IECC or later.

C406.1.2 Additional renewable and load management credit requirements.

Buildings shall comply with measures from C406.3 to achieve not less than the number of required renewable and load management credits from Table C406.1.2 based on *building* occupancy group and *climate zone*. Where a project contains multiple occupancies, credits in Table C406.1.2 from each *building* occupancy shall be weighted by the gross floor area to determine the weighted average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for purposes of Section C406.

Exception: Where a *building* achieves more energy efficiency credits in Section C406.2 than are required in Section C406.1.1, the renewable and load management credits required in Table C406.1.2 shall be reduced by the amount of surplus energy efficiency credits, not to exceed a 30 percent reduction.

TABLE C406.1.2 RENEWABLE AND LOAD MANAGEMENT CREDIT REQUIREMENTS BY BUILDING OCCUPANCY GROUP

C406.1.4 —

C406.1.5 —

C406.2 Additional Energy Efficiency Credits Achieved.

Each energy efficiency credit measure used to meet credit requirements for the project shall have efficiency that is greater than the requirements in Sections C402 through C405. Measures installed in the project that meet the requirements in Sections C406.2.1 through C406.2.7 shall achieve the base credits listed for the measure and occupancy type in Tables C406.2(1) through C406.2(9) or, where calculations required by Sections C406.2.1 through C406.2.7 create or modify the table credits, the credits achieved shall be based upon the calculations. Energy credits achieved for measures shall be determined by one of the following, as applicable:

1.	The measure's energy credit shall be the base energy credit from Tables C406.2(1) through C406.2(9) for the measure where no adjustment factor or calculation is included in the description of the measure in Section C406.2.
2.	The measure's energy credit shall be the base energy credit for the measure adjusted by a factor or equation as stated in the description of the measure in Section C406.2. Where adjustments are applied, each measure's energy credit shall be rounded to the nearest whole number.
3.	The measure's energy credit shall be calculation as stated in the measures description in Section C406.2, where each individual measure credit shall be rounded to the nearest whole number.

Energy credits achieved for the project shall be the sum of the individual measure’s energy credits. Credits are available for the measures listed in this Section. Where a project contains multiple *building* occupancy groups:

1.	Credits achieved for each occupancy group shall be summed and then weighted by the *conditioned floor area* of each occupancy group to determine the weighted average project energy credits achieved.
2.	Improved envelope efficiency (E01 through E06) and lighting reduction (L06) measure credits shall be determined for the *building* or permitted *conditioned floor area* as a whole. Credits for other measures shall be determined for each occupancy separately. Credits shall be taken from applicable tables or calculations for each occupancy and weighted by the *building* occupancy group floor area.

TABLE C406.2(1) BASE ENERGY CREDITS FOR GROUP R-2, R-4, AND I-1 OCCUPANCIES[a]

a.	"x" indicates credit is not available in that climate zone for that measure.

TABLE 406.2(2) BASE ENERGY CREDITS FOR GROUP I-2 OCCUPANCIES[a]

a.	"x" indicates credit is not available in that climate zone for that measure.

TABLE 406.2(3) BASE ENERGY CREDITS FOR GROUP R-1 OCCUPANICES[a]

a.	"x" indicates credit is not available in that climate zone for that measure.

TABLE 406.2(4) BASE ENERGY CREDITS FOR GROUP B OCCUPANCIES[a]

a.	"x" indicates measure is not available in that climate zone for that measure.

TABLE 406.2(5) BASE ENERGY CREDITS FOR GROUP A-2 OCCUPANCIES[a]

a.	"x" indicates measure is not available in that climate zone for that measure.

TABLE 406.2(6) BASE ENERGY CREDITS FOR GROUP M OCCUPANCIES[a]

a.	"x" indicates credit is not available in that climate zone for that measure.

TABLE 406.2(7) BASE ENERGY CREDITS FOR GROUP E OCCUPANCIES[a]

a.	"x" indicates measure is not available in that climate zone for that measure.

TABLE 406.2(8) BASE ENERGY CREDITS FOR GROUP S-1 AND S-2 OCCUPANCIES[a]

a.	"x" indicates measure is not available in that climate zone for that measure.

TABLE 406.2(9) BASE ENERGY CREDITS FOR OTHER OCCUPANCIES[a,b]

a.	"x" indicates measure is not available in that climate zone for that measure.
b.	Other occupancy groups include all Groups except for Groups A-2, B, E, I, M, and R.

C406.2.1 More efficient building thermal envelope.

A project shall achieve credits for improved envelope performance by complying with one of the following measures:

1.	Section C406.2.1.1: E01
2.	Section C406.2.1.2: E02
3.	Section C406.2.1.3: E03
4.	Both E02 and E03
5.	Any combination of: 5.1. Section C406.2.1.3: E03 5.2. Section C406.2.1.4: E04 5.3. Section C406.2.1.5: E05 5.4. Section C406.2.1.6: E06

C406.2.1.1 EO1 Improved envelope performance 901 Appendix C.

Building thermal *envelope* measures shall be installed to improve the energy performance ofthe project. The achieved energy credits shall be determined using Equation 4-12.

$$EC_{ENV} = 1000 \text{ X } (EPF_B - EPF_P)/EPF_B$$

(Equation 4-12)
EC_{ENV}= E01 measure energy credits
EPFB= base envelope performance factor calculated in accordance with ASHRAE 90.1Appendix C.
EPF_P= proposed envelope performance factor calculated in accordance with ASHRAE 90.1Appendix C.

C406.2.1.3 E03 Reduced air leakage.

Energy credits shall be achieved where tested *building air leakage* is not less than 10 percent less than the maximumleakage permitted by Section C402.5.2 provided the *building* is tested in accordance with the applicable method in Section C402.5.2. Energy credits achievedfor measure E03 shall be determined as follows:

$$EC_{E03} = EC_B \text{ X } EC_{adj}$$

(Equation 4-13)
EC_{E03}= Energy effi ciency credits achieved for envelope leakage reduction
EC_B= C406.2.1.3 credits from Tables C406.2(1) through C406.2(9)
EC_{adj}= Ls/EC_a
Ls = Leakage savings fraction: the lessor of [(Lr-Lm)/Lr] or 0.8
Lr = Maximum leakage permitted for tested *buildings*, by occupancy group, in accordance with Secction C402.5.2
Lm = Measured leakage in accordance with Section C402.5.2.1 or C402.5.2.2
EC_a= Energy Credit alignment factor: 0.37 for whole *building* tests in accordance with Section C402.5.2.1 or 0.25 for dwelling and *sleeping unit* enclosure tests in accordance with Section C402.5.2.2

C406.2.1.6 E06 Improve fenestration.

Energy credits shall be achieved for improved energy characteristics ofall vertical *fenestration* in the project meeting the requirements in Table C406.2.1.6. The area-weighted average U-factor and SHGC of all vertical *fenestration* shall be equal to or less than the value shown in the table . Where vertical *fenestration* is located under a permanently attached shading projection with a projection factor PF not less than 0.2 as determined in accordance with Section C402.4.3, the SHGC for that *fenestration* shall be permitted to be divided by 1.2. The area-weighted average visible transmittance (VT) of allvertical fenestration shall be equal to or greater than the value shown in the table .

C406.2.2 More Efficient HVAC Equipment Performance.

All heating and cooling systems shall meet the minimum requirements of Section C403 and efficiency improvements shall be referenced to minimum efficiencies listed in Tables referenced by Section C403.3.2. Where multiple efficiency requirements are listed, equipment shall meet the seasonal or part-load efficiencies including SEER, integrated energy efficiency ratio (IEER), integrated part load value (IPLV), or AFUE. Equipment that is larger than the maximum capacity range indicated in Tables referenced by Section C403.3.2 shall utilize the values listed for the largest capacity equipment for the associated equipment type shown in the table. Where multiple individual heating or cooling systems serve the project, the improvement shall be the weighted average improvement based on individual system capacity. Systems are permitted to achieve HVAC energy credits by meeting the requirements of either:

1.	C406.2.2.1 H01
2.	C406.2.2.2 H02
3.	C406.2.2.3 H03
4.	C406.2.2.4 H04
5.	C406.2.2.5 H05
6.	Any combination of H02, H03, H04 and H05
7.	The combination of H01 and H04

C406.2.2.1 H01 HVAC Performance (TSPR).

H01 energy credits shall be earned where systems are permitted to use Section C409 and where the proposed TSPR exceeds the minimum TSPR requirement by 5 percent or more. If improvement is greater than 5 percent, determine H01 earned credits using Equation 4-14. Energy credits for H01 shall not be combined with energy credits from HVAC measures H02, H03 or H05.

H01 energy credit = H01 base energy credit x TSPRs / 0.05

(Equation 4-14)
TSPRx = TSPRa x [the lessor of 0.20 and (1-(TSPRp/TSPRt))]
where:
TSPRa = [floor area served by systems permitted to use TSPR] / [total building *conditioned floor area*]
TSPRp = HVAC TSPR of the proposed design calculated in accordance with Sections C409.4, C409.5 and C409.6.
TSPRt = TSPRr / MPF
where:
TSPRr = HVAC TSPR of the reference *building* design calculated in accordance with Sections C409.4, C409.5 and C409.6.
MPF = Mechanical Performance Factor from Table C409.4 based on *climate zone* and *building* use type

Where a *building* has multiple *building* use types, MPF shall be area weighted in accordance with Section C409.4

C406.2.2.2 H02 More efficient HVAC equipment heating performance.

No less than 90 percent of the total HVAC capacity serving the total *conditioned floor area* of the entire *building* or tenant space in accordance with Section C406.1.1, shall comply with the requirements of this Section.

1.	Equipment installed shall be types that have their efficiency listed in Tables referenced by Section C403.3.2. Electric resistance heating capacity shall be limited to 20 percent of system capacity, with the exception of heat pump supplemental heating.
2.	Equipment shall exceed the minimum heating efficiency requirements listed in Tables referenced by Section C403.3.2 by at least 5 percent. Where equipment exceeds the minimum annual heating efficiency requirements by more than 5 percent, energy efficiency credits for heating shall be determined using Equation 4-15 rounded to the nearest whole number.

$$EEC_{HEH} = EEC_{H5} \text{ x } (HEI/0.05)$$

(Equation 4-15)

EEC_{HEH}= energy efficiency credits for heating efficiency improvement

EEC_{H5}= C406.2.2.2 credits from Tables C406.2(1) through C406.2(9)

HEI = the lesser of: the improvement (as a fraction) above minimum heating efficiency requirements, or 20 percent(0.20). Where heating equipment with different minimum efficiencies are included in the *building* , a heating capacity weighted average improvement shall be used. Where electric resistance primary heating or reheat is included in the *building* it shall be included in the weighted average improvement with an HEI of 0. Supplemental gas and electric heat for heat pump systems shall be excluded from the weighted HEI. For heat pumps rated at multiple ambient temperatures, the efficiency at 47ºF (8.3ºC) shall be used.

For metrics that increase as efficiency increases, HEI shall be calculated as follows:

HEI = $(HM_{DES} / HM_{MIN})-1$

Where:

HM_{DES}= Design heating efficiency metric, part-load or annualized where available

HM_{MIN}= Minimum required heating efficiency metric, part-load or annualized where available from Section C403.3.2

Exception: In low energy spaces complying with Section C402.1.1, no less than 90 percent of the installed heating capacity is provided by electric infrared or gas-fired radiant heating equipment for localized heating applications. Such spaces shall only achieve base energy credits for EEC_{H5} .

C406.2.2.3 H03 More efficient HVAC cooling equipment and fan performance.

No less than 90 percent of the total HVAC cooling capacity serving the total *conditioned floor area* of the entire *building* or tenant space in accordance with Section C406.1.1, shall comply with all of the requirements of this section.

1.	Equipment installed shall be types that are listed in Tables referenced by Section C403.3.2.
2.	Equipment shall exceed the minimum cooling efficiency requirements listed in Tables referenced by Section C403.3.2 by at least 5 percent. For water-cooled chiller plants, heat rejection equipment performance in Table C403.3.2(7) shall also be increased by at least the chiller efficiency improvement. Where equipment exceeds the minimum annual cooling efficiency and heat rejection efficiency requirements by more than 5 percent, energy efficiency credits for cooling shall be determined using Equation 4-16, rounded to the nearest whole number.

Where fan energy is not included in packaged equipment rating or it is and the fan size has been increased from the as-rated equipment condition, fanpower or horsepower shall be less than 95 percent of the allowed fan power in Section C403.8.1.

$$EEC_{HEC} = EEC_5 \text{ x } (CEI/0.05)$$

(Equation 4-16)

EEC_{HEC}= energy efficiency credits for cooling efficiency improvement

EEC_5= the lesser of: the improvement above minimum cooling efficiency and heat rejection performance requirements expressed as a fraction, or 0.20 (20percent). Where cooling equipment with different minimum efficiencies are included in the *building* , a cooling capacity weighted average improvement shall be used. Where multiple cooling efficiency or performance requirements are provided, the equipment shall exceed the annualized energy or part-load requirement. Meeting both part-load and full-load efficiencies is not required.For metrics that increase as efficiency increases, CEI shall be calculated as follows:

CEI = (CM_{DES}/CM_{MIN}) - 1For metrics that decrease as efficiency increases, CEI shall be calculated as follows:

CEI = (CM_{MIN}/CM_{DES}) - 1

Where:

CM_{DES}= Design cooling efficiency metric, part-load or annualized where available

CM_{MIN}= Minimum required cooling efficiency metric, part-load or annualized where available from Section C403.3.2

For Data Centers using ASHRAE Standard 90.4, CEI shall be calculated as follows:

CEI = $(AMLC_{\underline{MAX}} / AMLC_{DES})$ - 1

Where:

$AMLC_{DES}$= As-Designed Annualized Mechanical Load Component calculated in accordance with ASHRAE Standard 90.4, Section 6.5

$AMLC_{MAX}$= Maximum Annualized Mechanical Load Component from ASHRAE Standard 90.4, Table 6.5

C406.2.2.5 H05 Dedicated Outdoor Air System.

Credits for this measure are only allowed where single *zone* HVAC units are not required to have multi-speed or variable-speed fan control in accordance with Section C403.8.6.1. HVAC controls and *ventilation* systems shall include all of the following:

1.	*Zone* controls shall cycle the heating/cooling unit fans off when not providing required heating and cooling or shall limit fan power to 0.12 watts/cfm of *zone* air.
2.	Outdoor air shall be supplied by an independent *ventilation* system designed to provide no more than 130 percent of the minimum outdoor air to each individual occupied *zone*, as specified by the *International Mechanical Code*. **Exception:** Outdoor airflow is permitted to increase during emergency or economizer operation implemented as described in item 4.
3.	The *ventilation* system shall have energy recovery with an *enthalpy recovery ratio* of 65 percent or more at heating design conditions in climate zones 3 through 8 and an *enthalpy recovery ratio* of 65 percent or more at cooling design conditions in climate zones 0, 1, 2, 3A, 3B, 4A, 4B, 5A, and 6A. In“A” climate zones, energy recovery shall include latent recovery. Where no humidification is provided, heating energy recovery effectiveness is permitted to be based on *sensible energy recovery ratio* . Where energy recovery effectiveness is less than the 65 percent required for full credit, adjust the credits from Section C406.2 by the factors in Table C406.2.2.5.

4.	Where the *ventilation* system serves multiple zones and the system is not in a latent recovery outside air dehumidification mode. partial economizer cooling through an outdoor air bypass or wheel speed control shall automatically do one of the following: 4.1. Set the energy recovery leaving-air temperature 55°F (13°C) or 100 percent outdoor air bypass when a majority of zones require cooling and outdoor air temperature is below 70°F (21°C). 4.2. The HVAC *ventilation* system shall include supply-air temperature controls that automatically reset the supply-air temperature in response to representative building loads, or to outdoor air temperatures. The controls shall reset the supply-air temperature not less than 25 percent of the difference between the design supply-air temperature and the design room-air temperature.
5.	Ventilation systems providing mechanical dehumidifi cation shall use recovered energy for reheat within the limits of item 4. This shall not limit the use of latent energy recovery for dehumidification.

Where only a portion of the *building* is permitted to be served by constant air volume units or theenthalpy recovery ratio or *sensible energy recovery ratio* is less than 65 percent, the base energy credits shown in Section C406.2 shall be prorated as follows:

$$EC_{DOAS} = EC_{BASE} \text{ x } FLOOR_{CAV} \text{ x } ERE_{ADJ}$$

(Equation 4-17)
EC_{DOAS}= Energy credits achieved for <u>H05</u>
EC_{BASE}= <u>H05</u> base energy credits in Section C406.2
$FLOOR_{CAV}$= Fraction of whole project gross conditioned fl oor area not required to have variable speed or multi-speed fan airflow control in accordance with Section C403.8.6.
ERE_{adj}= The energy recovery adjustment from Table C406.2.2.5 based on the lower of actual cooling or heating enthalpy recovery ratio or *sensible energy recovery ratio* where required for the *climate zone*. Where recovery ratios vary, use a weighted average by supply airflow.

TABLE C406.2.2.5 DOAS Energy Recovery Adjustments
a. In climate zones where heating recovery is required <u>in Section C403</u> , for dwelling units a heating recovery effectiveness below 60 percent is not allowed.

C406.2.3 Reduced Energy Use In-service Water Heating.

Projects with service water-heating equipment that serves the whole *building*, a *building addition* or a tenant space shall achieve credits through compliance with the requirements of this section. Systems are permitted to achieve energy credits by meeting the requirements of either:

1.	C406.2.3.1 by selecting one allowed measure W01, W02<u>,</u> W03<u>, or a combination in accordance with Section C406.2.3.1.4</u>
2.	C406.2.3.2 W04
3.	C406.2.3.3 by selecting one allowed measure W05, W06, or W07
4.	C406.2.3.4 W08
5.	C406.2.3.5 W09

6.	C406.2.3.6 W10
7.	Any combination of measures in C402.2.3.1 through C402.2.3.6 as long no more than one allowed measure from C406.2.3.1 and C406.2.3.3 are selected.

C406.2.3.1 Service water-heating system efficiency.

A project is allowed to achieve energy credits from only one of Sections C406.2.3.1.1 through C406.2.3.1.4.

C406.2.3.1.1 W01 Recoverd 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 30 percent of the *building's* annual hot water requirements, or sized to provide not less than 70 percent of the *building's* annual hot water requirements if the *buildingis* required to comply with Section C403.10.5:

1.	Waste heat recovery from SHW, heat recovery chillers, *building* equipment, or process equipment.
2.	A water-to-water heat pump that precools chilled water return for *building* cooling while heating SHW.
3.	*On-site renewable energy* water-heating systems.

C406.2.3.1.2 W02 Heat pump water heater.

Air-source heat pump water heaters shall be installed according to manufacturer's instructions and at least 30 percent of design end use *service water heating* requirements shall be met using only heat pump heating at an ambient condition of 67.5 F, db without supplemental electric resistance or fossil fuel heating. For a heat pump *water heater* with supplemental electric resistance heating, the heat pump only capacity shall be deemed at 40 percent of first hour draw. Where the heat pump only capacity exceeds 50 percent of the design end use load excluding recirculating system losses, the credits from the Section C406.2 tables shall be prorated as follows:

$$EC_{HPWH} = (EC_{BASE}/0.5) \text{ X } \{(CAP_{HPWH})/(ENDLOAD)[\text{not greater than } 2]\}$$

(Equation 4-18)

EC_{HPWH}= Energy credits achieved for W02

EC_{BASE}= W02 base energy credits from Tables C406.2(1) through C406.2(9)

ENDLOAD = End use peak hot water load, excluding load for heat trace or recirculation, Btu/hr or kW

CAP_{HPWH} = the heat pump only capacity at 50ºF (10ºC) entering air and 70ºF (21ºC) entering potable water without supplemental electric resistance or fossil fuel heat, Btu/hr or kW

The heat pump *service water heating* system shall comply with the following requirements:

1.	For systems with an installed total output capacity of more than 100,000 Btu/hr (30 kW) at an ambient condition of 67.5ºF (19.7ºC), db a preheat storage tank with greater than or equal 0.75 gallons per 1000 Btu/hr (≥9.7 L/kW) of design end use *service water heating* requirements shall be heated only with heat pump heating when the ambient temperature is greater than 45ºF (7.2ºC).
2.	For systems with piping temperature maintenance, either a heat trace system or a separate *water heater* in series for recirculating system and final heating shall be installed.

3.	Heat pump *water heater* efficiency shall meet or exceed one of the following:		
		3.1.	Output-capacity-weighted-average UEF of 3.0 in accordance with 10 CFR 430 Appendix E.
		3.2.	Output-capacity-weighted-average COP of not less than 4.0 tested at 50ºF (10ºC) entering air and 70ºF (21ºC) entering potable water in accordance with AHRI standard 1300.

Where the heat pump capacity at 50 °F (10 °C) entering air and 70 °F (21 °C) entering water exceeds 50 percent of the design end-use load excluding recirculating system losses, the base credits from Section C406.2 shall be prorated based on Equation 4-19.

$$EC_{HPWH} = (EC_{BASE}/0.5) \text{ X } \{(CAP_{HPWH})/(ENDLOAD)[\text{not greater than } 2]\}$$

(Equation 4-19)

HP_{LF} = Heat pump capacity as a fraction of the design end-use SHW requirements excluding recirculating system losses, not to exceed 80 percent.

C406.2.3.1.3 W03 Efficient fossil fuel water heater.

The combined input-capacity-weighted-average equipment rating of all gas water-heating equipment in the *building* shall be not less than 95 percent Et or 0.93 UEF. Adjustments shall apply as follows:

1.	Where the *service water heating* system is required to comply with Section C404.2.1, this measure shall achieve 30 percent of the listed base W03 energy credits in Tables C406.2(1) through C406.2(9)
2.	Where the installed building service water heating capacity is less than 200,000 Btu/hr (59 kW) and weighted UEF is less than 0.93 UEF and not less than 0.82 this measure shall achieve 25 percent of the base W03 credit in Tables C406.2(1) through C406.2(9)

C406.2.3.2 W04: Service Hot Water Piping Insulation Increase.

Where service hot water is provided by a central water heating system, the hot water pipe insulation thickness shall be at least 1.5 times the thickness required in Section C404.4. All service hot water piping shall be insulated from the hotwater source to the fixture shutoff. Where no more than 50 percent of hot water piping does not have increased insulation due to installation in partitions, the credit shall be prorated as a percentage of lineal feet of piping with increased insulation.

Revise as follows:

C406.2.3.3 Water-heating distribution temperature maintenance.

A project is allowed to claim energy credits from only one of the following SHW distribution temperature maintenance measures.

1. **W05 Point of use water heaters.** Credits are available for Group B or E *buildings* larger than 5,000 ft^2 (460 m^2) where *service water heating* systems meet the following requirements:.

    1.1. Fixtures requiring hot water shall be supplied from a local *water heater* with no recirculating system or heat trace piping.
    Exception: Commercial kitchens or showers in locker rooms shall be permitted to have a local recirculating system or heat trace piping where water heaters are located not more than 50 lineal feet (15 m) from the furthest fixture served.

    1.2. Supply piping from the water heater to the termination of the fixture supply pipe shall be insulated to the levels shown in Table C404.4.1.
    Exception ~~**Exceptions**~~**:**

    1. Piping at locations where a vertical support of the piping is installed.
    2. Where piping passes through a framing member and insulation requires increasing the size of the framing member.

    1.3. The water volume in the piping from the water heater to the termination of any individual fixture shall be limited as follows:

    1.3.1. Non-residential public lavatory faucets that are available for use by members of the general public : not more than 2 oz (60 mL)

    1.3.2. Commercial kitchens or showers in locker rooms with recirculating systems or heat trace piping: not more than 24 oz (0.75 L) from the recirculating system or heat trace piping.

    1.3.3. All other plumbing fixtures or appliances: not more than 16 oz (0.95 0.5 L)

2. **W06 Thermostatic balancing valves.** Credits are available where *service water heating* is provided centrally and distributed throughout the *building* with a recirculating system. Each recirculating system branch return connection to the main SHW supply piping shall have an *automatic* thermostatic balancing valve set to a minimal return water flow when the branch return temperature is greater than 120ºF(49ºC).

3. **W07 Heat trace system.** Credits are available for projects with gross floor area greater than 10,000 square feet (930 m^2) and a central water-heating system. The energy credits achieved shall be from Tables C406.1.2(1) through C406.1.2(9). This system shall include self-regulating electric heat cables, connection kits, and electronic controls. The cable shall be installed directly on the hot water supply pipes underneath the insulation to replace standby losses.

C406.2.3.4 W08 Water-heating system submeters.

Each individual dwelling unit in a Group R-2 occupancy served by a central service water-heating system shall be provided with a service hot water meter connected to a reporting system that provides individual dwelling unit reporting of actual domestic hot water use. Preheated water serving the cold water inlet to showers need not be metered.

C406.2.3.5 W09 Service hot water flow reduction.

Dwelling unit, sleeping unit, and guest room plumbing fixtures that are connected to the service water-heating system shall have a flow or consumption rating less than or equal to the values shown in Table C406.2.3.5.

TABLE C406.2.3.5 Maximum Flow Rating for Residential Plumbing Fixtures with Heated Water

a.	Showerheads, lavatory faucets and kitchen faucets are subject to U.S. Federal requirements listed in 10 CFR 430.32(o)- (p).
b.	Maximum flow allowed is less than required by flow rates listed in U.S. 10 CFR 430.32(o)-(p) for showerheads and kitchen faucets.
c.	Residential kitchen faucet may temporarily increase the flow above the maximum rate, but not above 2.2 gallons per minute at 60 psi (8.3 L/m at 410 kPa) and must default to the maximum flow rate listed.
d.	When a shower is served by multiple shower heads, the combined flow rate of all shower heads controlled by a single valve shall not exceed the maximum flow rate listed or the shower shall be designed to allow only one shower head to operate at a time.

C406.2.3.6 W10 Shower drain heat recovery.

Cold water serving building showers shall be preheated by shower drain heat recovery units that comply with Section C404.7. The efficiency of drain heat recovery units shall be 54 percent or greater measured in accordance with CSA B55.1. Full credits are applicable to the following building uses: I-2, I-4, R-1, R-2 and also group E where there are more than eight showers. Partial credits are applicable to buildings where all but ground floor showers are served where the base energy credit from Section C406.2 is adjusted by Equation 4-20. (Equation 4-20)

C406.2.5 Energy Savings in Lighting Systems.

Projects are permitted to achieve energy credits for increased lighting system performance by meeting the requirements of either:

1.	C406.2.5.2 L02
2.	C406.2.5.3 L03
3.	C406.2.5.4 L04
4.	C406.2.5.5 L05
5.	C406.2.5.6 L06
6.	Any combination of L03, L04, L05 and L06
7.	Any combination of L02, L03 and L04

C406.2.5.2 L02 high-end trim lighting controls.

Measure credits shall be achieved where qualifying spaces are no less than 50 percent of the project interior floor area exclusive of *dwelling* and *sleeping units* Qualifying spaces are those where *general lighting* is controlled by *high-end trim* lighting controls complying with the following:

1.	The calibration adjustment equipment is located for *ready access* only by authorized personnel.

2.	Lighting controls with *ready access* for users cannot increase the lighting power above the maximum level established by the *high-end trim* controls.
3.	*Construction documents* shall state that maximum light output or power of *general lighting* in spaces contributing to the qualifying floor area shall be not greater than 85 percent of full power or light output.
4.	*High-end trim* lighting controls shall be tested in accordance with Section C408.3.1.5.

The base credits from Tables C406.1.2(1) through C406.1.2(9) shall be prorated as follows:
HET × *[Base energy credits for C406.2.5.2] / 50%*
HET = Floor area of qualifying spaces where *general lighting* is provided with *high-end trim* lighting controls complying with this section, expressed as a percentage of total interior floor area excluding *dwelling* and *sleeping units* .

C406.2.5.3 L03 Increase occupancy sensor.

Lighting controls shall comply with C406.2.5.3.1, C406.2.5.3.2 and C406.2.5.3.3.

C406.2.5.3.1 Occupant sensor controls.

Occupant sensor controls shall be installed to control lights in the following space types:

1.	Food preparation area
2.	Laboratory
3.	Elevator lobby
4.	Pharmacy area
5.	Vehicular maintenance area
6.	Workshop.
7.	Recreation room in a facility for the visually impaired
8.	Exercise area in a fitness center
9.	Playing area in a fitness center
10.	Exam/treatment room in a healthcare facility
11.	Imaging room in a healthcare facility
12.	Physical therapy room in a healthcare facility

13.	Library reading area
14.	Library stacks
15.	Detailed manufacturing area
16.	*Equipment room* in a manufacturing facility
17.	Low-bay area in a manufacturing facility
18.	Post office sorting area
19.	Religious fellowship hall
20.	Hair salon
21.	Nail salon
22.	Banking activity area
23.	Museum restoration room

C406.2.5.3.2 Occupant sensor control function.

Occupant sensors in library stacks and laboratories shall comply with Section C405.2.1.2. Occupant sensors in elevator lobbies shall comply with Section C405.2.1.4. All other occupant sensors required by Section C406.2.5.3.1 shall comply with Section C405.2.1.1.

Exception: In spaces where an *automatic* shutoff could endanger occupant safety or security occupant sensor controls shall uniformly reduce lighting power to not more than 20 percent of full power within 10 minutes after all occupants have left the space.Time-switch controls complying with C405.2.2.1 shall automatically turn lights off.

C406.2.5.3.3 Occupant sensor time delay and setpoint .

Occupant sensor controls installed in accordance with Sections C405.2.1.1, C405.2.1.2, C405.2.1.3, and C405.2.1.4 shall automatically turn lights off or reduce lighting power within 10 minutes after all occupants have left the space. Occupant sensor controls installed in accordance with Section C405.2.1.2 shall have an unoccupied setpoint of not greater than 20 percent of full power.

C406.2.5.4 L04 Increase daylight area.

The total daylight area of the *building* (DLA_{BLDG}) determined by Equation 4-21 shall be at least 5 percent greater than the typical daylight area (DLA_{TYP}) from Table C406.2.5.4 Credits for measure L04 shall be determined by Equation 4-22 or Equation 4-23, whichever is less:

$$DLA_{BLDG} = DLZ/LFA$$

(Equation 4-21)

DLZ = The total *building* floor area located within sidelit and toplit *daylight zones* complying with Section C405.2.4.2 or Section C405.2.4.3 and provided with daylight responsive controls complying with Section C405.2.4.1, ft^2 or m^2.

LFA = The total *building* floor area used to determine the lighting power allowance in Section C405.3.2, ft^2 or m^2.

$$EC_{DL} = EC_{DL5} \times 20 \times (DLA_{BLDG} - DLA_{TYP})$$

(Equation 4-22)

$$EC_{DL} = EC_{DL5} \times 20 \times (DLA_{MAX} - DLA_{TYP})$$

(Equation 4-23)

EC_{DL} = The number of credits achieved by this measure.

EC_{DL5} = C406.2.5.4 L04 base energy credits from Section C406.2 Tables C406.2(4), C406.2(6), C406.2(7), and C406.2(8).

DLA_{TYP} = Typical % percent of building floor area with daylight control (as a fraction) from Table C406.2.5.4.

DLA_{MAX} = Maximum percent of building floor area with daylight control that can be counted for compliance with this measure, from Table C406.2.5.4.

TABLE C406.2.5.4 ADDED DAYLIGHTING PARAMETERS

C406.2.5.5 L05 Residential light control.

In *buildings* with Group R-2 occupancy spaces, interior lighting systems shall comply with the following:

1.	In common area, the following space types shall have occupant sensor controls that comply with the requirements of Section C405.2.1.1 : 1.1 Laundry/washing areas, 1.2 Dining areas, 1.3 Food preparation areas, 1.4 Seating areas, 1.5 Exercise areas, 1.6 Massage spaces
2.	In dwelling units, not less than one receptacle in each living room and each sleeping room shall be controlled by a switch in that room.
3.	Each *dwelling unit* shall have a switch by the main entrance that turns off all the lighting and all switched receptacles in the *dwelling unit*. The switch shall be clearly labeled.

C406.2.5.6 L06 Reduced lighting power.

Interior lighting within all *building* areas shall comply with this section.

<table>
<tr><td>1.</td><td>The connected interior lighting power (LP) determined in accordance with C405.3.1 shall be 95 percent or less than the interior lighting power allowance (LPA) determined in accordance with Section C405.3.2 using the same method used to comply with C405.3. Energy credits shall not be greater than four times the L06 base credit from Section C406.2 and shall be determined using Equation 4-24.</td></tr>
<tr><td>2.</td><td>All permanently installed lighting serving dwelling units and sleeping units, including ceiling fan light kits and lighting integrated into range hoods and exhaust fans shall be provided by lamps with an efficacy of not less than 90 lumens per watt or by luminaires that have an efficacy of not less than 65 lumens per watt.

Exceptions:
<table><tr><td>1.</td><td>LIghting integral to other appliances</td></tr><tr><td>2.</td><td>Antimicrobial lighting used for the sole purpose of disinfecting.</td></tr></table></td></tr>
</table>

$$\underline{EC_{LPA} = EC_5 \text{ x } 20 \text{ x } (LPA_{\cancel{n}} – LP_{\cancel{n}})/LPA_{\cancel{n}}}$$

(Equation 4-24)
EC_{LPA}= additional energy credit for lighting power reduction
LP= connected interior lighting power calculated in accordance with Section C405.3.1, watts
LPA= interior lighting power allowance calculated in accordance with the requirements of Section C405.3.2, watts
EC5 = L06 base credit from Section C406.2

C406.2.6 Efficient Equipment Credits.

Projects are permitted to achieve energy credits using any combination of Efficient Equipment Credits Q01 through Q04.

C406.2.6.1 Q01 Efficient Elevator Equipment.

Qualifying elevators in the *building* shall be Energy efficiency class A per ISO 25745-2, Table 7. Only buildings 3 or more floors above grade may use this credit. Credits shall be prorated based on Equation 4-25, rounded to the nearest whole credit. Projects with acompliance ratio below 0.5 do not qualify for this credit.

$$EC_e = EC_t \text{ x } CR_e$$

(Equation 4-25)
EC_e= Elevator energy credit achieved for the *building*
EC_t= C406.2.7.1 Table energy credit
CR_e= Compliance Ratio = (F_A/ F_B)
F_A= Sum of floors served by class A elevators
F_B= Sum of floors served by all *building* elevators and escalators

C406.2.6.2 Q02 Efficient Commercial Kitchen Equipment.

For *buildings* and spaces designated as Group A-2, or facilities whose primary business type involves the use of a commercial kitchen where at least one gas or electric fryer is installed before the issuance of the Certificate of Occupancy all fryers, dishwashers, steam cookers and ovens installed before the issuance of the Certificate of Occupancy shall comply with all of the following:

1.	Achieve performance levels in accordance with the equipment specifications listed in Tables C406.2.7.2 (1) through C406.2.7.2 (4) when rated in accordance with the applicable test procedure.
2.	Have associated performance levels listed on the *construction documents* submitted for permitting.

TABLE C406.2.6.2(1) Minimum Efficiency Requirements: Commercial Fryers

C406.2.6.3 Q03 Efficient Residential Kitchen Equipment .

For projects with Group R-1 and R-2 occupancies, energy credits shall be achieved where all dishwashers, refrigerators, and freezers comply with all of the following:

1.	Achieve the Energy Star Most Efficient 2021 label in accordance with the specifications current as of:
1.1.	Refrigerators and freezers 5.0, 9/15/2014
1.2.	Dishwashers 6.0, 1/29/2016
2.	Be installed before the issuance of the certificate of occupancy.

For Group R-1 where only some guest rooms are equipped with both refrigerators and dishwashers, the table credits shall be prorated as follows:

[Section C406.2 base credits] x [floor area of guest rooms with kitchen

(Equation 4-26)

C406.3 Renewable and Load Management Credits achieved.

Renewable energy and load management measures shall achieve credits as follows:

1.	General measure requirements. Credits are achieved for measures installed in the *building* that comply with Sections C406.3.1 through C406.3.8

2.	Achieved credits are determined as follows:
2.1	Measure credits achieved shall be determined in one of two ways, depending on the measure:
2.1.1	The measure credit shall be the base credit listed by occupancy group and *climate zone* for the measure in Tables C406.3(1) through C406.3(9) where no adjustment factor or formula is shown in the description of the measure in Section C406.3.
2.1.2	The measure credit shall be the base energy credit for the measure adjusted by a factor or formula as stated in the description of the measure in Section C406.3. Where adjustments are applied, each energy credit shall be rounded to the nearest whole number.
2.2	Load management and renewable credits achieved for the project shall be the sum of credits for individual measures included in the project. Credits are available for the measures listed in this Section.
2.3	Where a project contains multiple *building* use groups, credits achieved for each *building* use group shall be summed and then weighted by the gross floor area of each *building* use group to determine the weighted average project energy credits achieved.

3. Load management control requirements. The load management measures in Sections C406.3.2 (G01) through C406.3.7 (G06) require load management control sequences that are capable of and configured to automatically provide the load management operation specified based on indication of a peak period related to high short-term electric prices, grid condition, or peak *building* load. Such a peak period shall, where possible, be initiated by a *demand response signal* from the controlling entity, such as a utility or service operator. When communications are disabled or unavailable, all demand responsive controls shall continue backup demand response based on a local schedule or *building* demand monitoring. The local *building* schedule shall be adjustable without programming and reflect the electric rate peak period dates and times. The load management control sequences shall be activated for peak period control by either:

3.1	A certified OpenADR 2.0a or OpenADR 2.0b Virtual End Node (VEN), as specified under Clause 11, Conformance, in the applicable OpenADR 2.0 Specification, or
3.2	A device certified by the manufacturer as being capable of responding to a *demand response signal* from a certified OpenADR 2.0b VEN by automatically implementing the control functions requested by the VEN for the equipment it controls, or
3.3	The physical configuration and communication protocol of CTA 2045-A or CTA 2045-B, or
3.4	For air conditioners and heat pumps with two or more stages of control and cooling capacity of less than 65,000 Btu/h (19 kW), thermostats with a *demand responsive control* that complies with the communication and performance requirements of AHRI 1380, or
3.5	A device that complies with IEC 62726-10-1, an international standard for the open automated demand response system interface between the appliance, system, or energy management system and the controlling entity, or
3.6	An interface that complies with the communication protocol required by a controlling entity, to participate in an automated demand response program, or
3.7	Where the controlling entity does not have a *demand response signal* available for the *building* type and size, local load management control shall be provided based on either:

3.7.1	*Building* demand management controls that monitor *building* electrical demand and initiate controls to minimize monthly or peak time period demand charges, or,
3.7.2	Where buildings are less than 25,000 gross square feet, a local *building* schedule that reflects the electric rate peak period dates and times. In this case a binary input to the control system shall be provided that activates the demand response sequence.

C406.3.1 R01 Renewable Energy.

Projects installing *on-site renewable energy* systems with a capacity of at least 0.1 watts per gross square foot (1.08W/m2) of *building* area or securing off-site renewable energy shall achieve energy credits for this measure calculated as follows:

$$EC_R = EC0.1 \text{ x } (R_t + R_{off} - R_{ex}) / (0.1 \text{ x PGFA})$$

(Equation 4-27)

EC_R= C406.3.1 R01 energy credits achieved for this project

$EC_{0.1}$= C406.3.1 R01 base credits from Tables C406.3(1) through C406.3(9)

R_t = Actual total rating of *on-site renewable energy* systems (W)

R_{OFF}= Actual total equivalent rating of off-site renewable energy contracts (W), calculated as follows:

R_{OFF}= TRE/(REN X 20)

where:

TRE = Total off-site renewable electrical energy in kilowatt-hours (kWh) that is procured in accordance with Sections C405.13.2.1 through C405.13.4

REN = Annual off-site renewable electrical energy from Table C405.13.2, in units of kilowatt-hours per watt of array capacity

R_{ex}= Rating (W) of *renewable energy resources* capacity excluded from credit calculated as follows:

R_{ex}= RR_r+ RR_x+ RR_c

where:

RR_r= Rating of on-site renewable energy systems required by Section C405.13.1, without exception (W).

RR_x= Rating of *renewable energy resources* used to meet any exceptions of this code (W).

RR_c= Rating of *renewable energy resources* used to achieve other energy credits in Section C406 (W).

PGFA = Project gross floor area, ft^2

Where renewable requirements, exceptions, or credits are expressed in annual kWh or Btu rather than Watts of output capacity, they shall be converted as3413 Btu = 1 kWh and converted to W equivalent capacity as follows:

RR_w= Actual total equivalent rating of renewable energy capacity (W), calculated as follows:

RR_w= TRE_x/ (REN × PGFA)

where:

TRE_x= Total renewable energy in kilowatt-hours (kWh) that is excluded from R01 energy credits

C406.3.2 G01 Lighting Load Management.

A project not required to comply with C405.2.9 can achieve energy credits for installing demand responsive lighting controls for interior general lighting that comply with C405.2.9.1. The demand responsive lighting controls shall automatically reduce the light output or power of controlled lighting to no more than 80 percent of full output, or 80 percent of the *high-end trim* set point, whichever is less. Energy credits can be earned where demand responsive lighting controls are installed for the following:

1.	Not less than 10 percent of the interior floor area in Group R or I occupancies; or
2.	Not less than 50 percent of the interior floor area in all other occupancies.

G01 credits shall be prorated using Equation 4-28 with no more than 75 percent of the interior floor area being counted.

[~~building~~ interior floor area with lighting load management, %] x [table credits for C406.3.2]/75%

(Equation 4-28)

C406.3.3 G02 HVAC Load Management.

Automatic load management controls shall be configured as follows:

1.	Cooling temperature shift: Where electric cooling is in use controls shall gradually increase the cooling setpoint by at least 3°F (1.7°C) over a minimum of three hours or reduce effective cooling capacity to 60% of installed capacity during the peak period or adjust cooling temperature setpoint as described in Section C403.6.1.

2.	Heating temperature shift: Where electric heating is in use controls shall gradually decrease the heating setpoint by at least 3°F (1.7°C) over a minimum of three hours or reduce effective heating capacity to 60% of installed capacity during the peak period or adjust heating temperature setpoint as described in Section C403.6.1.
3.	Ventilation shift: Where HVAC systems serve multiple zones and have less than 70 percent outdoor air required, include controls that provide excess outdoor airpreceding the peak period and reduce outdoor air by at least 30 percent during the peak period, in accordance with ASHRAE Standard 62.1 Section 6.2.5.2 Short Term Conditions or provisions for *approved* engineering analysis in the International Mechanical Code Section 403.3.1.1, Outdoor Airflow Rate.

Credits achieved for measure G02 shall be calculated as follows:

$$EC_{G02\_ach} = EC_{G02\_base} * EC_{G02\_adj}$$

(Equation 4-29)

where:

EC_{G02_ach} = *Demand responsive control* credit achieved for project

EC_{G02_base} = G02 Base energy credit from Section 406.3

EC_{G02_adj} = energy credit adjustment factor from Table C406.3.3

TABLE C406.3.3 Energy Credit Adjustment Based on Use of Ventilation Shift or Demand Response

a. "Demand Response Signal Available" is "Yes" where a controlling entity other than the owner makes a demand response signal available to the building.

b. Where the exception is invoked in Section C403.4.6.1 for buildings that comply with Load Management measure G02, then "Demand Response Required" is "Yes".

c. Ventilation shift controls in accordance with Section C406.3.3, item 3.

C406.3.4 G03 Automated Shading Load Management.

Where *fenestration* on east, south, and west exposures exceeds 20 percent of wall area, load management credits shall be achieved as follows:

1.	*Automatic* exterior shading devices or *dynamic glazing* that are capable of reducing solar gain (SHGC) through sunlit *fenestration* by at least 50 percent when fully closed shall receive the full credits in Tables C406.3(1) through C406.3(9). The exterior shades shall have fully open and fully closed SHGC determined in accordance with AERC 1.
2.	*Automatic* interior shading devices with a minimum solar refl ectance of 0.50 for the surface facing the *fenestration* shall receive 40 percent of the credits in Tables C406.3(1) through C406.3(9).

3.	All shading devices, *dynamic glazing*, or shading attachments shall:	
	3.1	Provide at least 90 percent coverage of the total *fenestration* on east, south, and west exposures in the *building* to achieve the credits determined in items 1 or 2. Alternatively, provide at least 70 percent coverage of the total *fenestration* on the south and west exposures in the *building* to achieve 50 percent of the credits determined in items 1 or 2.
	3.2	Be automatically controlled and shall modulate in multiple steps or continuously the amount of solar gain and light transmitted into the space in response to peak periods and either daylight levels or solar intensity.
	3.3	Include a *manual* override located in the same *enclosed space* as the shaded vertical *fenestration* that shall override operation of *automatic* controls no longer than four hours. Such override shall be locked out during peak periods.

For this section, directional exposures shall exclude *fenestration* that has an orientation deviating by more than 45 degrees of facing the cardinal direction . In the southern hemisphere, where the south exposure is referred to, it shall be replaced by the north exposure .

C406.3.5 G04 Electric Energy Storage.

Electric storage devices shall be charged and discharged by *automatic* load management controls to store energy during non-peak periods and use stored energy during peak periods to reduce *building* demand. Electric storage devices shall have a minimum capacity of 1.5 Wh/ft^2 (87 Wh/m^2) of gross *building* area. Base credits in Tables C406.3-1 through C406.3-8 are based on installed electric storage of 5 Wh/ft^2 (54 Wh/m^2) and shall be prorated for actual installed storage capacity between 1.5 and 15 Wh/ft^2 (16 to 160 Wh/m^2), as follows:

$$[\text{Installed electric storage capacity, Wh/ft}^2\ (\text{Wh/m}^2)]\ /\ 5\ (54)\ \text{x}\ [\text{C406.3}$$

(Equation 4-30)

Larger energy storage shall be permitted however, credits are limited to the range of 1.5 to 15 Wh/ft^2 (16 to 160 Wh/m^2).

C406.3.6 G05 Cooling Energy Storage.

Automatic load management controls shall be capable of activating ice or chilled water storage equipment to reduced emand during summer peak periods. Storage tank standby loss shall be demonstrated through analysis to be no more than 2 percent of storage capacity over a 24 hour period for the cooling design day.

Base credits in Section C406.3 are based on storage capacity of the design peak hour cooling load with a 1.15 sizing factor. Credits shall be prorated for installed storage systems sized between 0.5 and 4.0 times the design day peak hour cooling load, rounded to the nearest whole credit. Larger storage shall be permitted but the associated credits are limited to the range above. Energy credits shall be determined as follows:

$$ECs = EC_{1.0} \text{ x } (1.44 \text{ x } SR + 0.71) / 2.15$$

(Equation 4-31)

ECs = Cooling Storage credit achieved for Project

$EC_{1.0}$ = G05 base energy credit for *building* use type and *climate zone* based on 1.0 ton-hours storage per design day ton (kWh/kW) of cooling load

SR = Storage ratio in ton-hours storage per design day ton (kWh/kW) of cooling load where $0.5 \leq SR \leq 4.0$

C406.3.7 G06 SWH Energy Storage.

Where SHW is heated by electricity, *automatic* load management controls comply with ANSI/CTA-2045-B shall preheat stored SHW before the peak period and suspend electric water heating during the peak period. Storage capacity shall be provided by either:

1.	Preheating water above 140°F (60°C) delivery temperature with at least 1.34 kWh of energy storage per kW of water-heating capacity. Tempering valves shall be provided at the *water heater* delivery location.
2.	Providing additional heated water tank storage capacity above peak SHW demand with equivalent peak storage capacity to item 1.

Credits earned for measure G06 shall be calculated using Equation 4-32:

$$EC_{G06\ ach} = EC_{G06\ base} \times EC_{G06\ adj}$$

(Equation 4-32)
$EC_{G06\ ach}$ = SWH Energy Storage credit achieved for Project
$EC_{G06\ base}$ = G06 Base energy credit from Section 406.3
$EC_{G06\ adj}$ = energy credit adjustment factor from Table C406.3.7

TABLE C406.3.7 Energy Credit Adjustment Based on Use of Heat Pump Water Heater or Demand Response
a. "Demand Response Signal Available" is "Yes" where a controlling entity currently makes a demand response signal available to the building.

b. The lower values of $EC_{G06\ adj}$ in this column apply when no less than 67 percent of the whole-building design end use service water heating requirements are met using only heat pump heating at the conditions described in Section C406.2.3.1.2.

C406.3.8 G07 Building Thermal Mass.

The project shall have additional passive interior mass and a night flush control of the HVAC system. The credit is available to projects that have at least 80 percent of gross floor area unoccupied between midnight and 6:00 a.m. The project shall meet the following requirements:

1.	Interior to the *building* thermal *envelope* insulation, provide 10 lb/ft(50 kg/m) of project *conditioned floor area* of passive thermal mass in the *building interior wall*, the inside of the *exterior wall* , or interior floor construction. Mass *construction* shall have mass surfaces directly contacting the air in *conditioned spaces* with directly attached gypsum panels allowed. Mass with carpet or furred gypsum panels or *exterior wall* mass that is on the exterior of the insulation layer (e.g., the portion of CMU block on the exterior of insulation filled cell cavities) shall not be included toward the *building* mass required.
2.	HVAC units for 80 percent or more of the supply airflow in the project shall be equipped with outdoor air economizers and fans that have variable or low speed capable of operating at 66 percent or lower airflow and be included in the night flush *control* sequence.

3.	Night flush controls shall be configured with the following sequence or another night flush strategy shall be permitted where demonstrated to be effective, avoids added morning heating, and is *approved* by the *authority having jurisdiction*.
3.1.	Summer mode shall be activated when outdoor air temperature exceeds 70ºF (21ºC) and shall continue uninterrupted until deactivated when outdoor air temperature falls below 45ºF (7ºC). During summer mode, the occupied cooling *set point* shall be set 1ºF (0.6ºC) higher than normal and the occupied heating *set point* shall be reset 2ºF (1.1ºC) lower than normal.
3.2.	When all the following conditions exist, night flush shall be activated:
3.2.1.	Summer mode is active in accordance with item 3.1.
3.2.2.	Outdoor air temperature is 5ºF (2.8ºC) or more below indoor average zone temperature.
3.2.3.	Indoor average zone temperature is greater than morning occupied heating *set point*.
3.2.4.	In climate zones 0A, 1A, 2A, and 3A, outdoor dewpoint is below 50ºF (10ºC) or outdoor air enthalpy is less than indoor air enthalpy.
3.2.5.	Local time is between 10:00 pm and 6:00 am.
3.3.	When night flush is active, *automatic* night flush controls shall operate outdoor air *economizers* at low fan speed not exceeding 66 percent during the unoccupied period with *mechanical cooling* and heating locked out.

Reason Statement:

This proposed revision requires new mixed fuel buildings (specifically those using natural gas or propane for space and/or water heating) to unfairly and unnecessarily use a 1.25 energy credit threshold multiplier. Gas-fired appliances are covered by the Energy Policy and Conservation on Act (EPCA), 42 U.S.C. § 6201 *et seq.*, and are therefore preempted by federal law. The proposed revisions, coupled with proposed revisions to both the prescriptive and performance compliance pathways, could require builders to select appliances with efficiencies greater than those specified by the Department of Energy in order meet the proposed requirements. If adopted, this proposed revision could result in the Code being at best unenforceable and at worst unadoptable by the state or local jurisdiction.

Bibliography:

no attachments

Cost Impact:

The code change proposal will decrease the cost of construction.

The proposal will neither increase nor decrease the cost of construction

CE2D-53-23

CE2D-54-23

IECC CE: C406.1.1.1, C406.1.1.2, C502.3.7.1

Proponents:

Laura Petrillo-Groh, representing Air-Conditioning, Heating, and Refrigeration Institute (lpetrillo-groh@ahrinet.org); Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com); Vladimir Kochkin, representing NAHB (vkochkin@nahb.org); Emily Lorenz, representing self (emilyblorenz@gmail.com); Andrew Klein, representing BOMA International (andrew@asklein.com); Robert Ross, representing Self (robertross1952@gmail.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

~~C406.1.1.1 Buildings without heat pumps.~~

~~Buildings using purchased energy that is not electricity for space heating or service water heating, buildings with electric storage water heaters that are not heat pumps and buildings with total heat pump space heating capacity less than the space heating load at heating design conditions calculated in accordance with Section C403.1.1 shall comply with measures from C406.2 to achieve not less than 1.25 multiplied by the number of required efficiency credits from Table C406.1.1 based on building occupancy group and climate zone. Where a project contains multiple occupancies, credits in Table C406.1.1 from each building occupancy shall be multiplied by 1.25 and weighted by the gross conditioned floor area to determine the weighted average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for purposes of Section C406.~~

~~Exceptions: 1.Portions of buildings devoted to manufacturing or industrial use. 2. Buildings complying with all of the following: 2.1The building's peak heating load calculated in accordance with Section C403.1.1 is greater than the building's peak cooling load calculated in accordance with Section C403.1.1. 2.2The building's total heat pump space heating capacity is not less than 50 percent of the building's space heating load at heating design conditions calculated in accordance with Section C403.1.1. 2.3Any energy source other than electricity or on-site renewable energy is used for space heating only when a heat pump cannot provide the necessary heating energy to satisfy the thermostat setting. 2.4Electric resistance heat is used only in accordance with Section C403.4.1.1. 3.Low-energy buildings complying with Section C402.1.1.1. 4.Portions of buildings in Utility and Miscellaneous Group U, Storage Group S, Factory Group F, or High-Hazard Group H.~~

C406.1.1.2 Building Core/Shell and Build-Out Construction.

Where separate permits are issued for core and shell buildings and build-outconstruction, compliance shall be in accordance with the following requirements. 1.Core and shell buildings or portions of buildings shall comply with one of the following: 1.1.Where the permit includes a central HVAC system or service water heating system with chillers, heat pumps, boilers, service water heating equipment, or loop pumping systems with heat rejection, the project shall achieve not less than 50 percent of the energy credits required by Section~~s~~ C406.1.1 ~~and C406.1.1.1~~ in accordance with Section C406.2.

- 1.2.Alternatively, the project shall achieve not less than 33 percent of the energy credits required by Sections C406.1.1 ~~and C406.1.1.1~~.

- 2.For core and shell *buildings* or portions of *buildings* the energy credits achieved shall be subject to the following adjustments:

  1. 2.1.Lighting measure credits shall be determined only for areas with final lighting installed.

  2. 2.2.Where HVAC or *service water heating* systems are designed to serve the entire *building*, full HVAC or *service water heating* measure credits shall be achieved.

  3. 2.3.Where HVAC or *service water heating* systems are designed to serve individual areas, HVAC or *service water heating* measure credits achievedshall be reduced in proportion to the floor area with final HVAC systems or final *service water heating* systems installed.

- 3.Build-out construction shall be deemed to comply with Section C406.1 where either:

1. 3.1.Where heating and cooling generation are provided by a previously installed central system, the energy credits achieved in accordance with Section C406.2 under the build-out project are not less than 33 percent of the credits required by Section C406.1.1 and C406.1.1.1.
2. 3.2.Where heating and cooling generation are provided by an HVAC system installed in the build out, the energy credits achieved in accordance with Section C406.2 under the build-out project are not less than 50 percent of the credits required by Section C406.1.1 ~~and C406.1.1.1~~.
3. 3.3.Where the core and shell *building* was *approved* in accordance with C407 under 2021 IECC or later.

Delete without substitution:

~~C502.3.7.1 Additions not served by heat pumps~~.

~~Additions using purchased energy that is not electricity for space heating or service water heating , additions served by electric storage water heaters that are not heat pumps and additions served by total heat pump space heating capacity less than the peak space heating load at heating design conditions calculated in accordance with Section C403.1.1 shall comply with measures from Sections C406.2 and C406.3 to achieve not less than 67.5 percent of the number of required efficiency credits from Table C406.1.1 based on building occupancy group and climate zone . Where a project contains multiple occupancies, credits in Table C406.1.1 from each building occupancy shall be weighted by the gross conditioned floor area to determine the weighted average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for purposes of this section. Alterations to the existing building that are not part of an addition , but permitted with an addition, may be used to achieve the required credits.~~

~~**Exceptions:**~~

1.	Buildings in Utility and Miscellaneous Group U, Storage Group S, Factory Group F, or High-Hazard Group H.
2.	Additions less than 1,000 ft^2 (92 m^2) and less than 50 percent of existing floor area.
3.	Additions that do not include the *addition* or replacement of equipment covered by Tables C403.3.2(1) through C403.3.2(16) or Section C404.2.
4.	Additions that do not contain *conditioned space*.
5.	Where the *addition* alone or the existing *building* and *addition* together comply with Section C407.
6.	Additions complying with all of the following: 6.1 The *addition*'s peak heating load calculated in accordance with Section C403.1.1 is greater than the *addition*'s peak cooling load calculated in accordance with Section C403.1.1. 6.2 The *addition*'s total heat pump space heating capacity serving the *addition* is not less than 50 percent of the *addition*'s space heating load at heating design conditions calculated in accordance with Section C403.1.1. 6.3 Any energy source other than electricity or *on-site renewable energy* is used for space heating serving the *addition* only when a heat pump cannot provide the necessary heating energy to satisfy the *thermostat* setting. 6.4 Electric resistance heat serving the *addition* is used only in accordance with Section C403.4.1.1.

7.	Low-energy buildings complying with Section C402.1.1.1.

Attached Files

- **AHRI Reason Statement - ICC Com Public Draft 2 Vote 1_2023-05-25.pdf**
  https://energy.cdpaccess.com/proposal/1643/3538/files/download/536/

Reason Statement:

This proposal deletes sections C406.1.1.1 and C502.3.7.1, wishing to ensure that IECC 2024 has a pathway for minimum efficiency products.

In response to IECC Public Comment Draft Ballot #1 and #2, AHRI and its members, respectfully opposed the Proposed Revisions to Section C406.1.1.1 of the Energy Code, requiring new buildings using fossil fuels for space or water heating equipment, with certain exemptions, to increase the total energy credits required by 1.25. AHRI also opposed the additions to Section C502.3.7.1, requiring additions using fossil fuels for space or water heating equipment, with certain exemptions, to achieve 67.5 percent of the number of efficiency credits (a higher threshold than was proposed in Public Draft 1).

Increasing the base energy credits in TABLE C406.1.1(1) *Energy Credit Requirements by Building Occupancy Group* without appropriately increasing offsets in TABLE C406.1.1(2) *Limit to Energy Efficiency Credit Carryover from Renewable and Load Management Credits*, creates the same federal preemption problem that necessitated the creation of TABLE C406.1.1(2), in the first place (in CED1-190-22). The inclusion of such a multiplier creates a legally invalid code.

The Pacific Northwest National Laboratory (PNNL) energy credits technical support document was supplemented with additional analysis during the development of CED1-190-22 to ensure that energy efficiency credit requirements could be met without using higher efficiency Energy Policy Act-covered (EPACT) equipment. This methodology ensures a pathway for preempted equipment in the 2024 IECC – a critical legal requirement.

For CED1-190-22, PNNL modeled buildings with minimum efficiency equipment, using reasonable equipment selections (i.e., where appropriate, PNNL used fossil fuel equipment) to establish precisely the number of credits required to ensure minimum efficiency equipment could comply in each building type, in every climate zone. While the working group that refined CED1-190-22 debated the system types used to establish the credit tradeoff levels in TABLE C406.1.1(2), PNNL was trusted by IECC-C to be a neutral party and to make reasonable system selections. These system selections for each building type and climate zone underpin the entire energy credit analysis. Making arbitrary changes without substantial analysis, discussion, agreement at the committee/subcommittee, and support of PNNL's modeling, is completely inappropriate. No such analysis was provided, nor were any of these steps taken with the proposal that led to this change.

The exceptions proposed are completely insufficient and would lead to most new buildings and additions having the non-HP penalty applied to the energy credit requirement. Forcing incorrect product selection can lead to increased energy consumption, increased carbon emissions, and higher utility bills.

Much of the research and momentum behind cold-climate heat pumps has focused on residential applications and light commercial equipment. However, there are several applications where the ventilation rate in commercial Air Source Heat Pump (ASHP) equipment, exceeds 20 percent outdoor air there are many operational complexities that significantly impact customer comfort, energy use and building design that have yet to be addressed. The following system designs and applications need more consideration:

- Make-Up Air (MUA) systems for commercial kitchens and lab exhaust systems

- DX-DOAS equipment with and without energy recovery
- Exercise facilities
- Large assembly spaces (gymnasiums, auditoriums, performing arts centers, etc.)
- Industrial space heating

MUA and DX-DOAS equipment typically operate at 100 percent outdoor air conditions during occupied/operational hours and have the following operational concerns that have yet to be properly addressed. Additionally, large assembly spaces need to be capable of operating at 60-100 percent outside air during full occupancy. A significant portion of industrial heating markets leverage gas heating as opposed to electric or heat pump heating due to the large increase in electrical infrastructure that would be required.

1. Cold ambient conditions still require back-up electric heat in cold climates and require either back-up electric heat or preheat during mild condition operation.

The entering air temperature to the conditioning coil (generally referred to as indoor coils for most HVAC equipment) will be the outdoor temperature where energy recovery cannot be used. For these equipment types, if the entering temperature falls below 40-45°F, scroll compressor technologies can't operate within their allowable operating conditions (commonly referred to as operation envelopes) and the heat pump operation either must be shut down and use backup electric heat operation or use electric preheat to keep coil entering conditions high enough to continue operation. Systems with exhaust air energy recovery can operate at lower ambient temperatures, in some cases around 0°F, but require highly effective energy recovery devices. Getting above 60-70 percent enthalpy recovery ratios or sensible effectiveness without increasing equipment size generally means increased fan power requirements to overcome the additional heat transfer surfaces required for more effective heat exchangers. This additional fan energy should not be ignored since it can result in conditions where the additional fan energy consumes more energy than can be recovered, annually.

2.Defrost operation provides unacceptable air conditions requiring either additional electric heat operation or temporary ventilation reduction

.

Another complication with lower entering temperatures for the ASHP conditioning coils is that during defrost operation, the supply air temperatures are below occupant comfort levels and can approach 35°F with systems using highly effective ventilation energy recovery systems. Or, much lower than 35°F without operating preheat or supplemental heat. These cold supply temperatures can happen in any climate zone that approaches freezing temperatures. Manufacturers have found that defrosting at such cold conditions can cause the indoor/conditioning coil to develop frost causing degradation of ASHP performance. These systems could leverage recirculation to reduce cold supply air temperatures during defrost but the loss of ventilation or recirculation of higher class air generally disallow it.

3 . **Packaged refrigeration upsizing requirements along with the need to provide supplemental, back-up and/or electric preheat requires have much larger electrical loads than their predecessors.**

Many high percentage outdoor air systems generally use gas fired furnaces, especially in cold climates, and converting these to heat pumps with electric backup heat requires a significant increase in electrical capacity.

3.a. **Gas heating only MUA and space heating systems require over 50 times the electrical capacity of their gas counterparts.**

3.b. **In locations that will require backup heat, DX-DOAS and roof top units (RTU) with high percentage outdoor air, will require 2-3 times the electrical capacity of their gas counterparts.**

For large, multi-occupancy buildings, requiring exception 2.1 to be met for the whole building causes these concerns to be lost in the aggregation of the entire building. For single occupancy buildings of these applications and system types, meeting exception 2.2 may be unfeasible, especially in cold climates. Requiring an additional 25% in additional energy credits may be unattainable or require highly customized designs with redundant capacity and much higher costs.

Details on AHRI's concerns with the creation of a legally invalid code created by CECD-18-22, were submitted in response to the IECC Commercial Committee Action Report (issued on April 27, 2023) to supplement AHRI's "No" vote on Public Comment Draft Ballot #2, Vote #1, closing May 26, 2023, and are attached.

Cost Impact:

The code change proposal will decrease the cost of construction.

This proposal removes the additional cost of compliance required for buildings with fossil fuel space and water heating needs.

CE2D-54-23

CE2D-55-23

IECC CE: C406.1.1.1, C406.1.1.2, C502.3.7.1

Proponents:

Kevin Duell, representing NW Natural (kevin.duell@nwnatural.com)

2024 International Energy Code[CE Project] R3

Delete without substitution:

~~C406.1.1.1 Buildings without heat pumps.~~

~~Buildings using purchased energy that is not electricity for space heating or service water heating, buildings with electric storage water heaters that are not heat pumps and buildings with total heat pump space heating capacity less than the space heating load at heating design conditions calculated in accordance with Section C403.1.1 shall comply with measures from C406.2 to achieve not less than 1.25 multiplied by the number of required efficiency credits from Table C406.1.1 based on building occupancy group and climate zone. Where a project contains multiple occupancies, credits in Table C406.1.1 from each building occupancy shall be multiplied by 1.25 and weighted by the gross conditioned floor area to determine the weighted average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for purposes of Section C406.~~
~~Exceptions: 1.Portions of buildings devoted to manufacturing or industrial use. 2. Buildings complying with all of the following: 2.1The building's peak heating load calculated in accordance with Section C403.1.1 is greater than the building's peak cooling load calculated in accordance with Section C403.1.1. 2.2The building's total heat pump space heating capacity is not less than 50 percent of the building's space heating load at heating design conditions calculated in accordance with Section C403.1.1. 2.3Any energy source other than electricity or on-site renewable energy is used for space heating only when a heat pump cannot provide the necessary heating energy to satisfy the thermostat setting. 2.4Electric resistance heat is used only in accordance with Section C403.4.1.1. 3.Low-energy buildings complying with Section C402.1.1.1. 4.Portions of buildings in Utility and Miscellaneous Group U, Storage Group S, Factory Group F, or High-Hazard Group H.~~

Revise as follows:

C406.1.1.2 Building Core/Shell and Build-Out Construction.

Where separate permits are issued for core and shell buildings and build-outconstruction, compliance shall be in accordance with the following requirements. 1.Core and shell buildings or portions of buildings shall comply with one of the following: 1.1.Where the permit includes a central HVAC system or service water heating system with chillers, heat pumps, boilers, service water heating equipment, or loop pumping systems with heat rejection, the project shall achieve not less than 50 percent of the energy credits required by Sections C406.1.1 and C406.1.1.1 in accordance with Section C406.2.

- 1.2.Alternatively, the project shall achieve not less than 33 percent of the energy credits required by Sections C406.1.1~~ and C406.1.1.~~.
- 2.For core and shell *buildings* or portions of *buildings* the energy credits achieved shall be subject to the following adjustments:
  1. 2.1.Lighting measure credits shall be determined only for areas with final lighting installed.
  2. 2.2.Where HVAC or *service water heating* systems are designed to serve the entire *building*, full HVAC or *service water heating* measure credits shall be achieved.
  3. 2.3.Where HVAC or *service water heating* systems are designed to serve individual areas, HVAC or *service water heating* measure credits achievedshall be reduced in proportion to the floor area with final HVAC systems or final *service water heating* systems installed.
- 3.Build-out construction shall be deemed to comply with Section C406.1 where either:
  1. 3.1.Where heating and cooling generation are provided by a previously installed central system, the energy credits achieved

in accordance with Section C406.2 under the build-out project are not less than 33 percent of the credits required by Section C406.1.1~~ and C406.1.1.1~~.

2. 3.2.Where heating and cooling generation are provided by an HVAC system installed in the build out, the energy credits achieved in accordance with Section C406.2 under the build-out project are not less than 50 percent of the credits required by Section C406.1.1~~ and C406.1.1.1~~.
3. 3.3.Where the core and shell *building* was *approved* in accordance with C407 under 2021 IECC or later.

Delete without substitution:

~~C502.3.7.1 Additions not served by heat pumps.~~

~~Additions using purchased energy that is not electricity for space heating or service water heating , additions served by electric storage water heaters that are not heat pumps and additions served by total heat pump space heating capacity less than the peak space heating load at heating design conditions calculated in accordance with Section C403.1.1 shall comply with measures from Sections C406.2 and C406.3 to achieve not less than 67.5 percent of the number of required efficiency credits from Table C406.1.1 based on building occupancy group and climate zone . Where a project contains multiple occupancies, credits in Table C406.1.1 from each building occupancy shall be weighted by the gross conditioned floor area to determine the weighted average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for purposes of this section. Alterations to the existing building that are not part of an addition , but permitted with an addition, may be used to achieve the required credits.~~

~~**Exceptions:**~~

1.	Buildings in Utility and Miscellaneous Group U, Storage Group S, Factory Group F, or High-Hazard Group H.
2.	Additions less than 1,000 ft^2 (92 m^2) and less than 50 percent of existing floor area.
3.	Additions that do not include the *addition* or replacement of equipment covered by Tables C403.3.2(1) through C403.3.2(16) or Section C404.2.
4.	Additions that do not contain *conditioned space*.
5.	Where the *addition* alone or the existing *building* and *addition* together comply with Section C407.
6.	Additions complying with all of the following: 6.1 The *addition*'s peak heating load calculated in accordance with Section C403.1.1 is greater than the *addition*'s peak cooling load calculated in accordance with Section C403.1.1. 6.2 The *addition*'s total heat pump space heating capacity serving the *addition* is not less than 50 percent of the *addition*'s space heating load at heating design conditions calculated in accordance with Section C403.1.1. 6.3 Any energy source other than electricity or *on-site renewable energy* is used for space heating serving the *addition* only when a heat pump cannot provide the necessary heating energy to satisfy the *thermostat* setting. 6.4 Electric resistance heat serving the *addition* is used only in accordance with Section C403.4.1.1.
7.	Low-energy buildings complying with Section C402.1.1.1.

Reason Statement:

Care should be taken when modifying the prescriptive and performance paths and then imposing an energy credit threshold multiplier. This appears to be a violation of the Energy Policy and Conservation on Act, since it may force builders to use appliance with efficiencies that exceed federal minimums. So, a jurisdiction that adopts this section would be opening itself to similar litigation to the *Berkeley* case.

For these reasons, please delete the changes added from CECD1-18-22.

Cost Impact:

The code change proposal will decrease the cost of construction.

The revision will increase equipment choices for builders allowing lower costs. It may also eliminate the need for doubling up on heating equipment in some cases.

CE2D-55-23

CE2D-56-23

IECC CE: C406.1.1.1

Proponents:

Renee Lani, representing American Public Gas Association (rlani@apga.org)

2024 International Energy Code[CE Project] R3

Delete without substitution:

~~C406.1.1.1 Buildings without heat pumps.~~

~~Buildings using purchased energy that is not electricity for space heating or service water heating, buildings with electric storage water heaters that are not heat pumps and buildings with total heat pump space heating capacity less than the space heating load at heating design conditions calculated in accordance with Section C403.1.1 shall comply with measures from C406.2 to achieve not less than 1.25 multiplied by the number of required efficiency credits from Table C406.1.1 based on building occupancy group and climate zone. Where a project contains multiple occupancies, credits in Table C406.1.1 from each building occupancy shall be multiplied by 1.25 and weighted by the gross conditioned floor area to determine the weighted average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for purposes of Section C406.~~
~~Exceptions: 1.Portions of buildings devoted to manufacturing or industrial use. 2. Buildings complying with all of the following: 2.1The building's peak heating load calculated in accordance with Section C403.1.1 is greater than the building's peak cooling load calculated in accordance with Section C403.1.1. 2.2The building's total heat pump space heating capacity is not less than 50 percent of the building's space heating load at heating design conditions calculated in accordance with Section C403.1.1. 2.3Any energy source other than electricity or on-site renewable energy is used for space heating only when a heat pump cannot provide the necessary heating energy to satisfy the thermostat setting. 2.4Electric resistance heat is used only in accordance with Section C403.4.1.1. 3.Low-energy buildings complying with Section C402.1.1.1. 4.Portions of buildings in Utility and Miscellaneous Group U, Storage Group S, Factory Group F, or High-Hazard Group H.~~

Reason Statement:

APGA appreciates the opportunity to provide IECC-C Committee this input. APGA is the national trade association for approximately 1,000 communities across the U.S. that own and operate their own retail natural gas distribution entities. They include municipal gas distribution systems, public utility districts, county districts, and other public agencies, all locally accountable to the citizens they serve. Public gas systems focus on providing safe, reliable, resilient, and affordable natural gas service to their customers. APGA members serve their communities by providing sustainable and clean energy to be used for cooking, clothes drying, and space and water heating, as well as for various commercial and industrial applications.

APGA is concerned that this proposal is both unfairly and unnecessarily forcing new mixed energy buildings, specifically those using natural gas or propane for space or water heating, to use an energy credit threshold multiplier. The result of this multiplier is the possibility of a builder being forced to select appliances that have efficiencies above those set as the federal minimum by the Department of Energy. In other words, this provision could essentially, in a roundabout way, create a IECC-required efficiency level for appliances in certain situations, which is clearly preempted by federal law under EPCA.

To avoid this scenario, APGA recommends deleting the section entirely to ensure that the IECC does not become unenforceable when adopted or potentially unadoptable because of preemption concerns.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This will ensure choice and not trigger preemption, but cost will ultimately depend on the selected appliances installed in the building.

CE2D-57-23

IECC CE: C406.1.1.1

Proponents:

Richard Lord, representing Carrier Corporation (richard.lord@carrier.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C406.1.1.1 Buildings without heat pumps.

Buildings using purchased energy that is not electricity for space heating or service water heating, buildings with electric storage water heaters that are not heat pumps and buildings with total heat pump space heating capacity less than the space heating load at heating design conditions calculated in accordance with Section C403.1.1 shall comply with measures from C406.2 to achieve not less than 1.25 multiplied by the number of required efficiency credits from Table C406.1.1 based on building occupancy group and climate zone. Where a project contains multiple occupancies, credits in Table C406.1.1 from each building occupancy shall be multiplied by 1.25 and weighted by the gross conditioned floor area to determine the weighted average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for purposes of Section C406.

Exceptions:

1.	Portions of buildings devoted to manufacturing or industrial use.
2.	Buildings complying with all of the following: 2.1. Enter text 2.2. The building's peak heating load calculated in accordance with Section C403.1.1 is greater than the building's peak cooling load calculated in accordance with Section C403.1.1. 2.3. Any energy source other than electricity or on-site renewable energy is used for space heating only when a heat pump cannot provide the necessary heating energy to satisfy the thermostat setting. 2.4. Electric resistance heat is used only in accordance with Section C403.4.1.1.
3.	Low-energy buildings complying with Section C402.1.1.1.
4.	Portions of buildings in Utility and Miscellaneous Group U, Storage Group S, Factory Group F, or High-Hazard Group H.
5.	Buildings located in climate zones 0A, 0B, 1A, 2B, and 2C that are dominated by cooling operation.

Reason Statement:

Heat pumps have a 5 to 10% lower cooling efficiency due to 4 way valve, accumulator and charge optimization losses and would actual result in increased energy in cooling dominated climates. Heat pumps should not be required in these climates for commercial buildings that are dominated by cooling.

Bibliography:

Th economic models for credits were not shared by PNNL so we could not easily model the energy use, but some quick analysis we did shows that this will result in energy savings for commercial buildings.

Also it seems like the 1.25 should vary by climate zone and decrease in warmer climates.

Cost Impact:

The code change proposal will decrease the cost of construction.

This actual will be a cost reduction and an energy savings so payback will be instantaneous.

CE2D-57-23

CE2D-58-23

IECC CE: C406.1.2

Proponents:

Jay Crandell, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

2024 International Energy Code[CE Project] R3

Revise as follows:

C406.1.2 Additional renewable and load management credit requirements.

Buildings shall comply with measures from C406.3 to achieve not less than the number of required renewable and load management credits from Table C406.1.2 based on *building* occupancy group and *climate zone*. Where a project contains multiple occupancies, credits in Table C406.1.2 from each *building* occupancy shall be weighted by the gross floor area to determine the weighted average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for purposes of Section C406.

Exception: Where a *building* achieves more energy efficiency credits in Section C406.2 than are required in Section C406.1.1, the renewable and load management credits required in Table C406.1.2 shall be <u>permitted to be</u> reduced by the amount of surplus energy efficiency credits~~, not to exceed a 30 percent reduction~~.

Reason Statement:

This proposal addresses two issues in the exception to Section C406.1.2: (1) to allow or permit reduction in required renewable and load management credits but not require it as currently written if there are surplus efficiency credits available, and (2) remove the limit on using excess efficiency credits to reduce the renewable and load management credit requirements. Energy efficiency or conservation of renewable and non-renewable primary energy sources is the back-bone of an energy conservation code. This is particularly so in an environment where transition to renewables and low-carbon energy sources is already occurring at a rapid pace due to other major policies that are focused on upstream energy sources rather than attempting to control them at the building project level. Also, use of renewable energy or load management measures does not reduce the net energy demand of the building so it is unclear how these credits can be considered on equivalent basis of energy efficiency credits. To the awareness of this proponent, there did not appear to be a rationale provided to justify inclusion of the 30 percent reduction limit.

ALTERNATE PROPOSAL: As an alternative solution, energy efficiency credits and renewable/load management credits should be treated separately (delete the exception in C406.1.2 and exception 2 in C406.1.1). Coordinating changes should be considered for Appendices CD and CF as well.

Cost Impact:

The code change proposal will decrease the cost of construction.

By adding additional flexibility in the use of surplus energy efficiency credits to offset required credits for renewables and load management, this should tend to reduce cost by providing the user with more options to satisfy the requirements of Section C406.

CE2D-58-23

CE2D-59-23

IECC CE: C406.1.2

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com); Andrew Klein, representing BOMA International (andrew@asklein.com); Emily Lorenz, representing International Institute of Building Enclosure Consultants (emilyblorenz@gmail.com); Robert Ross, representing Self (robertross1952@gmail.com); Vladimir Kochkin, representing NAHB (vkochkin@nahb.org); Laura Petrillo-Groh, representing Air-Conditioning, Heating, and Refrigeration Institute (lpetrillo-groh@ahrinet.org); Martha VanGeem, representing Masonry Alliance for Codes and Standards (martha.vangeem@gmail.com); Glen Clapper, representing National Roofing Contractors Association (gclapper@nrca.net); Jeff Bradley, representing American Wood Coucil (jbradley@awc.org)

2024 International Energy Code[CE Project] R3

Revise as follows:

C406.1.2 Additional renewable and load management credit requirements.

Buildings shall comply with measures from C406.3 to achieve not less than the number of required renewable and load management credits from Table C406.1.2 based on *building* occupancy group and *climate zone*. Where a project contains multiple occupancies, credits in Table C406.1.2 from each *building* occupancy shall be weighted by the gross floor area to determine the weighted average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for purposes of Section C406.

Exception: Where a *building* achieves more energy efficiency credits in Section C406.2 than are required in Section C406.1.1, the renewable and load management credits required in Table C406.1.2 shall be reduced by the amount of surplus energy efficiency credits~~, not to exceed a 30 percent reduction~~.

Reason Statement:

The arbitrary 30 percent limitation on the reduction of required renewable and load management credits for the provision of surplus energy efficiency credits is unfortunately reflective of the parsimonious nature of many perspectives involved in IECC development and diminishes the value of superior performance in energy efficiency.

It’s oddly unique to energy code development to have opponents to relaxing efficiency requirements for the provision of renewable generation also opposed to fully rewarding improved energy efficiency. ‘Free ridership’ is a derogatory term for an owner’s provision of features that exceed the minimum energy efficiency by people who refuse to credit enhanced performance.

It is a transparent initiative to force building owners to exceed code minimums by limiting the credit they can receive for systems that improve the general energy performance of the building beyond code minimums. It automatically limits flexibility in building design and construction and thereby raises the cost of construction, all without providing a cost-justification or cost-impact statement.

It would be challenging to find a building or fire code not related to energy that penalizes owners for going beyond code compliance by requiring more performance.

Cost Impact:

The code change proposal will decrease the cost of construction.

Presumably, more compliance flexibility will decrease construction costs.

CE2D-60-23

IECC CE: TABLE C406.1.2

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code[CE Project] R3

Delete without substitution:

~~TABLE C406.1.2 RENEWABLE AND LOAD MANAGEMENT CREDIT REQUIREMENTS BY BUILDING OCCUPANCY GROUP~~

Reason Statement:

Credit values are unsubstantiated by transparent and reviewable or citations presenting supporting calculations.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Deletion of renewable and load management credit requirements is unlikely to affect cost of construction.

CE2D-60-23

CE2D-61-23

IECC CE: C406.2, C406.2.2.1

Proponents:

Michael Tillou, representing Pacific Northwest National Lab (michael.tillou@pnnl.gov)

2024 International Energy Code[CE Project] R3

Revise as follows:

C406.2 Additional Energy Efficiency Credits Achieved.

Each energy efficiency credit measure used to meet credit requirements for the project shall have efficiency that is greater than the requirements in Sections C402 through C405. Measures installed in the project that meet the requirements in Sections C406.2.1 through C406.2.7 shall achieve the base credits listed for the measure and occupancy type in Tables C406.2(1) through C406.2(9) or, where calculations required by Sections C406.2.1 through C406.2.7 create or modify the table credits, the credits achieved shall be based upon the calculations. Energy credits achieved for measures shall be determined by one of the following, as applicable:

1.	The measure's energy credit shall be the base energy credit from Tables C406.2(1) through C406.2(9) for the measure where no adjustment factor or calculation is included in the description of the measure in Section C406.2.
2.	The measure's energy credit shall be the base energy credit for the measure adjusted by a factor or equation as stated in the description of the measure in Section C406.2. Where adjustments are applied, each measure's energy credit shall be rounded to the nearest whole number.
3.	The measure's energy credit shall be calculation as stated in the measures description in Section C406.2, where each individual measure credit shall be rounded to the nearest whole number.

Energy credits achieved for the project shall be the sum of the individual measure’s energy credits. Credits are available for the measures listed in this Section. Where a project contains multiple *building* occupancy groups:

1.	Credits achieved for each occupancy group shall be summed and then weighted by the *conditioned floor area* of each occupancy group to determine the weighted average project energy credits achieved.
2.	Improved envelope efficiency (E01 through E06), HVAC Performance (H01), and lighting reduction (L06) measure credits shall be determined for the *building* or permitted *conditioned floor area* as a whole. Credits for other measures shall be determined for each occupancy separately. Credits shall be taken from applicable tables or calculations for each occupancy and weighted by the *building* occupancy group floor area.

C406.2.2.1 H01 HVAC Performance (TSPR).

H01 energy credits shall be earned where systems are permitted to use Section C409 and where the savings (TSPRs) based on the proposed TSPR (TSPRp) compared to the target TSPR (TSPRt) is 5 percent or more. If savings is greater than 5 percent, determine H01 earned credits using Equation 4-14. Energy credits for H01 shall not be combined with energy credits from HVAC measures H02, H03 or H05.

$$EC_{TSPR} \quad = \quad EC_{BASE} \text{ x TSPRa x TSPRs / 0.05}$$

(Equation 4-14)

where:

EC_{TSPR} = Energy credits achieved for H01

EC_{BASE} = H01 base energy credits from Tables C406.2(1) through C406.2(9)

TSPRs = TSPRa x [the lessor of 0.20 and (1-(TSPRt / TSPRp))]

TSPRa = [floor area served by systems permitted to use TSPR] / [total building *conditioned floor area*]

TSPRp = HVAC TSPR of the proposed design calculated in accordance with Sections C409.4, C409.5 and C409.6.

TSPRt = TSPRr / MPF

TSPRr = HVAC TSPR of the reference *building* design calculated in accordance with Sections C409.4, C409.5 and C409.6.

MPF = Mechanical Performance Factor from Table C409.4 based on *climate zone* and *building* use type

Where a *building* has multiple *building* use types, MPF shall be area weighted in accordance with Section C409.4

Attached Files

- **H01-edit-IECC24-proposal-1666.pdf**
  https://energy.cdpaccess.com/proposal/1666/3436/files/download/530/

Reason Statement:

Review and testing of the formula for TSPRs found three issues that this proposal corrects:

1. The subscript TSPRx is inccorect and changed to TSPRs for TSPRsavings

2. TSPRp and TSPRt were reversed in the formula for TSPRs resulting in a negative result and a fraction representing improvement in TSPR rather than the savings indicated by the improvement in TSPR. The corrected core formula for TSPRsavings is: 1 - (TSPRt / TSPRp)

As an example, for a typical improvement case, the current TSPRs formula would return -12.6% savings when the TSPR improvement was 12.6%, and the actual savings in site energy use was 11.2%. The corrected formula returns 11.2%.

3. The adjustment for building area included in the TSPR calculation (TSPRa) was moved to the main formula so that TSPRs can be properly referenced to be in the range of 0.05 to 0.20 for setting measure eligibility limits.

Two symbols were added for the base and earned energy credits to match the format of other measure adjustment formulas.

In addition, charging language was clarified to indicate the minimum 5% is a savings from TSPR improvement rather than the TSPR improvement itself. Also, the mixed-use section was modified to include measure H01 with those measures that are calculated for the project as a whole.

NOTE: CDPaccess did not retain strikeout and underline for many of the proposed corrections, a file is attached that shows all the proposed changes from the second round IECC posting.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

There is no cost impact from this correction to match the intended 5% savings basis for measure H01.

CE2D-61-23

CE2D-62-23

IECC CE: C406.2.3.1.3

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C406.2.3.1.3 W03 Efficient fossil fuel water heater.

The combined input-capacity-weighted-average equipment rating of all gas water-heating equipment in the *building*shall be not less than 95 percent Et or 0.93 UEF. Adjustments shall apply as follows:

~~1.~~	Where the *service water heating* system is required to comply with Section C404.2.1, this measure shall achieve 30 percent of the listed base W03 energy credits in Tables C406.2(1) through C406.2(9)
~~2.~~	~~Where the installed building service water heating capacity is less than 200,000 Btu/hr (59 kW) and weighted UEF is less than 0.93 UEF and not less than 0.82 this measure shall achieve 25 percent of the base W03 credit in Tables C406.2(1) through C406.2(9)~~

Reason Statement:

Adjustment #2 changes in UEF are not justified by transparent and reviewable analysis or citations presenting supporting calculations.

Cost Impact:

The code change proposal will decrease the cost of construction.

The deletion of Adjustment #2 is likely to make available additional water heating products and allow for better installed cost optimization.

CE2D-62-23

CE2D-63-23

IECC CE: C406.2.5.5

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C406.2.5.5 L05 Residential light control.

In *buildings* with Group R-2 occupancy spaces, interior lighting systems shall comply with the following:

1.	In common area, the following space types shall have occupant sensor controls that comply with the requirements of Section C405.2.1.1 : 1.1 Laundry/washing areas, 1.2 Dining areas, 1.3 Food preparation areas, 1.4 Seating areas, 1.5 Exercise areas, 1.6 Massage spaces
2.	In dwelling units, not less than one receptacle in each living room and each sleeping room shall be controlled by a switch in that room.
~~3.~~	~~Each *dwelling unit* shall have a switch by the main entrance that turns off all the lighting and all switched receptacles in the *dwelling unit*. The switch shall be clearly labeled.~~

Reason Statement:

Awarding points for providing a single switch at an R-2 dwelling unit's main entrance that can switch-off all lighting in the dwelling unit is inappropriate; it incents a life-safety hazard.

No single switch, accessible to any occupant, should be able to turn the lights off on people who could be cooking at a hot stove, or using knives for food preparation, or a hot glue gun for crafts, or on a ladder cleaning, or in the shower bathing, or with their hands in the electric panel to turn-off an individual circuit, or doing any number of other activities in their home.

Supporters of this provision noted that:

1. This type of installation is already legal.
2. This type of installation is popular with consumers.

3. All power in the dwelling unit is already able to be shut-off by the mains disconnect in the service panel.

In response:

1. Legal is not synonymous with a good idea. The code should not incent bad ideas, regardless of whether they are legal. Of course, it is possible that this type of installation may not be legal in the future – it is just a successful code change away from being illegal.

2. Popular is not synonymous with a good idea. Many things are popular with people that are bad ideas.

3. There is an additional level of decision making that is involved in accessing the electric panel to turn-off the power in the dwelling unit. It is unlikely to be done accidentally or by an occupant who is unaware of the potential impacts, such as a child.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Impact$ are uncertain.

CE2D-63-23

CE2D-64-23

IECC CE: C406.2.5.5

Proponents:

Jack Bailey, representing INTERNATIONAL ASSOCIATION OF LIGHTING DESIGNERS (jbailey@oneluxstudio.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C406.2.5.5 L05 Residential light control.

In *buildings* with Group R-2 occupancy spaces, interior lighting systems shall comply with the following:

1.	In common area, the following space types shall have occupant sensor controls that comply with the requirements of Section C405.2.1.1 : 1.1 Laundry/washing areas, 1.2 Dining areas, 1.3 Food preparation areas, 1.4 Seating areas, 1.5 Exercise areas, 1.6 Massage spaces
2.	In dwelling units, not less than one receptacle in each living room and each sleeping room shall be controlled by a switch in that room.
3.	Each *dwelling unit* shall have a switch by the main entrance that turns off all the lighting and all switched receptacles in the *dwelling unit*. The switch shall be clearly labeled. <u>**Exception:** Lighting and switched receptacles controlled by an occupant sensor complying with C405.2.1.1 are not required to be controlled by the switch at the main entrance.</u>

Reason Statement:

Legitimate safety concerns were raised during the consensus committee hearing related to elderly or disabled people being unable to safely find their way to the main switch in the event that someone else inadvertently shut the lights off on them. Equivalent energy savings will be achieved through the use of occupant sensors, while eliminating the safety concern.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

An occupant sensor is more expensive than a switch, but providing one is optional.

CE2D-65-23

IECC CE: TABLE C406.3.7

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code[CE Project] R3

Delete without substitution:

~~TABLE C406.3.7 Energy Credit Adjustment Based on Use of Heat Pump Water Heater or Demand Response~~
~~a. "Demand Response Signal Available" is "Yes" where a controlling entity currently makes a demand response signal available to the building.~~

~~b. The lower values of~~ $\cancel{EC_{G06\ adj}}$ ~~in this column apply when no less than 67 percent of the whole-building design end use service water heating requirements are met using only heat pump heating at the conditions described in Section C406.2.3.1.2.~~

Reason Statement:

Credit adjustments for heat pump water heaters lack justification from transparent and reviewable analysis or citations supporting calculations.

Cost Impact:

The code change proposal will decrease the cost of construction.

Deletion of the table is likely to reduce cost of construction by removing a disincentive for more cost effective, on an installation cost basis, water heating options.

CE2D-65-23

CE2D-66-23

IECC CE: C408.3.1.4, C408.3.1.5

Proponents:

Harold Jepsen, representing Legrand (harold.jepsen@legrand.us)

2024 International Energy Code[CE Project] R3

Revise as follows:

C408.3.1.4 High-end trim controls.

Where lighting controls are configured for *high-end trim*, verify the following:

1.	*High-end trim* maximum level has been set.
2.	The calibration adjustment equipment is located for *ready access* only by authorized personnel.
3.	Lighting controls with *ready access* for users cannot increase the lighting power above the maximum level established by the *high-end trim* controls.

C408.3.1.5 High end trim lighting control verification for Additional Efficiency Credit L02.

For the qualifying spaces associated with the project receiving additional efficiency credits in Section C406.2.5.2, the following shall be documented while daylight responsive controls are not reducing lighting power:

1.	The maximum setting for power or light output for each control group of *general lighting* luminaires.
2.	The *high-end trim* setting for power or light output for each control group of *general lighting* luminaires.
3.	For projects with seven or fewer claimed qualifying spaces, the reduction in light level or reduction in power due to *high-end trim* shall be tested in all spaces and shown to reduce the *general lighting* power or light level to not greater than 85 percent of full power or light output. For projects with more than seven claimed qualifying spaces, the reduction in light level or reduction in power due to *high-end trim* shall be tested in not less than 10 percent of spaces, and no less than seven spaces, and shown to reduce *general lighting* power or light level to not greater than 85 percent of full power or light output. Where more than 30 percent of the tested spaces fail, the remaining qualifying spaces shall be tested.
4.	Summarize the reduction in *general lighting* power or light output resulting from the *high-end trim* setting for each qualifying space and the floor area of each qualifying space.
5.	Summarize the fraction of total floor area for spaces where *high-end trim* reduces *general lighting* power or light output to not greater than 85 percent of full power or light output.

Reason Statement:

Some of these shown changes are to restore language from PC Proposal CECD1-4-22, which were left out of the PC DRAFT1 version.

Other changes are editorial to provide greater clarity to the requirements. These changes align language with defined terms,and identifies lighting output reduction as a method to verify functional operation as already identified in three earlier sections of this section. The stringency, intent orapplication of the code is not altered with these changes.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

These changes are to correct proposal language which was left out of the PC Draft1 version as well as for editorial and clarity reasons.

CE2D-66-23

CE2D-67-23

IECC CE: C408.3.1.6

Proponents:

Harold Jepsen, representing Legrand (harold.jepsen@legrand.us)

2024 International Energy Code[CE Project] R3

Revise as follows:

C408.3.1.6 Demand responsive lighting controls G01.

For spaces associated with the project receiving Renewable and Load Management Credits in Section C406.3.2, the following procedures shall be performed:

1.	Confirm the maximum set point upon receipt of the *demand response signal* has been established for each space.
2.	For projects with seven or fewer spaces ~~rooms~~ with controls, each space ~~room~~ shall be tested.
3.	For projects with more than seven spaces~~rooms~~ with controls, testing shall be done for each unique space type. Where multiple spaces~~rooms~~ of each space type exist, not less than 10 percent and in no case fewer than one space~~room~~, of each space type shall be tested unless the *code official* requires a higher percentage to be tested. Where 30 percent or more of the tested controls fail in a space type, all remaining identical space types shall be tested.
4.	For demand responsive controls to be tested, verify the following: 4.1 Where *high-end trim* controls are used, the *high-end trim* shall be set before testing. 4.2 Turn off all non-*general lighting* in the space~~room~~. 4.3 Set *general lighting* to its maximum illumination level. Where *high-end trim* is set, this will be the maximum illumination level at the *high-end trim* setpoint. 4.4 An illumination measurement shall be taken in an area of the space~~room~~ not controlled by daylight responsive controlled lighting. If there is not an area without daylight responsive controls the daylight responsive controls shall be overridden from reducing the lighting level during the test. 4.5 Measure and document the space~~room~~ maximum illumination level.
5.	Simulate a *demand response signal* and measure the illumination level at the same location as for the measurement in C408.3.1.5.(4.5). Verify the illumination level has been reduced to no greater than 80 percent of the maximum illumination level documented in C408.3.1.5.(4.5).
6.	Simulate the end of a demand event by turning off the *demand response signal*, confirm controls automatically return to their normal operational settings at the end of the demand response event.

Reason Statement:

These changes are editorial to provide greater clarity to the requirements by changing the term "room" for that of "space". Using the term space is consistent with other functional testing requirements in this section. The stringency, intent or application of the code is not altered with these changes.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

These changes are editorial and for greater clarity.

CE2D-67-23

CE2D-68-23

IECC CE: C502.3.7.1

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code[CE Project] R3

Delete without substitution:

~~C502.3.7.1 Additions not served by heat pumps.~~

~~Additions using purchased energy that is not electricity for space heating or service water heating , additions served by electric storage water heaters that are not heat pumps and additions served by total heat pump space heating capacity less than the peak space heating load at heating design conditions calculated in accordance with Section C403.1.1 shall comply with measures from Sections C406.2 and C406.3 to achieve not less than 67.5 percent of the number of required efficiency credits from Table C406.1.1 based on building occupancy group and climate zone . Where a project contains multiple occupancies, credits in Table C406.1.1 from each building occupancy shall be weighted by the gross conditioned floor area to determine the weighted average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for purposes of this section. Alterations to the existing building that are not part of an addition , but permitted with an addition, may be used to achieve the required credits.~~

~~**Exceptions:**~~

1.	Buildings in Utility and Miscellaneous Group U, Storage Group S, Factory Group F, or High-Hazard Group H.
2.	Additions less than 1,000 ft^2 (92 m^2) and less than 50 percent of existing floor area.
3.	Additions that do not include the *addition* or replacement of equipment covered by Tables C403.3.2(1) through C403.3.2(16) or Section C404.2.
4.	Additions that do not contain *conditioned space*.
5.	Where the *addition* alone or the existing *building* and *addition* together comply with Section C407.
6.	Additions complying with all of the following: 6.1 The *addition*'s peak heating load calculated in accordance with Section C403.1.1 is greater than the *addition*'s peak cooling load calculated in accordance with Section C403.1.1. 6.2 The *addition*'s total heat pump space heating capacity serving the *addition* is not less than 50 percent of the *addition*'s space heating load at heating design conditions calculated in accordance with Section C403.1.1. 6.3 Any energy source other than electricity or *on-site renewable energy* is used for space heating serving the *addition* only when a heat pump cannot provide the necessary heating energy to satisfy the *thermostat* setting. 6.4 Electric resistance heat serving the *addition* is used only in accordance with Section C403.4.1.1.

7.	Low-energy buildings complying with Section C402.1.1.1.

Reason Statement:

Imposition of additional energy credit requirements for additions not served by heat pumps lacks justification from transparent and reviewable analysis or citations supporting calculations.

Cost Impact:

The code change proposal will decrease the cost of construction.

Deletion of the section is likely to allow for more optimal installed cost equipment installation.

CE2D-68-23

CE2D-69-23

IECC CE: C503.2.1

Proponents:

Glen Clapper, representing National Roofing Contractors Association (gclapper@nrca.net)

2024 International Energy Code[CE Project] R3

Revise as follows:

C503.2.1 Roof, ceiling, and attic alterations.

Insulation complying with Section C402.1 and Section C402.2.1, or an *approved* design that minimizes deviation from the insulation requirements, shall be provided for the following alterations:

1.	An *alteration* of roof-ceiling construction other than refroofing where existing insulation located below the roof deck or on an attic floor above *conditioned space* does not comply with Table C402.1.2.
2.	*Roof replacement* .or a roof *alteration* that includes removing and replacing the *roof covering*, where the *roof assembly* includes insulation entirely above the *roof* deck. **Exceptions:** Where compliance with Section C402.1 cannot be met due to limiting conditions on an existing roof, an *approved* design shall be submitted with the following: 1. *Construction documents* that include a report by a *registered design professional* or an *approved* ~~third party~~ <u>*source*</u> documenting details of the limiting conditions affecting compliance with the insulation requirements. 2. *Construction documents* that include a roof design by a *registered design professional* or an *approved* ~~third party~~ <u>*source*</u> that minimizes deviation from the insulation requirements.
3.	Conversion of unconditioned attic space into *conditioned space*.
4.	Replacement of ceiling finishes exposing cavities or surfaces of the roof-ceiling construction.

Reason Statement:

This proposal restores the newly (2024) defined term, approved as modified in the first Public Input Initial Draft. The use of a defined term versus an undefined term reduces a potential conflict for the building/code official with regard to the entity providing the required information.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This proposal will neither increase nor decrease the cost of construction.

CE2D-69-23

CE2D-70-23

IECC CE: C503.5.1

Proponents:

Shane Hoeper, representing SEHPCAC

2024 International Energy Code[CE Project] R3

Revise as follows:

C503.5.1 Interior lighting and controls.

Alterations to interior spaces, lighting, or controls shall comply with the following:

1.	Where an alteration ~~the area~~ of an interior ~~spaces is altered, those spaces~~ space includes the addition or relocation of full height partitions, the space shall comply with ~~the lighting power requirements of Section~~ Sections C405.2, C405.3 and C408.3. ~~those spaces shall comply with the lighting control requirements of Sections C405.2 and C408.3.~~
2.	Where the lighting within interior spaces is altered, those spaces shall comply with ~~the lighting power requirements of~~ Sections C405.2, C405.3 and C408.3. ~~those spaces shall comply with the lighting control requirements of C405.2 and C408.3.~~
3.	Where the lighting controls within interior spaces are altered, those spaces shall comply with ~~the lighting control requirements of~~ Sections C405.2 and C408.3.

Exception: Compliance with Section C405.2.~~9~~8 is not required for alterations.

Reason Statement:

These recommended revisions are mainly editorial in nature to add clarity, conciseness, and enforceability to the section.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

These changes do not impact the cost effectiveness nor the original technical merit or intent of the requirement.

CE2D-70-23

CE2D-71-23

IECC CE: C503.5.2

Proponents:

Shane Hoeper, representing SEHPCAC

2024 International Energy Code[CE Project] R3

Revise as follows:

C503.5.2 Exterior lighting and controls.

Alterations to exterior lighting and controls shall comply with the following:

1.	Where the connected exterior lighting power is increased by more than 400 Watts, all exterior lighting, including lighting which is not proposed to be altered, shall comply with ~~lighting power requirements of~~ Section C405.5.
2.	Where the combined power of added and replacement luminaires is more than 400 Watts, all lighting which is added or altered shall be controlled in accordance with Sections C405.2 and C408.3. **Exception:** Individual luminaires less than 50 Watts ~~which~~ provided they pass functional tests verifying ~~that lights are automatically~~ automatic shut off where daylight is present.
3.	Where portions of exterior lighting controls are added or altered, those portions ~~of the lighting control system which are added or altered~~ shall comply with Sections C405.2 and C408.3.

Reason Statement:

These recommended revisions are mainly editorial in nature to add clarity, conciseness, and enforceability to the section. These changes do not impact the cost effectiveness nor the original technical merit or intent of the requirement.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

These changes do not impact the cost effectiveness nor the original technical merit or intent of the requirement.

CE2D-71-23

CE2D-72-23

IECC CE: C503.6

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code[CE Project] R3

Delete without substitution:

~~C503.6 Additional credit requirements for alterations~~ .

~~*Alterations* that are *substantial improvements* shall comply with measures from Sections C406.2, Section C406.3, or both to earn the number of required credits specified in Table C406.1.1 based on *building* occupancy group and *climate zone*. Where a project contains multiple occupancies, credits specified in Table C406.1.1 for each *building* occupancy shall be weighted by the *gross conditioned floor area* to determine the weighted average credits required. Accessory occupancies, other than Groups F or H, shall be included with the primary occupancy group for the purposes of this section.~~

~~**Exceptions:**~~

1.	*Alterations* that do not contain *conditioned space*.
2.	Portions of *buildings* devoted to manufacturing or industrial use.
3.	*Alterations* to buildings where the *building* after the *alteration* complies with Section C407.
4.	*Alterations* that are permitted with an *addition* complying with Section C502.3.7.

Reason Statement:

Imposition of additional energy credit requirements for additions not served by heat pumps lacks justification from transparent and reviewable analysis or citations supporting calculations.

Cost Impact:

The code change proposal will decrease the cost of construction.

Deletion of these requirements is likely to incentives installation of more installed cost effective equipment not required to meet the additional requirements scheme.

CE2D-72-23

CE2D-73-23

IECC CE: TABLE CF102.1(2)

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code[CE Project] R3

Delete without substitution:

~~TABLE CF102.1(2) LIMIT TO ENERGY EFFICIENCY CREDIT CARRYOVER FROM RENEWABLE AND LOAD MANAGEMENT CREDITS~~

Reason Statement:

Credit carryover value limits are unsubstantiated by transparent and reviewable analysis or citations supporting calculations.

Cost Impact:

The code change proposal will decrease the cost of construction.

Removal of carryover credit limits is likely to reduce costs of compliance in the credit scheme.

CE2D-73-23

CE2D-74-23

IECC CE: APPENDIX CG

Proponents:

Fredric Zwerg, representing Self

2024 International Energy Code[CE Project] R3

Delete without substitution:

~~APPENDIX CG ALL-ELECTRIC COMMERCIAL BUILDING PROVISIONS~~

Reason Statement:

As a licensed mechanical engineer in the State of Arizona and Nevada, and a LEED AP BD+C for commercial buildings, I am requesting to delete this appendix in its entirety. The appendix is a bias code proposal that will negatively impact the designing and the operation of new commercial buildings. The appendix is restricting the use of electricity only and does not allow for all alternative energy sources. As a designer, I look at the energy efficiency options and the costs to the building owner/operator to provide the most efficient and cost-effective systems. The restriction of electric only energy source is contrary to that purpose.

In the state of Nevada, the EIA estimates Nevada's 2023 electric power generation is approximately 60% from natural gas. In the State of Arizona, the EIA estimates Arizona's 2023 electric power generation is approximately 30% from natural gas. Arizona utilities have been pushing to expand their gas power generation facilities to meet the increased electrical demands. By restricting only electrical energy to be supplied to new commercial buildings will automatically increase the demand for power generation and higher uses of fossil fueled power plants. This will increase the greenhouse gas emissions and increase the cost of electricity.

This appendix has no reasonable energy efficiency or cost impact justification to be added to a "Building Energy Code".

Bibliography:

The U.S. Energy Information Administration (EIA):

1. Nevada State Energy Profile: https://www.eia.gov/state/?sid=NV#tabs-4
2. Arizona State Energy Profile: https://www.eia.gov/state/?sid=AZ#tabs-4

Arizona Salt River Project

https://ktar.com/story/4661458/salt-river-project-sets-sights-on-expanding-natural-gas-plant-south-of-phoenix/#:~:text=Construction%20at%20the%20quick%2Dstart,summer%202025%2C%20the%20company%20said.

Cost Impact:

The code change proposal will decrease the cost of construction.

By deleting this appendix, the cost of new commercial buildings should be less. Designers automatically review cost impacts and provide estimated operating costs to the building owners when designing the building's lighting, mechanical and plumbing systems, with trade-offs to meeting the building's operation. By removing the electrification restrictions, the building will be more efficient and more economical.

CE2D-74-23

CE2D-75-23

IECC CE: CG103.2.6

Proponents:

Jennifer Kane, representing Trane Technologies

2024 International Energy Code[CE Project] R3

Revise as follows:

CG103.2.6 Pre-heating of outdoor air.

Systems with energy recovery ventilation shall be permitted to utilize electric resistance to preheat outdoor air for defrost or temper air entering the energy recovery device. The electric resistance used to preheat outdoor air for the energy recovery device shall not preheat outdoor air greater than 5F; if the space is mechanically humidified or has a process application that will maintain the space above 30% relative humidity, the preheat may not preheat outdoor air greater than 25F. The electric resistance used to preheat outdoor air for heating only applications with sensible heat recover exchangers shall not preheat air greater than 25F.

Attached Files

- **Trane Technologies Comments on IECC Electrification Appendix.pdf**
  https://energy.cdpaccess.com/proposal/1746/3475/files/download/546/

Reason Statement:

See attachment.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

See attachment.

CE2D-75-23

CE2D-76-23

IECC CE: ASTM Chapter 06

Proponents:

Theresa Weston, representing Air Barrier Association of America (ABAA) (holtweston88@gmail.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

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

E283/E283M-2019~~)~~:	Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen

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

E1186-<u>2022</u>	Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems

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

E2357—202~~2~~<u>3</u>:	Standard Test Method for Determining Air Leakage of Air Barriers Assemblies

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

E3158-201~~9~~<u>8</u>:	Test Method for Measuring the Air Leakage Rate of a Large or Multizone Building

Reason Statement:

This proposal is eratta. It corrects the dates on referenced standards.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This corrects errata in the noted dates of reference standards. It makes no technical changes.

CE2D-76-23

CE2D-77-23

IECC CE: AHRI Chapter 06 (New), SECTION C404

Proponents:

Bryan Ahee, representing Bradford White Corporation (bahee@bradfordwhite.com)

2024 International Energy Code[CE Project] R3

Add new standard(s) as follows:

AHRI	Air-Conditioning, Heating, & Refrigeration Institute ~~2111~~ 2311 Wilson Blvd, Suite ~~500~~ 400 Arlington VA 22201

1430	AHRI 1430 (I-P): Demand Flexible Electric Storage Water Heaters

SECTION C404 — SERVICE WATER HEATING

Attached Files

- **Commercial Demand Response Water Heating update.pdf**
  https://energy.cdpaccess.com/proposal/1595/3428/files/download/545/

Reason Statement:

AHRI 1430 has been published, this standard was intended to replace the language 'or another equivalent approved standard' in section C404.10, which was a placeholder while AHRI 1430 was finalized. This will align the demand response language with the residential code R403.5.5 and Table R403.5.5 which already reflect these changes.

Bibliography:

AHRI

AHRI Standard 1430-2022 (I-P) Demand Flexible Electric Storage Water Heaters
2111 Wilson Blvd, Suite 500
Arlington, VA 22201

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This standard applies to communication, infrastructure, and system functionality as these relate to the implementation of energy management strategies for demand flexible water heaters (DFWH) and will neither increase nor decrease the cost of construction.

CE2D-77-23

CE2D-78-23 Part I

IECC CE: NEMA (New)

Proponents:

Kristopher Stenger, representing icc

2024 International Energy Code[CE Project] R3

Add new text as follows:

NEMA 1300 North 17th Street, Suite 900, Rosslyn, VA 22209.

OS 4-2016 Requirements for Air-Sealed Boxes for Electrical and Communication Applications

CE2D-78-23 Part I

CE2D-78-23 Part II

IECC RE: NEMA (New)

Proponents:

Kristopher Stenger, representing icc

2024 International Energy Code [RE] [RE Project] R3

Add new text as follows:

NEMA 1300 North 17th Street, Suite 900, Rosslyn, VA 22209.

OS 4-2016 Requirements for Air-Sealed Boxes for Electrical and Communication Applications

Reason Statement:

Standard Reference for air-sealed boxes for electrical and communication applications provisions in IECC-C and IECC-R

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Reference standard. No cost implication

CE2D-78-23 Part II

CE2D-79-23

IECC CE: APPENDIX CG, CG101, CG101.1, CG101.2

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code[CE Project] R3

Delete without substitution:

~~APPENDIX CG ALL-ELECTRIC COMMERCIAL BUILDING PROVISIONS~~

~~CG101 — GENERAL~~

~~CG101.1 Intent.~~

~~The intent of this Appendix is to amend the International Energy Conservation Code to reduce greenhouse gas emissions from buildings and improve the safety and health for commercial building occupants by requiring new all-electric buildings and efficient electrification of existing buildings.~~

~~CG101.2 Scope.~~

~~The provisions in this appendix are applicable to commercial buildings. New construction shall comply with Section CG103. Additions, alterations, repairs and changes of occupancy to existing buildings shall comply with Chapter 5 and Section CG104.~~

Reason Statement:

As proposed, this Appendix would be enforced as normative requirements of the IECC CE, not as "informative." The "intent" as written extends the IECC CE beyond building energy efficiency and would likely serve only to push climate-related emissions upstream through the delivered energy chain. No analysis of this unintended consequence is evidenced. The Appendix, if enforced, would prescribe energy decisions and force energy choice in the direction of grid electricity, thereby subsidizing electric utilities at the expense of building owners and occupances by monopolizing energy use. All-electric buildings would increase use of grid electricity and associated increases in full fuel cycle energy consumption and emissions upstream of the point of energy delivery. As a conclusion, the Appendix does not belong in the IECC CE and would be better considered in the an electrical building code or a "stretch" or "green" building code if analysis would justify electricity (grid and renewable onsite) as singular option.

Cost Impact:

The code change proposal will decrease the cost of construction.

If adopted as normative material, this Appendix would require energy equipment choices that would not be optimal in terms of installed cost.

CE2D-79-23

CE2D-80-23

IECC CE: APPENDIX CG

Proponents:

Laura Petrillo-Groh, representing Air-Conditioning, Heating, and Refrigeration Institute (lpetrillo-groh@ahrinet.org); Vladimir Kochkin, representing NAHB (vkochkin@nahb.org); Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com); Andrew Klein, representing BOMA International (andrew@asklein.com); Robert Ross, representing Self (robertross1952@gmail.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

~~APPENDIX CG ALL-ELECTRIC COMMERCIAL BUILDING PROVISIONS~~

Reason Statement:

AHRI has federal preemption concerns with APPENDIX CG.

AHRI respectfully opposes APPENDIX CG, which introduces an optional pathway for jurisdictional adoption of all-electric commercial building provisions. An adopting jurisdiction would prevent the installation of covered appliances from *using* natural gas by banning this equipment. Section 6297(c) of EPCA expressly preempts State and local regulations concerning the energy use of many natural gas appliances, including those used for space and water heating.

Last month, the U.S. District Court of Appeals for the Ninth Circuit issued a unanimous opinion in the case of *California Restaurant Association v. City of Berkeley*, finding that the Berkeley ordinance is preempted by EPCA, despite the City's contention that prohibiting natural gas *piping*, rather than the gas itself, was not preempted by federal law. The opinion "held that, by its plain text and structure, the Act's preemption provision encompasses building codes that regulate natural gas use by covered products. By preventing such appliances from *using* natural gas," the Court found, "the Berkeley building code did exactly that."

The Ninth Circuit Decision has potential implications for other state and local jurisdictions hoping to pass similar measures aimed at eliminating the end-use of natural gas in homes and businesses. The ruling renders APPENDIX CG, the proposed appendix for all electric commercial building provisions, susceptible to federal preemption concerns. AHRI urges the Committee to review the recent court decision in its consideration of APPENDIX CG.

AHRI recommends striking APPENDIX CG in its entirety.

Cost Impact:

The code change proposal will decrease the cost of construction.

The code change proposal may decrease the cost of construction. Refer to the NAHB electrification cost study: https://www.nahb.org/blog/2021/03/How-Much-Does-Whole-Home-Electrification-Cost

CE2D-80-23

CE2D-81-23

IECC CE: APPENDIX CG, CG101, CG101.1, CG101.2, CG102, CG103, CG103.1, CG103.2, CG103.2.1, CG103.2.2, CG103.2.3, CG103.2.4, CG103.2.5, CG103.2.5.1, CG103.2.5.2, CG103.2.6, CG103.2.7, CG103.2.8, CG103.3, CG103.4, CG103.5, CG103.6, CG104, CG104.1, CG104.2, CG104.3, CG104.4, CG104.5, CG104.6, CG105

Proponents:

Steven Cowen, representing Black Hills Energy

2024 International Energy Code[CE Project] R3

Delete without substitution:

~~APPENDIX CG ALL-ELECTRIC COMMERCIAL BUILDING PROVISIONS~~

~~CG101 — GENERAL~~

~~CG101.1 Intent.~~

~~The intent of this Appendix is to amend the International Energy Conservation Code to reduce greenhouse gas emissions from buildings and improve the safety and health for commercial building occupants by requiring new all-electric buildings and efficient electrification of existing buildings.~~

~~CG101.2 Scope.~~

~~The provisions in this appendix are applicable to commercial buildings. New construction shall comply with Section CG103. Additions, alterations, repairs and changes of occupancy to existing buildings shall comply with Chapter 5 and Section CG104.~~

~~CG102 DEFINITIONS.~~

~~ALL-ELECTRIC BUILDING.A building using no purchased energy other than electricity when utility power is available.~~

~~APPLIANCE.A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.~~

~~COMBUSTION EQUIPMENT.Any equipment or *appliance* used for space heating, *service water heating*, cooking, clothes drying, humidification, or lighting that uses *fuel gas* or fuel *oil*.~~

~~PURCHASED ENERGY. Energy or power purchased for consumption and delivered to the *building site*.~~

~~SUBSTANTIAL IMPROVEMENT.Any *repair* , reconstruction, rehabilitation, *alteration* , *addition* or other improvement of a *building* or structure, the cost of which equals or is more than 50 percent of the market value of the structure before the improvement. Where the structure has sustained substantial damage, as defined in the *International Building Code*, any repairs are considered substantial improvement regardless of the actual *repair* work performed. *Substantial improvement* does not include the following:~~

~~1. Improvement of a *building* required to correct health, sanitary or safety code violations ordered by the *code official* , or~~

~~2. *Alteration* of a *historic building* where the *alteration* will not affect the *building's* designation as a *historic building* .~~

~~CG103 — NEW COMMERCIAL BUILDINGS~~

~~CG103.1 Application.~~

~~New commercial buildings shall be all-electric buildings and comply with Sections C401.2.1 or C401.2.2.~~

1.	*Purchased energy* other than electricity shall be permitted where it has been demonstrated to the building official that the building is required by an applicable law or regulation to provide space heating with an emergency power system or a standby power system.
2.	*Purchased energy* shall be permitted for an emergency power system or a standby power system.

~~CG103.2 Electric resistance heating equipment~~.

~~The sole use of electric resistance equipment and appliances for space and water heating shall be prohibited other than for buildings or portions of buildings that comply with not less than one of Sections CG103.2.1 through CG103.2.8.~~

~~CG103.2.1 Low space heating capacity~~.

~~Electric resistance appliances or equipment shall be permitted in buildings or areas of buildings not served by a mechanical cooling system and with a total space heating capacity not greater than 4.0 BTU/h (1.2 watts) per square foot of conditioned space .~~

~~CG103.2.2 Small systems~~.

~~Buildings in which electric resistance appliances or equipmentcomprise less than 5 percent of the total system heating capacity or serve less than 5 percent of the conditioned floor area.~~

~~CG103.2.3 Specific conditions~~.

~~Portions of buildings or specific equipment and appliances that require electric resistance heating that cannot practicably be served by electric heat pumps as approved.~~

~~CG103.2.4 Kitchen make-up air~~.

~~Make-up air for commercial kitchen exhaust systems required to be tempered by Section 508.1.1 of the International Mechanical Code is permitted to be heated by electric resistance~~

~~CG103.2.5 Freeze protection~~.

~~The use of electric resistance heat for freeze protection shall comply with Sections CG103.2.5.1 through CG103.2.5.2.~~

~~CG103.2.5.1 Low indoor design conditions~~.

~~Space heating systems sized for spaces with indoor design conditions of not greater than 40°F (4.5°C) and intended for freeze protection, including temporary systems in unfinished spaces, shall be permitted to use electric resistance. The building envelope of any such space shall be insulated in compliance with Section C402.1.~~

~~CG103.2.5.2 Freeze protection system~~.

~~Freeze protection systems shall comply with Section C403.13.3.~~

~~CG103.2.6 Pre-heating of outdoor air~~.

~~Systems with energy recovery ventilation shall be permitted to utilize electric resistance to preheat outdoor air for defrost or temper air entering the energy recovery device to not more than 45°F (7.2°C). Hydronic systems without energy recovery ventilation shall be permitted to utilize electric resistance to temper air entering the energy recovery device to not more than 40°F (4.5°C).~~

~~CG103.2.7 Small buildings~~.

~~Buildings with a conditioned floor area of not more than 250 square feet (23.2 m2) and not served by a mechanical space cooling system shall be permitted to use electric resistance appliances or equipment for space heating.~~

~~CG103.2.8 Supplemental heat~~.

~~Electric resistance heat shall be permitted as supplemental heat when installed with heat pumps sized in accordance with Section CG103.3 and when operated only when a heat pump cannot provide the necessary heating energy to satisfy the thermostat setting.~~

~~CG103.3 Heat pump sizing for space heating~~.

~~Heat pump space heating systems shall be sized to meet the building heating load at the greater of 0°F (-18°C) or the 99 Percent Annual Heating Dry-Bulb for the nearest weather station provided in the ASHRAE Handbook of Fundamentals. The heat pump space heating system shall not require the use of supplemental electric heat at or above this temperature other than for defrosting. Lower capacity heat pumps that operate in conjunction with thermal storage shall be permitted if the system meets the requirements of this section.~~

~~CG103.4 Heat pump sizing for water heating~~.

~~Heat pump service heating systems shall be sized to meet not less than the building service water heating load at the greater of 15°F (-9.5°C) or the 99 Percent Annual Heating Dry-Bulb for the nearest weather station provided in the latest edition of the ASHRAE Fundamentals Handbook. Supplemental electric heat shall not be required at or above this temperature other than for temperature maintenance in recirculating systems and defrosting.~~

~~CG103.5 Heating outside a building~~.

~~Systems for heating outside a building shall comply with C403.13.1.~~

~~CG103.6 Low capacity cooling equipment~~.

~~Air conditioners with capacity less than 240,000 Btu/hr (70 kW) shall be electric heat pump equipment sized and configured to provide both space cooling and space heating.~~

~~CG104 — EXISTING COMMERCIAL BUILDINGS~~

~~CG104.1 Combustion equipment in additions~~.

~~Additions shall use no purchased energy other than electricity and new equipment installed to serve additions shall use no purchased energy other than electricity. Where existing systems using purchased energy other than electricity serve an addition, the existing building and addition together shall use no more purchased energy other than electricity than the existing building alone.~~

~~CG104.2 Substantial improvement~~.

~~Buildings undergoing substantial improvements shall be all-electric buildings, comply with C402.5 and meet a site EUI by building type in accordance with ASHRAE Standard 100 Table 7-2a.~~

~~**Exception:** Compliance with Standard 100 shall not be required where Group R occupancies achieve an ERI score of 80 or below without *on-site renewable energy* included in accordance with RESNET/ICC 301, for each *dwelling unit*.~~

~~CG104.3 Cooling equipment~~.

~~New and replacement air conditioners shall be electric heat pump equipment sized and configured to provide both space cooling and space heating. Any existing space heating systems other than existing heat pump equipment that serve the same zone as the new equipment shall be configured as supplementary heat in accordance with Section CG104.6.~~

~~CG104.4 Service water heating equipment~~.

~~Where water heaters are added or replaced, they shall use no purchased energy other than electricity.~~

~~CG104.5 Furnace replacement~~.

~~Newly installed warm air furnaces provided for space heating shall only be permitted as supplementary heat controlled in accordance with Section CG104.6.~~

~~CG104.6 Heat pump supplementary heat~~.

~~Heat pumps having combustion equipment or electric resistance equipment for supplementary space or service water heating shall have controls that limit supplemental heat operation to only those times when one of the following applies:~~

1.	The heat pump is operating in defrost mode.
2.	The vapor compression cycle malfunctions.
3.	For space heating systems, the *thermostat* malfunctions.
4.	For space heating systems, the vapor compression cycle cannot provide the necessary heating energy to satisfy the *thermostat* setting.
5.	The outdoor air temperature is less than the design temperature determined in accordance with Section CG103.3.
6.	For *service water heating*, the heat pump *water heater* cannot maintain an output water temperature of not less than 120°F (49°C) .
7.	For temperature maintenance in *service water heating* systems.

~~New supplementary space and *service water heating* systems for heat pump equipment shall not be permitted to have a heating output capacity greater than the heating output capacity of the heat pump equipment.~~

~~CG105 REFERENCE STANDARDS~~.

~~ASHRAE~~
-
~~ASHRAE~~
~~180 Technology Parkway NW~~
~~Peachtree Corners GA 30092~~
~~100-2018 Energy Efficiency in Existing Buildings~~

Reason Statement:

At Black Hills Energy, we provide safe, reliable and cost-effective natural gas and electric service to over 1.3 million customers in eight states. Our mission of improving life with energy means we must be ready to make tomorrow even better than today. That is why we are committed to creating a cleaner energy future which builds upon our responsibility to provide the safe, reliable and cost-effective energy that improves our customers' lives.

Building codes should not be utilized as a path for eliminating the energy access of Americans. Provisions in a building code such as electric-only construction explicitly eliminates affordable, reliable energy options for customers that best suit their needs, budgets and energy accessibility. Further, this provision also does not guarantee a reduction in energy consumption.

Black Hills Energy supports, and is a partner in, pursuing all sensible paths to reducing emissions and providing affordable, reliable energy for our customers today and tomorrow. Our natural gas systems are among the most advanced in the industry, and we continue to invest in clean and modern energy. Last year we announced a new commitment to achieve Net Zero emissions by 2035 for our natural gas distribution system. This target replaces our previous commitment of a 50% reduction in GHG emissions intensity for mains and services by 2035, doubling our reduction target and expanding the boundary of the goal to all sources of emissions in our distribution system.

We have continued to achieve progress towards our goal to reduce electric utility emission intensity 40% by 2030 and 70% by 2040, already reducing emissions by more than a third since 2005.

Sustainably reducing greenhouse gas emissions will require continued efforts to reduce emissions from the natural gas sector; foster innovation of clean fuels, such as renewable natural gas and hydrogen; continued integration of clean energy sources like renewables and natural gas; utilization of our country's energy delivery infrastructure, and careful consideration of the impact to Americans.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This proposal removes a new provision.

CE2D-81-23

CE2D-82-23

IECC CE: APPENDIX CG

Proponents:

Shannon Corcoran, representing American Gas Association (corcoransm@att.net)

2024 International Energy Code[CE Project] R3

Revise as follows:

~~APPENDIX CG~~
~~APPENDIX CG ALL-ELECTRIC COMMERCIAL BUILDING PROVISIONS~~

Reason Statement:

This proposed revision is to include an optional adoptable appendix for all-electric commercial buildings. The International Energy Conservation Code should be fuel neutral and provide for energy savings regardless of the fuel source. It should continue to focus on cost-effective energy efficiency. This proposal does not guarantee any energy or carbon savings and could allow increased use of electric resistance space and water heating, thereby increasing both energy use and carbon emissions.

If adopted by a local jurisdiction, the all-electric appendix would disallow the installation of appliances covered by EPCA that use natural gas and propane. On April 17, 2023, the

the Unites Stats Court of Appeals for the Ninth Circuit on the California Restaurant Association's appeal of the United States District Court for the Northern District of California's ruled on the action alleging that the Energy Policy and Conservation Act preempts a City of Berkeley regulation that prohibits the installation of natural gas piping within newly constructed buildings. "A unanimous panel of the United States Court of Appeals for the Ninth Circuit held that the federal Environmental Policy and Conservation Act, EPCA, expressly preempts a municipal code that regulated gas use in covered products by prohibiting gas service in new construction". The opinion "held that, by its plain text and structure, the Act's preemption provision encompasses building codes that regulate natural gas use by covered products. By preventing such appliances from *using* natural gas," the Court found, "the Berkeley building code did exactly that." Section 6297(c) of EPCA expressly preempts State and local regulations concerning the energy use of many natural gas appliances, including those used for space and water heating.

Additionally, more than 22 states have passed fuel-choice legislation preventing individual cities or jurisdictions from banning the installation of natural gas infrastructure or appliances.

Therefore, this appendix, if adopted by a state or local jurisdiction, opens said jurisdiction to legal action, therefore limiting the adoptability of the appendix and potentially the 2024 edition of the code/

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The proposal does not increase nor decrease the cost of construction based on the 2021 edition of the code.

CE2D-82-23

CE2D-83-23

IECC CE: APPENDIX CG, CG101.1, CG103, CG103.1, CF102.1, TABLE CF102.1(2), TABLE C406.1.1(2), CG103.2, CG103.2.1, CG103.2.2, CG103.2.3, CG103.2.4, CG103.2.5, CG103.2.5.1, CG103.2.5.2, CG103.2.6, CG103.2.7, CG103.2.8, CG103.3, CG103.4, CG103.5, CG103.6, CG104.1, C502.3.7, CG104.2, CG104.3, CG104.4, CG104.5, CG104.6

Proponents:

Diana Burk, representing New Buildings Institute (diana@newbuildings.org)

2024 International Energy Code[CE Project] R3

Revise as follows:

APPENDIX CG ~~ALL-ELECTRIC~~ <u>HEAT PUMP PERFORMANCE-LEVEL</u> COMMERCIAL BUILDING PROVISIONS

CG101.1 Intent.

The intent of this Appendix is to amend the International Energy Conservation Code to reduce greenhouse gas emissions from buildings and improve the safety and health for commercial building occupants by <u>ensuring buildings using fossil fuel equipment are as efficient as buildings using efficient electric heat pump equipment and have the electric infrastructure for future electric equipment.</u> ~~requiring new all-electric buildings and efficient electrification of existing buildings~~.

CG103 — NEW COMMERCIAL BUILDINGS

Revise as follows:

CG103.1 Application.

New commercial buildings shall <u>comply with C401.2.1 or C401.2.2 and one of the following:</u>

<u>1.</u>	<u>New commercial buildings shall be all-electric buildings and comply with Sections C401.2.1 or C401.2.2.</u>
<u>2.</u>	<u>New commercial buildings shall comply with CG103.2 and Appendix CH.</u>

<u>**Exceptions:**</u>

1.	*Purchased energy* other than electricity shall be permitted <u>to comply with CG103.1(1)</u> where it has been demonstrated to the building official that the building is required by an applicable law or regulation to provide space heating with an emergency power system or a standby power system.
2.	*Purchased energy* <u>other than electricity</u> shall be permitted <u>to comply with CG103.1(1)</u> for an emergency power system or a standby power system.

Add new text as follows:

<u>CG103.2 Advanced Energy Credit Package requirements</u>.

<u>The requirements of this section supersede the requirements of Section C406.1.1. Projects shall comply with measures from C406.2 to achieve the minimum number of required efficiency credits from Table CG103.2(1) based on *building* occupancy group and *climate zone*. Projects with multiple occupancies, unconditioned parking garages, and *buildings* with separate shell-and-core and build-out construction permits shall comply as follows:</u>
<u>Where a project contains multiple occupancies, credits in Table CG103.2(1) from each *building* occupancy shall be weighted by the</u>

gross floor area to determine the weighted average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for purposes of Section C406 and Appendix CG.

Exceptions:

1.	Unconditioned parking garages that achieve 50 percent of the credits required for use groups S-1 and S-2 in Table CD102.1.
2.	Portions of buildings devoted to manufacturing or industrial use.
3.	Where a *building* achieves more renewable and load management credits in Section C406.3 than are required in Section C406.1. to reduce required energy efficiency credits as follows: $$EEC_{red} = EEC_{tbl} - \{the\ lesser\ of: (SRLM_{lim} , \quad SRLM_{adj} \times [RLM$$ EEC_{red} = Reduced required energy efficiency credits EEC_{tbl} = Required energy efficiency credits from Table CG103.2(1) $SRLM_{lim}$ = Surplus renewable and load management credit limit from Table CG103.2(2) $SRLM_{adj}$ = 1.0 for all-electric or all-renewable buildings (excluding emergency generation) 0.7 for buildings with fossil fuel generation) RLM_{ach} = Achieved renewable and load management credits from Section C406.3 RLM_{req} = Required renewable and load management credits from Section C406.1.2

TABLE CG103.2(1) Energy Credit Requirement by Occupancy Group

-	CLIMATE ZONE																		
BUILDING OCCUPANCY GROUP	OA	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R-2, R-4, AND I-1																			
I-2																			
R-1																			
B																			
A-2																			
M																			
E																			
S-1 and S-2																			
All other																			

TABLE CG103.2(2) LIMIT TO ENERGY EFFICIENCY CREDIT CARRYOVER FROM RENEWABLE AND LOAD MANAGEMENT CREDITS

-	CLIMATE ZONE

BUILDING OCCUPANCY GROUP	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R-2, R-4, AND I-1																			
I-2																			
R-1																			
B																			
A-2																			
M																			
E																			
S-1 AND S-2																			
All Other																			

Revise as follows:

~~CG103.2~~ CG103.3 Electric resistance heating equipment.

The sole use of electric resistance equipment and appliances for space and water heating shall be prohibited other than for buildings or portions of buildings that comply with not less than one of Sections CG103.3.1 through ~~CG103.2.8~~ CG103.3.8.

~~CG103.2.1~~ CG103.3.1 Low space heating capacity.

Electric resistance appliances or equipment shall be permitted in buildings or areas of buildings not served by a mechanical cooling system and with a total space heating capacity not greater than 4.0 BTU/h (1.2 watts) per square foot of conditioned space .

~~CG103.2.2~~ CG103.3.2 Small systems.

Buildings in which electric resistance appliances or equipmentcomprise less than 5 percent of the total system heating capacity or serve less than 5 percent of the conditioned floor area.

~~CG103.2.3~~ CG103.3.3 Specific conditions.

Portions of buildings or specific equipment and appliances that require electric resistance heating that cannot practicably be served by electric heat pumps as approved.

~~CG103.2.4~~ CG103.3.4 Kitchen make-up air.

Make-up air for commercial kitchen exhaust systems required to be tempered by Section 508.1.1 of the International Mechanical Code is permitted to be heated by electric resistance

CG103.3.5 Freeze protection.

The use of electric resistance heat for freeze protection shall comply with Sections CG103.3~~2~~.5.1 through CG103.3~~2~~.5.2.

~~CG103.2.5.1~~ CG103.3.5.1 Low indoor design conditions.

Space heating systems sized for spaces with indoor design conditions of not greater than 40°F (4.5°C) and intended for freeze protection, including temporary systems in unfinished spaces, shall be permitted to use electric resistance. The building envelope of any such space shall be insulated in compliance with Section C402.1.

CG103.3.5.2 Freeze protection system.

Freeze protection systems shall comply with Section C403.14.4~~13.3~~.

~~CG103.2.6~~ CG103.3.6 Pre-heating of outdoor air.

Systems with energy recovery ventilation shall be permitted to utilize electric resistance to preheat outdoor air for defrost or temper air entering the energy recovery device to not more than 45°F (7.2°C). Hydronic systems without energy recovery ventilation shall be permitted to utilize electric resistance to temper air entering the energy recovery device to not more than 40°F (4.5°C).

CG103.2.7 ~~CG103.3.7~~ Small buildings.

Buildings with a conditioned floor area of not more than 250 square feet (23.2 m2) and not served by a mechanical space cooling system shall be permitted to use electric resistance appliances or equipment for space heating.

~~CG103.2.8~~ CG103.3.8 Supplemental heat.

Electric resistance heat shall be permitted as supplemental heat when installed with heat pumps sized in accordance with Section CG103.4 and when operated only when a heat pump cannot provide the necessary heating energy to satisfy the thermostat setting.

~~CG103.3~~ CG103.4 Heat pump sizing for space heating.

Heat pump space heating systems shall be sized to meet the building heating load at the greater of 0°F (-18°C) or the 99 Percent Annual Heating Dry-Bulb for the nearest weather station provided in the ASHRAE Handbook of Fundamentals. The space heating system shall not require the use of supplemental electric heat at or above this temperature other than for defrosting. Lower capacity heat pumps that operate in conjunction with thermal storage shall be permitted if the system meets the requirements of this section.

~~CG103.4~~ CG103.5 Heat pump sizing for water heating.

Heat pump service heating systems shall be sized to meet not less than the building service water heating load at the greater of 15°F (-9.5°C) or the 99 Percent Annual Heating Dry-Bulb for the nearest weather station provided in the latest edition of the ASHRAE Fundamentals Handbook. Supplemental electric heat shall not be required at or above this temperature other than for temperature maintenance in recirculating systems and defrosting.

~~CG103.5~~ CG103.6 Heating outside a building.

Systems for heating outside a building shall comply with C403.13.1.

~~CG103.6 Low capacity cooling equipment~~.

~~Air conditioners with capacity less than 240,000 Btu/hr (70 kW) shall be electric heat pump equipment sized and configured to provide both space cooling and space heating.~~

CG104.1 Combustion equipment in additions.

Additions shall comply with one of the following:

1.	The addition shall use no *purchased energy*~~purchased energy~~ other than electricity and new equipment installed to serve additions shall use no *purchased energy* ~~purchased energy~~ other than electricity. Where existing systems using purchased energy other than electricity serve an addition, the existing *building* ~~building~~ and addition together shall use no more *purchased energy*~~purchased energy~~ other than electricity than the existing ~~building~~ *building* alone.

2.	The addition shall comply with Section CG104.1.1 and Appendix CH.

Add new text as follows:

CG104.1.1 Additional energy efficiency credits.

Additions using *purchased energy* other than electricity and *additions* with new equipment installed to serve the addition that use *purchased energy* other than electricity shall comply with measures from Sections C406.2 and C406.3 to achieve not less than 50 percent the number of required efficiency credits from Table CG103.2(1) based on *building* occupancy group and *climate zone.* Where a project contains multiple occupancies, credits in Table CG103.2(1) from each *building* occupancy shall be weighted by the gross floor area to determine the weighted average project energy credits required. Accessory occupancies shall be included with the primary occupancy group for purposes of this section. *Alterations* to the existing *building* that are not part of an *addition*, but permitted with an *addition*, may be used to achieve the required credits.

Exceptions:

1.	*Buildings* in Utility and Miscellaneous Group U, Storage Group S, Factory Group F, High-Hazard Group H.
2.	*Additions* less than 1,000 ft^2 (92 m^2) and less than 50 percent of existing floor area.
3.	*Additions* that do not include the *addition* or replacement of equipment covered by Tables C403.3.2(1) through C403.3.2(16) or Section C404.2.
4.	*Additions* that do not contain *conditioned space*.
5.	Where the *addition* alone or the existing *building* and *addition* together comply with Section C407.

Revise as follows:

CG104.2 Substantial improvement.

Buildings undergoing substantial improvements shall be ~~all-electric buildings,~~ comply with C402.5, ~~and~~ meet a site EUI by building type in accordance with ASHRAE Standard 100 Table 7-2a, and shall comply with one of the following:

1.	Buildings undergoing *substantial improvements* shall be *all-electric buildings*.
2	Buildings undergoing *substantial improvements* shall comply with Appendix CH.

Exception: Compliance with Standard 100 shall not be required where Group R occupancies achieve an ERI score of 80 or below without *on-site renewable energy* included in accordance with RESNET/ICC 301, for each *dwelling unit*.

~~CG104.3 Cooling equipment.~~

~~New and replacement air conditioners shall be electric heat pump equipment sized and configured to provide both space cooling and space heating. Any existing space heating systems other than existing heat pump equipment that serve the same zone as the new equipment shall be configured as supplementary heat in accordance with Section CG104.6.~~

~~CG104.4 Service water heating equipment.~~

~~Where water heaters are added or replaced, they shall use no purchased energy other than electricity.~~

~~CG104.5 Furnace replacement~~.

~~Newly installed warm air furnaces provided for space heating shall only be permitted as supplementary heat controlled in accordance with Section CG104.6.~~

~~CG104.6~~ CG104.3 Heat pump supplementary heat.

Heat pumps having combustion equipment or electric resistance equipment for supplementary space or service water heating shall have controls that limit supplemental heat operation to only those times when one of the following applies:

1.	The heat pump is operating in defrost mode.
2.	The vapor compression cycle malfunctions.
3.	For space heating systems, the *thermostat* malfunctions.
4.	For space heating systems, the vapor compression cycle cannot provide the necessary heating energy to satisfy the *thermostat* setting.
5.	The outdoor air temperature is less than the design temperature determined in accordance with Section CG103.3.
6.	For *service water heating*, the heat pump *water heater* cannot maintain an output water temperature of not less than 120°F (49°C) .
7.	For temperature maintenance in *service water heating* systems.

New supplementary space and *service water heating* systems for heat pump equipment shall not be permitted to have a heating output capacity greater than the heating output capacity of the heat pump equipment.

Reason Statement:

On April 17, 2023, a three judge panel from the United States Court of Appeals for the Ninth Circuit issued an opinion stating that Berkeley's ban on the installation of natural gas infrastructure in new construction violated federal preemption by the Energy Policy and Conservation Act (EPCA). The opinion states that EPCA preempts state and local regulations from regulating natural gas use by covered products in matters that have no nexus with the efficiency of the product. The proponents of this change do not agree with the court's interpretation of EPCA – it is not consistent with pre-existing federal agency interpretations or the original intent of EPCA [1] – and we are confident the ruling will not hold upon further hearing. However, we also know that this opinion has had a chilling effect on the adoption of all-electric requirements by jurisdictions both within the ninth circuit where the opinion is in effect and out of the ninth circuit where the opinion has no effect.

As it could take a year to several years for the case to be finally adjudicated, the proponents are submitting this modification in order to provide jurisdictions with an option that will both meet their policy goals to reduce carbon emissions from buildings while addressing concerns about the legal vulnerability of all-electric requirements in light of the ninth circuit's current interpretation of EPCA pre-emption.

1. We have revised the proposal to allow the use of both federally minimum natural gas and electric appliances while ensuring buildings that comply with this appendix meet heat pump levels of performance. Buildings that choose to install fossil fuel equipment will have to achieve heat pump levels of performance through improved energy efficiency by achieving additional energy credits or by achieving additional renewable or load management credits. It should be noted that the analysis to determine the appropriate number of credits required to achieve equivalent levels of performance will be submitted at a later date once the analysis is complete.
2. In addition, new buildings and substantial improvements that choose to install fossil fuel equipment must comply with the electric-

ready provisions in Appendix CH so that building owners will have the choice to install all-electric appliances in the future.
3. The proponents removed sections of the Appendix that explicitly do not allow natural gas appliances.
4. The proponents also revised the existing building section to allow buildings that choose to install natural gas equipment in additions to achieve equivalent levels of performance through energy credits or renewable and load management credits.

Bibliography:

[1] California Restaurant Association v. City of Berkeley, 21-16278 (9th Cir. 2023). https://cdn.ca9.uscourts.gov/datastore/opinions/2023/04/17/21-16278.pdf

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The code change proposal will neither increase nor decrease the cost of instruction because buildings that complied with the original Appendix will also comply with this modified Appendix. This proposal merely adds additional flexibility by allowing the installation of natural gas equipment if the overall building achieves heat pump levels of performance.

CE2D-83-23

CE2D-84-23

IECC CE: APPENDIX CG

Proponents:

Kevin Duell, representing NW Natural (kevin.duell@nwnatural.com)

2024 International Energy Code[CE Project] R3

Delete without substitution:

~~APPENDIX CG ALL-ELECTRIC COMMERCIAL BUILDING PROVISIONS~~

Reason Statement:

An all-electric building does not guarantee any energy or carbon savings. In fact, in some areas of the country, all electric buildings have higher energy use and carbon emissions that buildings that directly use gas – especially if they use electric resistance space and water heating, which this proposal allows.

This proposal also seems to violate the Energy Policy and Conservation on Act in the same way that the *Berkeley* decision describes by disallowing the use of natural gas appliances. So, a jurisdiction that adopts this appendix would be opening itself to similar litigation.

For these reasons, please delete the changes added from CECD1-15-22.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Construction costs have many variables, especially for commercial buildings. The original proposal and these suggested revisions might either increase, decrease or not change construction costs depending on the building type, project and location.

CE2D-84-23

CE2D-85-23

IECC CE: APPENDIX CG, CG101.1, CG101, CG101.2, CG102, CG103, CG104, CG105

Proponents:

Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 International Energy Code[CE Project] R3

Delete without substitution:

~~APPENDIX CG ALL-ELECTRIC COMMERCIAL BUILDING PROVISIONS~~

~~CG101.1 Intent.~~

~~The intent of this Appendix is to amend the International Energy Conservation Code to reduce greenhouse gas emissions from buildings and improve the safety and health for commercial building occupants by requiring new all-electric buildings and efficient electrification of existing buildings.~~

~~CG101 — GENERAL~~

~~CG101.2 Scope.~~

~~The provisions in this appendix are applicable to commercial buildings. New construction shall comply with Section CG103. Additions, alterations, repairs and changes of occupancy to existing buildings shall comply with Chapter 5 and Section CG104.~~

~~CG102 DEFINITIONS.~~

~~ALL-ELECTRIC BUILDING.A building using no purchased energy other than electricity when utility power is available.~~

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~~APPLIANCE.A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.~~

~~COMBUSTION EQUIPMENT.Any equipment or *appliance* used for space heating, *service water heating*, cooking, clothes drying, humidification, or lighting that uses *fuel gas* or fuel *oil*.~~

~~PURCHASED ENERGY. Energy or power purchased for consumption and delivered to the *building site*.~~

~~SUBSTANTIAL IMPROVEMENT.Any *repair* , reconstruction, rehabilitation, *alteration* , *addition* or other improvement of a *building* or structure, the cost of which equals or is more than 50 percent of the market value of the structure before the improvement. Where the structure has sustained substantial damage, as defined in the *International Building Code*, any repairs are considered substantial improvement regardless of the actual *repair* work performed. *Substantial improvement* does not include the following:~~

~~1. Improvement of a *building* required to correct health, sanitary or safety code violations ordered by the *code official* , or~~

~~2. *Alteration* of a *historic building* where the *alteration* will not affect the *building's* designation as a *historic building* .~~

~~CG103 — NEW COMMERCIAL BUILDINGS~~

~~CG104 — EXISTING COMMERCIAL BUILDINGS~~

~~CG105 REFERENCE STANDARDS.~~

~~ASHRAE~~

-

~~ASHRAE~~
~~180 Technology Parkway NW~~

~~Peachtree Corners GA 30092~~
~~100-2018 – Energy Efficiency in Existing Buildings~~

Reason Statement:

The intent, as stated in CG101.1, is to "reduce greenhouse gas emissions from building." That will not always be the case with the current electric grid in place now, and for many years to come. It is totally dependent on the location of the building and the energy sources that are used to supply the grid. By leaving Appendix CG in the Code, jurisdictions can easily be fooled into making a false choice.

We propose the following general principles as a pathway to achieving net zero carbon buildings:

1. It is highly doubtful that society, given the constraints of practicality and financial resources, would be able to fully upgrade the electric grid or provide enough on-site renewable energy to meet the demand that would be imposed with a “full-steam-ahead” electrification policy, which many are trying to achieve with the 2024 IECC.2. The “real” issue we are addressing is not so much energy conservation, but carbon conservation in the form of limiting CO_2e emissions. No energy sources should be discounted if, on a source-basis, they can achieve a superior level of performance than other sources.

3. The code is revised and published every three years. A step-wise approach to be taken is the most prudent, as it allows the grid to be upgraded to handle the additional loads expected (much of it due to electrification of vehicles) and to allow implementation of two-way technology for returning electrons to the grid, which most locations to not currently permit.

It is very apparent that the huge ambitions held by some electrification advocates will outstrip the capacity of our infrastructure to deliver. The cost to build a “future-proof” grid will likely be somewhere between $1 trillion (Reuters[1]) and $7 trillion (Oilprice.com[2]). This is an expenditure on the order of what the US spent[3] on the wars in Iraq and Afghanistan between 2001 – 2021. The appetite for policymakers and ratepayers to absorb such costs is a question that must be answered prior to causing upheaval of the nation's citizens and its economy.

Meanwhile, the US EIA has documented that average electric transmission system outage times have roughly doubled between 2013 - 2021[4]. We therefore are facing the prospect of adding massive new load to a network that is already badly in need of maintenance, without knowing with any degree of certainty how much investment capital will be available to: a) enable safe and robust bi-directional power flow for distributed storage and generation; b) protect this new “smart” grid against cyberattack and other forms of sabotage; and c) procure enough domestic supplies of scarce critical minerals (e.g. lithium, cobalt, neodymium) to ensure a secure and affordable source for the—literally—billions of batteries that are intended to serve the electric vehicle, residential and commercial energy storage, utility-scale energy storage, and consumer electronics industries.

(And, not to be dismissed, when fusion energy becomes widespread, we will need yet more lithium from which to manufacture tritium—one necessary component of the most feasible fuel for any prospective fusion power plant.)

Therefore, we view inclusion of mandatory electrification in building codes as far more than an energy efficiency, or even a greenhouse gas, issue: it also has massive national security and health/safety implications that, in our opinions, are not being adequately analyzed. While building codes may not, per se, be tasked with solving all of those problems, they are nevertheless relied upon by decisionmakers as being rational, reliable, and conservative bases for managing the building stock of our nation’s homes and businesses. Based on the foregoing, there should be consideration for more agnostically defining what is meant by a sustainable (rather than, strictly speaking, renewable) resource in the hope that we can use every feasible tool imaginable to optimize our energy system with respect to its myriad technical and environmental constraints.

Also importantly, twenty-five states have enacted legislation that will protect consumers' energy choice. By keeping Appendix CG in the Code, there is a risk that buildings constructed utilizing the "electric only" provisions in states where energy choice is mandated will be ruled in violation of those laws.

[1]

McLaughlin, T. (2022), "Creaky U.S. power grid threatens progress on renewables, EVs", Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/

[2] Hyman, L. and Tilles, W. (2021), "The $7 Trillion Cost Of Upgrading The U.S. Power Grid", Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[3] https://www.brown.edu/news/2021-09-01/costsofwar

[4] US Energy Information Administration (2022), "Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state", https://www.eia.gov/electricity/annual/ .

Bibliography:

[1] McLaughlin, T. (2022), "Creaky U.S. power grid threatens progress on renewables, EVs", Reuters, https://www.reuters.com/investigates/special-report/usa-renewables-electric-grid/

[2] Hyman, L. and Tilles, W. (2021), "The $7 Trillion Cost Of Upgrading The U.S. Power Grid", Oilprice.com, https://oilprice.com/Energy/Energy-General/The-7-Trillion-Cost-Of-Upgrading-The-US-Power-Grid.html .

[3] https://www.brown.edu/news/2021-09-01/costsofwar

[4] US Energy Information Administration (2022), "Table 11.2. Reliability metrics using IEEE of U.S. distribution system by state", https://www.eia.gov/electricity/annual/ .

Cost Impact:

The code change proposal will decrease the cost of construction.

The code change will decrease the cost of construction by allowing a greater range of energy choices for building owners.

CE2D-85-23

CE2D-86-23

IECC CE: APPENDIX CG, CG101, CG101.1, CG101.2, CG102, CG103, CG103.1, CG103.2, CG103.2.1, CG103.2.2, CG103.2.3, CG103.2.4, CG103.2.5, CG103.2.5.1, CG103.2.5.2, CG103.2.6, CG103.2.7, CG103.2.8, CG103.3, CG103.4, CG103.5, CG103.6, CG104, CG104.1, CG104.2, CG104.3, CG104.4, CG104.5, CG104.6, CG105

Proponents:

Renee Lani, representing American Public Gas Association (rlani@apga.org)

2024 International Energy Code[CE Project] R3

Delete without substitution:

APPENDIX ~~CG ALL-ELECTRIC COMMERCIAL BUILDING PROVISIONS~~

~~CG101 — GENERAL~~

~~CG101.1 Intent~~.

~~The intent of this Appendix is to amend the International Energy Conservation Code to reduce greenhouse gas emissions from buildings and improve the safety and health for commercial building occupants by requiring new all-electric buildings and efficient electrification of existing buildings.~~

~~CG101.2 Scope~~.

~~The provisions in this appendix are applicable to commercial buildings. New construction shall comply with Section CG103. Additions, alterations, repairs and changes of occupancy to existing buildings shall comply with Chapter 5 and Section CG104.~~

APPENDIX ~~CG ALL-ELECTRIC COMMERCIAL BUILDING PROVISIONS~~

~~CG102 DEFINITIONS~~.

~~ALL-ELECTRIC BUILDING.A building using no purchased energy other than electricity when utility power is available.~~

~~APPLIANCE.A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.~~

~~COMBUSTION EQUIPMENT.Any equipment or *appliance* used for space heating, *service water heating*, cooking, clothes drying, humidification, or lighting that uses *fuel gas* or fuel *oil*.~~

~~PURCHASED ENERGY. Energy or power purchased for consumption and delivered to the *building site*.~~

~~SUBSTANTIAL IMPROVEMENT.Any *repair* , reconstruction, rehabilitation, *alteration* , *addition* or other improvement of a *building* or structure, the cost of which equals or is more than 50 percent of the market value of the structure before the improvement. Where the structure has sustained substantial damage, as defined in the *International Building Code*, any repairs are considered substantial improvement regardless of the actual *repair* work performed. *Substantial improvement* does not include the following:~~

~~1. Improvement of a *building* required to correct health, sanitary or safety code violations ordered by the *code official* , or~~

~~2. *Alteration* of a *historic building* where the *alteration* will not affect the *building's* designation as a *historic building* .~~

APPENDIX ~~CG ALL-ELECTRIC COMMERCIAL BUILDING PROVISIONS~~

~~CG103 — NEW COMMERCIAL BUILDINGS~~

~~CG103.1 Application~~.

~~New commercial buildings shall be all-electric buildings and comply with Sections C401.2.1 or C401.2.2.~~

1.	*Purchased energy* other than electricity shall be permitted where it has been demonstrated to the building official that the building is required by an applicable law or regulation to provide space heating with an emergency power system or a standby power system.
2.	*Purchased energy* shall be permitted for an emergency power system or a standby power system.

~~CG103.2 Electric resistance heating equipment~~.

~~The sole use of electric resistance equipment and appliances for space and water heating shall be prohibited other than for buildings or portions of buildings that comply with not less than one of Sections CG103.2.1 through CG103.2.8.~~

~~CG103.2.1 Low space heating capacity~~.

~~Electric resistance appliances or equipment shall be permitted in buildings or areas of buildings not served by a mechanical cooling system and with a total space heating capacity not greater than 4.0 BTU/h (1.2 watts) per square foot of conditioned space .~~

~~CG103.2.2 Small systems~~.

~~Buildings in which electric resistance appliances or equipmentcomprise less than 5 percent of the total system heating capacity or serve less than 5 percent of the conditioned floor area.~~

~~CG103.2.3 Specific conditions~~.

~~Portions of buildings or specific equipment and appliances that require electric resistance heating that cannot practicably be served by electric heat pumps as approved.~~

~~CG103.2.4 Kitchen make-up air~~.

~~Make-up air for commercial kitchen exhaust systems required to be tempered by Section 508.1.1 of the International Mechanical Code is permitted to be heated by electric resistance~~

~~CG103.2.5 Freeze protection~~.

~~The use of electric resistance heat for freeze protection shall comply with Sections CG103.2.5.1 through CG103.2.5.2.~~

~~CG103.2.5.1 Low indoor design conditions~~.

~~Space heating systems sized for spaces with indoor design conditions of not greater than 40°F (4.5°C) and intended for freeze protection, including temporary systems in unfinished spaces, shall be permitted to use electric resistance. The building envelope of any such space shall be insulated in compliance with Section C402.1.~~

~~CG103.2.5.2 Freeze protection system~~.

~~Freeze protection systems shall comply with Section C403.13.3.~~

~~CG103.2.6 Pre-heating of outdoor air~~.

~~Systems with energy recovery ventilation shall be permitted to utilize electric resistance to preheat outdoor air for defrost or temper air entering the energy recovery device to not more than 45°F (7.2°C). Hydronic systems without energy recovery ventilation shall be permitted to utilize electric resistance to temper air entering the energy recovery device to not more than 40°F (4.5°C).~~

~~CG103.2.7 Small buildings.~~

~~Buildings with a conditioned floor area of not more than 250 square feet (23.2 m2) and not served by a mechanical space cooling system shall be permitted to use electric resistance appliances or equipment for space heating.~~

~~CG103.2.8 Supplemental heat.~~

~~Electric resistance heat shall be permitted as supplemental heat when installed with heat pumps sized in accordance with Section CG103.3 and when operated only when a heat pump cannot provide the necessary heating energy to satisfy the thermostat setting.~~

~~CG103.3 Heat pump sizing for space heating.~~

~~Heat pump space heating systems shall be sized to meet the building heating load at the greater of 0°F (-18°C) or the 99 Percent Annual Heating Dry-Bulb for the nearest weather station provided in the ASHRAE Handbook of Fundamentals. The heat pump space heating system shall not require the use of supplemental electric heat at or above this temperature other than for defrosting. Lower capacity heat pumps that operate in conjunction with thermal storage shall be permitted if the system meets the requirements of this section.~~

~~CG103.4 Heat pump sizing for water heating.~~

~~Heat pump service heating systems shall be sized to meet not less than the building service water heating load at the greater of 15°F (-9.5°C) or the 99 Percent Annual Heating Dry-Bulb for the nearest weather station provided in the latest edition of the ASHRAE Fundamentals Handbook. Supplemental electric heat shall not be required at or above this temperature other than for temperature maintenance in recirculating systems and defrosting.~~

~~CG103.5 Heating outside a building.~~

~~Systems for heating outside a building shall comply with C403.13.1.~~

~~CG103.6 Low capacity cooling equipment.~~

~~Air conditioners with capacity less than 240,000 Btu/hr (70 kW) shall be electric heat pump equipment sized and configured to provide both space cooling and space heating.~~

~~APPENDIX CG ALL-ELECTRIC COMMERCIAL BUILDING PROVISIONS~~

~~CG104 — EXISTING COMMERCIAL BUILDINGS~~

~~CG104.1 Combustion equipment in additions.~~

~~Additions shall use no purchased energy other than electricity and new equipment installed to serve additions shall use no purchased energy other than electricity. Where existing systems using purchased energy other than electricity serve an addition, the existing building and addition together shall use no more purchased energy other than electricity than the existing building alone.~~

~~CG104.2 Substantial improvement.~~

~~Buildings undergoing substantial improvements shall be all-electric buildings, comply with C402.5 and meet a site EUI by building type in accordance with ASHRAE Standard 100 Table 7-2a.~~

~~**Exception:** Compliance with Standard 100 shall not be required where Group R occupancies achieve an ERI score of 80 or below without *on-site renewable energy* included in accordance with RESNET/ICC 301, for each *dwelling unit*.~~

~~CG104.3 Cooling equipment.~~

~~New and replacement air conditioners shall be electric heat pump equipment sized and configured to provide both space cooling and~~

~~space heating. Any existing space heating systems other than existing heat pump equipment that serve the same zone as the new equipment shall be configured as supplementary heat in accordance with Section CG104.6.~~

~~CG104.4 Service water heating equipment~~.

~~Where water heaters are added or replaced, they shall use no purchased energy other than electricity.~~

~~CG104.5 Furnace replacement~~.

~~Newly installed warm air furnaces provided for space heating shall only be permitted as supplementary heat controlled in accordance with Section CG104.6.~~

~~CG104.6 Heat pump supplementary heat~~.

~~Heat pumps having combustion equipment or electric resistance equipment for supplementary space or service water heating shall have controls that limit supplemental heat operation to only those times when one of the following applies:~~

1.	The heat pump is operating in defrost mode.
2.	The vapor compression cycle malfunctions.
3.	For space heating systems, the *thermostat* malfunctions.
4.	For space heating systems, the vapor compression cycle cannot provide the necessary heating energy to satisfy the *thermostat* setting.
5.	The outdoor air temperature is less than the design temperature determined in accordance with Section CG103.3.
6.	For *service water heating*, the heat pump *water heater* cannot maintain an output water temperature of not less than 120°F (49°C) .
7.	For temperature maintenance in *service water heating* systems.

~~New supplementary space and *service water heating* systems for heat pump equipment shall not be permitted to have a heating output capacity greater than the heating output capacity of the heat pump equipment.~~

APPENDIX ~~CG ALL-ELECTRIC COMMERCIAL BUILDING PROVISIONS~~

~~CG105 REFERENCE STANDARDS~~.

~~ASHRAE~~

-

~~ASHRAE~~
~~180 Technology Parkway NW~~
~~Peachtree Corners GA 30092~~
~~100-2018 - Energy Efficiency in Existing Buildings~~

Reason Statement:

APGA appreciates the opportunity to provide IECC-C Committee this input. APGA is the national trade association for approximately 1,000 communities across the U.S. that own and operate their own retail natural gas distribution entities. They include municipal gas distribution systems, public utility districts, county districts, and other public agencies, all locally accountable to the citizens they serve. Public gas systems focus on providing safe, reliable, resilient, and affordable natural gas service to their customers. APGA members serve their communities by providing sustainable and clean energy to be used for cooking, clothes drying, and space and water heating, as well as for various commercial and industrial applications.

APGA proposes deleting the all-electric appendix in its entirety, as, if adopted, it would neither guarantee energy use reductions nor emissions reductions, meaning it would fall outside the scope of the IECC-C. Further, the appendix greatly limits a consumer's ability to pick the energy source that best fits their needs and budgets.

The need for fuel neutrality in building codes is underscored by a recent court decision from the United States Court of Appeals for the Ninth Circuit, California Restaurant Association v. City of Berkeley (“CRA v. Berkeley”). No. 21-16278. In CRA v. Berkeley, the court found that the Energy Policy and Conservation Act (“EPCA”) (42 U.S.S. § 6297(c)) preempts the city’s building code that banned natural gas piping in new buildings. The court found that “by its plain language, EPCA preempts Berkeley’s regulation here because it prohibits the installation of necessary natural gas infrastructure on premises where covered natural gas appliances are used.” The court went on to explain that “EPCA does not permit States and localities to dodge preemption by hiding ‘energy use’ regulations in building codes.” Accordingly, any model building codes or standards that expressly prohibit natural gas piping or appliances in new or existing buildings would be a misguided approach. According to judges in the 9th Circuit, such codes or standards are expressly preempted under EPCA.

Removing the appendix from the IECC-C will not prohibit those builders who wish to do so from building all-electric homes as they see fit- it simply will align with federal law, persuasive case law, and consumer choice/affordability.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The cost of construction will depend on what appliances a builder/consumer chooses to install, so it can not be said whether costs will increase or decrease.

CE2D-86-23

CE2D-87-23

IECC CE: CH, CH101, CH101.1, CH101.2

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code[CE Project] R3

Delete without substitution:

~~CH ELECTRIC-READY COMMERCIAL BUILDING PROVISIONS~~

~~CH101 — GENERAL~~

~~CH101.1 Intent.~~

~~The intent of this Appendix is to amend the International Energy Conservation Code to reduce future retrofit costs by requiring commercial buildings with combustion equipment to install the electrical infrastructure for electric equipment.~~

~~CH101.2 Scope.~~

~~The provisions in this appendix are applicable to commercial buildings. New construction shall comply with Section CH103.~~

Reason Statement:

As proposed, this Appendix would be enforced as normative requirements of the IECC CE, not as "informative." The "intent" as written extends the IECC CE beyond building energy efficiency and, if implemented by installing all-electric options, would likely serve only to push climate-related emissions upstream through the delivered energy chain. No analysis of this unintended consequence is evidenced. Requirements for "electric-ready" systems and equipment goes beyond minimum building energy requirements, facilitates electrification that is not contributing to building energy savings, subsidizes non-building energy uses, if electric options are implemented will increase building energy consumption and full fuel cycle energy consumption and emissions upstream from grid electricity, and if electric options are not implemented, imposes stranded asset costs and unnecessarily increasing overall building costs. These requirements do not belong in a minimum energy efficiency code and would be more properly proposed to a "stretch" or "green" building code.

Cost Impact:

The code change proposal will decrease the cost of construction.

If enforced as normative requirements, the incremental cost of "electric-readiness" with no assurance of ever being used would increase costs of construction, potentially with no economic return.

CE2D-87-23

CE2D-88-23

IECC CE: CH

Proponents:

Laura Petrillo-Groh, representing Air-Conditioning, Heating, and Refrigeration Institute (lpetrillo-groh@ahrinet.org); Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com); Andrew Klein, representing BOMA International (andrew@asklein.com); Robert Ross, representing Self (robertross1952@gmail.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

~~CH ELECTRIC-READY COMMERCIAL BUILDING PROVISIONS~~

Reason Statement:

AHRI opposes proposed Appendix CH, which introduces optional jurisdictional adoption for electric-ready commercial building provisions, requiring electric infrastructure to be added wherever combustion equipment for space and water heating has been selected. CECD1-28-22 is too broad, requiring electrical infrastructure installation for electric heat pumps for heating in all climate zones, where technology and energy savings are not yet proven.

Though included as an optional appendix, these provisions are intended for adoption by jurisdictions and are therefore subject to the same scrutiny as other mandatory provisions. Requiring additional infrastructure, that may never be used, is not cost effective. Indeed, in the first round of public review the Commercial Consensus Committee (E4C) disposed of CEPI-22, which contained identical provisions. E4C's cited reasoning was that CEPI-22 "[d]oes not provide cost analysis as it relates to additional electrical infrastructure." The cost analysis provided by the New Buildings Institute (NBI) did not change for CECD1-28-22.[1] In stark contrast to the NBI report, the cost of electric ready and electrification measures was shown to be unjustified by a Home Innovation Research Labs study of electrification of single-family homes.[2]

AHRI supports an energy code that can be adopted uniformly by jurisdictions. The proliferation of appendices for optional jurisdictional adoption will exacerbate the patchwork of energy code in the U.S.

AHRI recommends striking Appendix CH in its entirety until the cost justification has been satisfactorily proven.

[1] Cost: https://newbuildings.org/wp-content/uploads/2022/04/BuildingDecarbCostStudy.pdf

- Two buildings (single family/med office), one climate zone
- all-electric medium office has an incremental cost of $0.33-0.50/ sf.
- electric-ready medium office has an incremental cost of $1.03-1.20/sf

[2]

https://www.nahb.org/blog/2021/03/How-Much-Does-Whole-Home-Electrification-Cost

Cost Impact:

The code change proposal will decrease the cost of construction.

This proposal seeks to rectify the cost impact of requiring additional infrastructure, that may never be used. Please also refer to the NAHB electrification cost study: https://www.nahb.org/blog/2021/03/How-Much-Does-Whole-Home-Electrification-Cost

CE2D-88-23

CE2D-89-23

IECC CE: CH, CH101, CH101.1, CH101.2, CH102, CH103, CH103.1, CH103.1.1, TABLE CH103.1.1, CH103.1.1.1, CH103.1.1.2, CH103.1.1.3, CH103.1.2, TABLE CH103.1.2, CH103.1.2.1, CH103.1.2.2, CH103.1.2.3, CH103.1.2.4, CH103.1.3, CH103.1.3.1, TABLE CH103.1.3.1, CH103.1.3.2, CH103.1.4, CH103.1.4.1, CH103.1.4.2, CH103.1.5, CH103.2, CH103.3

Proponents:

Steven Cowen, representing Black Hills Energy

2024 International Energy Code[CE Project] R3

Delete without substitution:

~~CH ELECTRIC-READY COMMERCIAL BUILDING PROVISIONS~~

~~CH101 — GENERAL~~

~~CH101.1 Intent.~~

~~The intent of this Appendix is to amend the International Energy Conservation Code to reduce future retrofit costs by requiring commercial buildings with combustion equipment to install the electrical infrastructure for electric equipment.~~

~~CH101.2 Scope.~~

~~The provisions in this appendix are applicable to commercial buildings. New construction shall comply with Section CH103.~~

~~CH102 DEFINITIONS.~~

~~APPLIANCE. A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.~~

~~COMBUSTION EQUIPMENT. Any equipment or appliance used for space heating, *service water heating*, cooking, clothes drying or lighting that uses a fossil fuel.~~

~~COMMERCIAL COOKING APPLIANCES. used in a commercial food service establishment for heating or cooking food and which produce grease vapors, steam, fumes, smoke or odors that are required to be removed through a local exhaust ventilation system. Such *appliances* include deep fat fryers, upright broilers, griddles, broilers, steam-jacketed kettles, hot-top ranges, under-fired broilers (charbroilers), ovens, barbecues, rotisseries, and similar appliances.~~

~~CH103 — NEW COMMERCIAL BUILDING~~

~~CH103.1 Additional electric infrastructure.~~

~~Electric infrastructure in buildings that contain combustion equipment shall be installed in accordance with this section.~~

~~CH103.1.1 Combustion space heating.~~

~~Spaces containing combustion equipment for space heating shall comply with Sections CH103.1.1.1, CH103.1.1.2 and CH103.1.1.3.~~

~~TABLE CH103.1.1 ALTERNATE ELECTRIC SPACE HEATING EQUIPMENT CONVERSION FACTORS (VA/kBtu/h)~~

99.6% HEATING DESIGN TEMPERATURE	P_s	-
GREATER THAN (°F)	NOT GREATER THAN	VA/kBtu/h
50	N/A	N/A

45	50	94
40	45	100
35	40	107
30	35	115
25	30	124
20	25	135
15	20	149
10	15	164
5	10	184
0	5	210
-5	0	243
-10	-5	289
-15	-10	293

~~CH103.1.1.1 Designated exterior locations for future electric space heating equipment~~.

~~Spaces containing combustion equipment for space heating shall be provided with designated exterior location(s) shown on the plans and of sufficient size for outdoor space heating heat pump equipment, with a chase that is sized to accommodate refrigerant lines between the exterior location and the interior location of the space heating equipment, and with natural drainage for condensate from heating operation or a condensate drain located within 3 feet (914 mm) of the location of the future exterior space heating heat pump equipment.~~

~~CH103.1.1.2 Dedicated branch circuits for future electric space heating equipment~~.

~~Spaces containing combustion space heating equipment with a capacity not more than 65,000 Btu/h shall be provided with a dedicated 240-volt, branch circuit with ampacity of not less than 50. The branch circuit shall terminate within 6 feet (1829 mm) of the space heating equipment and be in a location with ready access. Both ends of the branch circuit shall be labeled with the words "For Future Electric Space Heating Equipment" and be electrically isolated. Spaces containing combustion equipment for space heating with a capacity of not less than 65,000 Btu/h shall be provided with a dedicated branch circuit rated and sized in accordance with Section CH103.1.1.3, and terminating in a junction box within 3 feet (914 mm) of the location the space heating equipment in a location with ready access. Both ends of the branch circuit shall be labeled "For Future Electric Space Heating Equipment."~~

~~**Exceptions:**~~

1.	Where a branch circuit provides electricity to the space heating combustionequipment and is rated and sized in accordance with Section CH103.1.1.3

2.	Where a branch circuit provides electricity to space cooling equipment andis rated and sized in accordance with Section CH103.1.1.3.
3.	Where future electric space heating equipment would require three-phase power and the space containing combustion equipment for space heating is provided with an electrical panel with a label stating, "For Future Electric Space Heating Equipment" and with a bus bar rated and sized in accordance with Section CH103.1.1.3.
4.	Buildings where the 99.6 percent design heating temperature is not lessthan 50°F (10°C)

~~CH103.1.1.3 Additional space heating electric infrastructure sizing~~.

~~Electric infrastructure for future electric space heating equipment shall be sized toaccommodate not less than one of the following:~~

1.	An electrical capacity not less than the nameplate space heating combustionequipment heating capacity multiplied by the value in Table CH103.1.1 $$VA_s = Q_{com} \text{ x } P_s$$ Equation CH-1 VA_s = The required electrical capacity of the electrical infrastructure in volt-amps Q_{com} = The nameplate heating capacity of the combustion equipment in kBtu/h P_s = The VA per kBtu/h from Table CH103.1 in VA/kBtu/h
2.	An electrical capacity not less than the peak space heating load of the buildingareas served by the space heating combustion equipment, calculated inaccordance with Section C403.1.1, multiplied by the value for the 99.6 percentdesign heating temperature in Table CH103.1.1 per the equation below, or $$VA_s = Q_{design} \text{ x } P_s$$ Equation CH-2 VA_s = The required electrical capacity of the electrical infrastructure in volt-amps Q_{design} = The 99.6 percent design heating load of the spaces served by thecombustion equipment in kBtu/h P_s = The VA per kBtu/h from Table CH103.1.1 in VA/kBtu/h
3.	An *approved* alternate design that uses no energy source other than electricity or *on-site renewable energy*.

~~CH103.1.2 Combustion service water heating~~.

~~Spaces containing combustion equipment for service water heating shall comply with Sections CH103.1.2.1, CH103.1.2.2 and CH103.1.2.3.~~

~~TABLE CH103.1.2 ALTERNATE ELECTRIC WATER HEATING EQUIPMENT CONVERSION FACTORS (VA/kBtu/h)~~

99.6% HEATING DESIGN TEMPERATURE		Pw
GREATER THAN (°F)	NOT MORE THAN	VA/kBtu/h
55	60	118

50	55	123
45	50	129
40	45	136
35	40	144
30	35	152
25	30	162
20	25	173
15	20	185
10	15	293
5	10	293
0	5	293
Less than 0°F (-17.8°C)		293

~~CH103.1.2.1 (NEED TITLE)~~.

~~For each piece of combustion equipment for water heating with an input capacity of not more than 75,000 Btu/h, the following electrical infrastructure is required:~~

1.	An individual 240-volt branch circuit with an ampacity of not less than 30 shall be provided and terminate within 6 ft (2 m) of the *water heater* and shall be in a location with ready access.
2.	The branch circuit overcurrent protection device and the termination of the branch circuit shall be labeled "For future electric water heater".
3.	The space for containing the future *water heater* shall include the space occupied by the combustion equipment and shall have a height of not less than 7 ft (2 m), a width of not less than 3 ft (1 m), a depth of not less than 3ft (1 m) and with a volume of not less than 700 ft^3 (20 m^3).

~~**Exception:** Where the space containing the *water heater* is provides for air circulation sufficient for the operation of a heat pump *water heater*, the minimum room volume shall not be required.~~

~~CH103.1.2.2 Designated locations for future electric heat pump water heating equipment~~.

~~1.Designated exterior location(s) shown on the plans and of sufficient size for outdoor water heating heat pump equipment, with a chase that is sized to accommodate refrigerant lines between the exterior location and the interior location of the water heating equipment. 2.An interior location with a minimum volume the greater of 700 cubic feet(2000 L) or 7 cubic feet (200 L) per 1,000 Btu/h combustion equipment water heating capacity. The interior location shall include the space occupied by the combustion equipment. 3.An interior location with sufficient airflow to exhaust cool air from future water heating heat pump equipment provided by no less than one 16-inch(406 mm) by 24-inch (610 mm) grill to a heated space and one 8-inch (203mm) duct of no more than 10 feet (3048 mm) in length for cool exhaust air.~~

~~CH103.1.2.3 Dedicated branch circuits for future electric heat pump water heating equipment~~.

~~Spaces containing combustion equipment for water heating with a capacityof greater than 75,000 Btu/h shall be provided with a dedicated branch circuit rated and sized in accordance with Section CH103.1.2.4 and terminating in a junction box within 3feet (914 mm) of the location the water heating equipment in a location with ready access. Both ends of the branch circuit shall be labeled "For Future Electric Water Heating Equipment."~~

~~**Exception:** Where future electric water heating equipment would require threephase power and the main electrical service panel has a reserved space for a bus bar rated and sized in accordance with Section CH103.1.2.4 and labeled "For Future Electric Water Heating Equipment."~~

~~CH103.1.2.4 Additional water heating electric infrastructure sizing~~.

~~Electric infrastructure water heating equipment with a capacity of greater than 75,000 Btu/hshall be sized to accommodate one of the following:~~

1.	An electrical capacity not less than the combustion equipment water heating capacity multiplied by the value in Table CH103.1.2 plus electrical capacity to serve recirculating loads as shown in the equation below. $$VA_w = (Q_{capacity} \text{ x } P_w) + (Q_{recirc} \text{ x } 293 \text{ (VA/(Btu/h))}$$ Equation CH-3 VA_w = The required electrical capacity of the electrical infrastructure for water heating in volt-amps $Q_{capacity}$ = The water heating capacity of the combustion equipment in kBtu/h P_w = The VA per kBtu/h from Table CH103.1.2 in VA/kBtu/h Q_{recirc} = The capacity required for temperature maintenance by recirculation, if applicable, in Btu/h
2.	An alternate design that complies with this code, that is approved by the authority having jurisdiction, and that uses no energy source other than electricity or *on-site renewable energy.*

~~CH103.1.3 Combustion cooking~~.

~~Spaces containing combustion equipment for cooking shall comply with either CH103.1.3.1 or CH103.1.3.2~~

~~CH103.1.3.1 Commercial cooking~~.

~~Spaces containing commercial cooking appliances shall be provided with a dedicated branch circuit with a minimum electrical capacity in accordance with Table CH103.1.3.1 based on the appliance in the space. The branch circuit shall terminate within 3 feet (914 mm) of the appliance in a location with ready access. Both ends of the branch circuit shall be labeled with the words "For Future Electric Cooking Equipment" and be electrically isolated.~~

~~TABLE CH103.1.3.1 COMMERCIAL COOKING MINIMUM BRANCH CIRCUIT CAPACITY~~

COMMERCIAL COOKING APPLIANCE	MINIMUM BRANCH CIRCUIT CAPACITY
Range	469 VA/kBtu/h
Steamer	114 VA/kBtu/h
Fryer	200 VA/kBtu/h

Oven	266 VA/kBtu/h
Griddle	195 VA/kBtu/h
All other commercial cooking appliances	114 VA/kBtu/h

~~CH103.1.3.2 All other cooking~~.

~~Spaces containing all other cooking equipment not designated as commercial cooking appliances shall be provided with a dedicated branch circuit in compliance with NFPA 70 Section 422.10. The branch circuit shall terminate within 6 feet (1829 mm) of fossil fuel ranges, cooktops and ovens and be in a location with ready access. Both ends of the branch circuit shall be labeled with the words “For Future Electric Cooking Equipment” and be electrically isolated.~~

~~CH103.1.4 Combustion clothes drying~~.

~~Spaces containing combustion equipment for clothes drying shall comply with either CH103.1.4.1 or CH103.1.4.2~~

~~CH103.1.4.1 Commercial drying~~.

~~Spaces containing clothes drying equipment, and end-uses for commercial laundry applications shall be provided with conduit that is continuous between a junction box located within 3 feet (914 mm) of the equipment and an electrical panel. The junction box, conduit and bus bar in the electrical panel shall be rated and sized to accommodate a branch circuit with sufficient capacity for an equivalent electric equipment with an equivalent equipment capacity. The electrical junction box and electrical panel shall have labels stating, “For Future Electric Clothes Drying Equipment.”~~

~~CH103.1.4.2 Residential drying~~.

~~Spaces containing clothes drying equipment, appliances, and end-uses serving multiple dwelling units or sleeping areas with a capacity less than or equal to 9.2 cubic feet shall be provided with a dedicated 240-volt branch circuit with a minimum capacity of 30A and shall terminate within 6 feet (1829 mm) of fossil fuel clothes dryers and shall be in a location with ready access. Both ends of the branch circuit shall be labeled with the words “For Future Electric Clothes Drying Equipment” and be electrically isolated.~~

~~CH103.1.5 On-site transformers~~.

~~Enclosed spaces and underground vaults containing onsite electric transformers on the building side of the electric utility meter shall have sufficient space to accommodate transformers sized to serve the additional electric loads identified in CH103.1.1, CH103.1.2, CH103.1.3 and CH103.1.4.~~

~~CH103.2 Hydronic heating design requirements~~.

~~For all hydronic space heating systems, the design entering water temperature for coils, radiant panels, radiant floor systems, radiators, baseboard heaters, and any other device that uses hot water to provide heat to a space shall be not more than 130°F (55°C).~~

~~CH103.3 Construction documentation~~.

~~The construction documents shall provide details for additional electric infrastructure, including branch circuits, conduit, pre-wiring, panel capacity, and electrical service capacity, as well as interior and exterior spaces designated for future electric equipment.~~

Reason Statement:

At Black Hills Energy, we provide safe, reliable and cost-effective natural gas and electric service to over 1.3 million customers in eight states. Our mission of improving life with energy means we must be ready to make tomorrow even better than today. That is why we are committed to creating a cleaner energy future which builds upon our responsibility to provide the safe, reliable and cost-effective energy that improves our customers’ lives.

Electric-ready provisions in building codes are not guaranteed to reduce energy consumption or greenhouse gas emissions. These provisions will add increased costs to consumers for features and service that may never be utilized.

Black Hills Energy supports, and is a partner in, pursuing all sensible paths to reducing emissions and providing affordable, reliable energy for our customers today and tomorrow. Our natural gas systems are among the most advanced in the industry, and we continue to invest in clean and modern energy. Last year we announced a new commitment to achieve Net Zero emissions by 2035 for our natural gas distribution system. This target replaces our previous commitment of a 50% reduction in GHG emissions intensity for mains and services by 2035, doubling our reduction target and expanding the boundary of the goal to all sources of emissions in our distribution system.

We have continued to achieve progress towards our goal to reduce electric utility emission intensity 40% by 2030 and 70% by 2040, already reducing emissions by more than a third since 2005.

Sustainably reducing greenhouse gas emissions will require continued efforts to reduce emissions from the natural gas sector; foster innovation of clean fuels, such as renewable natural gas and hydrogen; continued integration of clean energy sources like renewables and natural gas; utilization of our country’s energy delivery infrastructure, and careful consideration of the impact to Americans.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This proposal removes a new provision.

CE2D-89-23

CE2D-90-23

IECC CE: CH, CH103, CH103.1, CH103.1.1, TABLE CH103.1.1, CH103.1.1.1, CH103.1.1.2 (New), CH103.1.1.2, CH103.1.1.3, CH103.1.2, TABLE CH103.1.2, CH103.1.2.1, CH103.1.2.2, CH103.1.2.3, CH103.1.2.4, CH103.1.3, CH103.1.3.1, TABLE CH103.1.3.1, CH103.1.3.2, CH103.1.4, CH103.1.4.1, CH103.1.4.2, CH103.1.5, CH103.2, CH103.3

Proponents:

Michele Mihelic, representing The American Institute of Architects (AIA) (michelemihelic@aia.org)

2024 International Energy Code[CE Project] R3

CH ELECTRIC-READY COMMERCIAL BUILDING PROVISIONS

CH103 — NEW COMMERCIAL BUILDING

CH103.1 Additional electric infrastructure.

Electric infrastructure in buildings that contain combustion equipment shall be installed in accordance with this section.

CH103.1.1 Combustion space heating.

Spaces containing combustion equipment for space heating shall comply with Sections CH103.1.1.1, CH103.1.1.2 and CH103.1.1.3.

TABLE CH103.1.1 ALTERNATE ELECTRIC SPACE HEATING EQUIPMENT CONVERSION FACTORS (VA/kBtu/h)

CH103.1.1.1 Designated exterior locations for future electric space heating equipment.

Spaces containing combustion equipment for space heating shall be provided with designated exterior location(s) shown on the plans and of sufficient size for outdoor space heating heat pump equipment, with a chase that is sized to accommodate refrigerant lines between the exterior location and the interior location of the space heating equipment, and with natural drainage for condensate from heating operation or a condensate drain located within 3 feet (914 mm) of the location of the future exterior space heating heat pump equipment.

Add new text as follows:

CH103.1.1.2 Electric service capacity for future electric space heating equipment.

Where the addition of future electric space heating equipment would require an increase in the capacity of the electric service capacity for the building, provisions should be made for future increase in the capacity, including designated space for larger and or additional utility transformers to serve the building and additional conduit from the transformer location to the main electrical panel for the building.

Revise as follows:

~~CH103.1.1.2~~ CH103.1.1.2.1 Dedicated branch circuits for future electric space heating equipment.

Spaces containing combustion space heating equipment with a capacity not more than 65,000 Btu/h shall be provided with ~~a dedicated 240-volt, branch circuit with ampacity of not less than 50. The branch circuit shall~~ a conduit run sufficient to convey 208/240v, 50Amp

conductors from the main electrical panel and terminating ~~terminate~~ within 6 feet (1829 mm) of the space heating equipment. ~~and be in a location with ready access. Both ends of the branch circuit shall be labeled with the words "For Future Electric Space Heating Equipment" and be electrically isolated. Spaces containing combustion equipment for space heating with a capacity of not less than 65,000 Btu/h shall be provided with a dedicated branch circuit rated and sized in accordance with Section CH103.1.1.3, and terminating in a junction box within 3 feet (914 mm) of the location the space heating equipment in a location with ready access. Both ends of the branch circuit shall be labeled "For Future Electric Space Heating Equipment."~~
The main panel shall include a reserved breaker space sufficient to serve future space heating equipment and shall be labeled for "Future Electric Space Heating Equipment".

Exceptions:

1.	Where a branch circuit provides electricity to the space heating combustion equipment and is rated and sized in accordance with Section CH103.1.1.3
2.	Where a branch circuit provides electricity to space cooling equipment and is rated and sized in accordance with Section CH103.1.1.3.
3.	Where future electric space heating equipment would require three-phase power and the space containing combustion equipment for space heating is provided with an electrical panel with a label stating, "For Future Electric Space Heating Equipment" and with a bus bar rated and sized in accordance with Section CH103.1.1.3.
4.	Buildings where the 99.6 percent design heating temperature is not less than 50ºF (10°C)

CH103.1.1.3 Additional space heating electric infrastructure sizing.

<u>Electric infrastructure for future electric space heating equipment shall be sized toaccommodate not less than one of the following:</u>

1.	An electrical capacity not less than the nameplate space heating combustionequipment heating capacity multiplied by the value in Table CH103.1.1 $$VA_s = Q_{com} \text{ x } P_s$$ Equation CH-1 VA_s = The required electrical capacity of the electrical infrastructure in volt-amps Q_{com} = The nameplate heating capacity of the combustion equipment in kBtu/h P_s = The VA per kBtu/h from Table CH103.1 in VA/kBtu/h
2.	An electrical capacity not less than the peak space heating load of the buildingareas served by the space heating combustion equipment, calculated inaccordance with Section C403.1.1, multiplied by the value for the 99.6 percentdesign heating temperature in Table CH103.1.1 per the equation below, or $$VA_s = Q_{design} \text{ x } P_s$$ Equation CH-2 VA_s = The required electrical capacity of the electrical infrastructure in volt-amps Q_{design} = The 99.6 percent design heating load of the spaces served by thecombustion equipment in kBtu/h P_s = The VA per kBtu/h from Table CH103.1.1 in VA/kBtu/h
3.	An *approved* alternate design that uses no energy source other than electricity or *on-site renewable energy*.

CH103.1.2 Combustion service water heating.

Spaces containing combustion equipment for service water heating shall comply with Sections CH103.1.2.1, CH103.1.2.2 and CH103.1.2.3.

TABLE CH103.1.2 ALTERNATE ELECTRIC WATER HEATING EQUIPMENT CONVERSION FACTORS (VA/kBtu/h)

Revise as follows:

CH103.1.2.1 (NEED TITLE).

For each piece of combustion equipment for water heating with an input capacity of not more than 75,000 Btu/h, the following electrical infrastructure is required:

1.	An individual 240-volt branch circuit with an ampacity of not less than 30 shall be provided and terminate within 6 ft (2 m) of the *water heater* and shall be in a location with ready access.
2.	~~The branch circuit overcurrent protection device and the termination of the branch circuit shall be labeled "For future electric water heater".~~ The panel serving the device shall have a reserved breaker space sufficient to serve the future electric water heating equipment. The reserved breaker space and conduit run shall be labeled for " Future Electric Water Heater".
3.	The space for containing the future *water heater* shall include the space occupied by the combustion equipment and shall have a height of not less than 7 ft (2 m), a width of not less than 3 ft (1 m), a depth of not less than 3ft (1 m) and with a volume of not less than 700 ft^3 (20 m^3).

Exception: Where the space containing the *water heater* is provides for air circulation sufficient for the operation of a heat pump *water heater*, the minimum room volume shall not be required.

CH103.1.2.2 Designated locations for future electric heat pump water heating equipment.

1.	Designated exterior location(s) shown on the plans and of sufficient size for outdoor water heating heat pump equipment, with a chase that is sized to accommodate refrigerant lines between the exterior location and the interior location of the water heating equipment.
2.	An interior location with a minimum volume the greater of 700 cubic feet(2000 L) or 7 cubic feet (200 L) per 1,000 Btu/h combustion equipment water heating capacity. The interior location shall include the space occupied by the combustion equipment.
3.	An interior location with sufficient airflow to exhaust cool air from future water heating heat pump equipment provided by no less than one 16-inch(406 mm) by 24-inch (610 mm) grill to a heated space and one 8-inch (203mm) duct of no more than 10 feet (3048 mm) in length for cool exhaust air.

CH103.1.2.3 Dedicated branch circuits for future electric heat pump water heating equipment.

Spaces containing combustion equipment for water heating with a capacityof greater than 75,000 Btu/h shall be provided with a dedicated branch circuit rated and sized in accordance with Section CH103.1.2.4 and terminating in a junction box within 3feet (914 mm) of the location the water heating equipment in a location with ready access. Both ends of the branch circuit shall be labeled “For Future

Electric Water Heating Equipment.”

Exception: Where future electric water heating equipment would require threephase power and the main electrical service panel has a reserved space for a bus bar rated and sized in accordance with Section CH103.1.2.4 and labeled “For Future Electric Water Heating Equipment.”

Revise as follows:

CH103.1.2.4 Additional water heating electric infrastructure sizing.

Electric infrastructure accommodations for future water heating equipment with a capacity of greater than 75,000 Btu/h shall be sized to accommodate one of the following:

1.	An electrical capacity not less than the combustion equipment water heating capacity multiplied by the value in Table CH103.1.2 plus electrical capacity to serve recirculating loads as shown in the equation below. $$VA_w = (Q_{capacity} \text{ x } P_w) + (Q_{recirc} \text{ x } 293 \text{ (VA/(Btu/h))}$$ Equation CH-3 VA_w = The required electrical capacity of the electrical infrastructure for water heating in volt-amps $Q_{capacity}$ = The water heating capacity of the combustion equipment in kBtu/h P_w = The VA per kBtu/h from Table CH103.1.2 in VA/kBtu/h Q_{recirc} = The capacity required for temperature maintenance by recirculation, if applicable, in Btu/h
2.	An alternate design that complies with this code, that is approved by the authority having jurisdiction, and that uses no energy source other than electricity or *on-site renewable energy.*

CH103.1.3 Combustion cooking.

Spaces containing combustion equipment for cooking shall comply with either CH103.1.3.1 or CH103.1.3.2

Revise as follows:

CH103.1.3.1 Commercial cooking.

Spaces containing commercial cooking appliances shall be provided with a ~~dedicated branch~~ conduit sized for a circuit with an ~~minimum~~ electrical ampacity in accordance with Table CH103.1.3.1 based on the appliance in the space. The ~~branch circuit~~ conduit shall run from the panel to terminate within 3 feet (914 mm) of the appliance in a location with ready access. ~~Both ends of the branch circuit shall be labeled with the words “For Future Electric Cooking Equipment” and be electrically isolated.~~

The panel shall be provided with a reserved breaker space sufficient to serve the future space heating equipment based on the capacities specified in CH103.1.3.1. The reserved breaker space and conduit shall be labeled for “Future Electric Space Heating Equipment

TABLE CH103.1.3.1 COMMERCIAL COOKING MINIMUM BRANCH CIRCUIT CAPACITY

CH103.1.3.2 All other cooking.

Spaces containing all other cooking equipment not designated as commercial cooking appliances shall be provided with a dedicated branch circuit in compliance with NFPA 70 Section 422.10. The branch circuit shall terminate within 6 feet (1829 mm) of fossil fuel ranges, cooktops and ovens and be in a location with ready access. Both ends of the branch circuit shall be labeled with the words “For Future Electric Cooking Equipment” and be electrically isolated.

CH103.1.4 Combustion clothes drying.

Spaces containing combustion equipment for clothes drying shall comply with either CH103.1.4.1 or CH103.1.4.2

CH103.1.4.1 Commercial drying.

Spaces containing clothes drying equipment, and end-uses for commercial laundry applications shall be provided with conduit that is continuous between a junction box located within 3 feet (914 mm) of the equipment and an electrical panel. The junction box, conduit and bus bar in the electrical panel shall be rated and sized to accommodate a branch circuit with sufficient capacity for an equivalent electric equipment with an equivalent equipment capacity. The electrical junction box and electrical panel shall have labels stating, “For Future Electric Clothes Drying Equipment.”

Revise as follows:

CH103.1.4.2 Residential drying.

Spaces containing clothes drying equipment, appliances, and end-uses serving multiple dwelling units or sleeping areas with a capacity less than or equal to 9.2 cubic feet shall be provided with ~~a dedicated 240-volt branch circuit with a minimum capacity of 30A and shall terminate~~ with an empty conduit sufficient to convey 208/240v, 30Amp conductors running from the main electrical panel terminating within 6 feet (1829 mm) of fossil fuel clothes dryers and shall be in a location with ready access. ~~Both ends of the branch circuit shall be labeled with the words “For Future Electric Clothes Drying Equipment” and be electrically isolated.~~

The panel shall be provided with a reserved breaker space sufficient to serve the future clothes drying equipment based on a 208/240v, 30Amp load. The reserved breaker space and conduit shall be labeled as reserved for future “Electric Space Heating Equipment”.

CH103.1.5 On-site transformers.

Enclosed spaces and underground vaults containing onsite electric transformers on the building side of the electric utility meter shall have sufficient space to accommodate transformers sized to serve the additional electric loads identified in CH103.1.1, CH103.1.2, CH103.1.3 and CH103.1.4.

CH103.2 Hydronic heating design requirements.

For all hydronic space heating systems, the design entering water temperature for coils, radiant panels, radiant floor systems, radiators, baseboard heaters, and any other device that uses hot water to provide heat to a space shall be not more than 130°F (55°C).

CH103.3 Construction documentation.

The construction documents shall provide details for additional electric infrastructure, including branch circuits, conduit, pre-wiring, panel capacity, and electrical service capacity, as well as interior and exterior spaces designated for future electric equipment.

Reason Statement:

In order for the U.S. to reach net zero carbon emissions, the country must not only reduce energy use through energy efficiency and move to utility scale and on-site renewable energy, but also begin to transition away from using combustion equipment in buildings that run on fossil fuels to electric equipment. In 2021, combustion equipment in commercial and residential buildings accounted for 35% of US greenhouse gas emissions.[1] The cost of installing electric-ready infrastructure when a building is under construction, walls are open, and the trades are already on-site, is small in comparison to the cost of retrofitting a building to install the same level of electric equipment. Having electric-ready infrastructure in place gives building owners or occupants the choice to shift to electric appliances at time of replacement or retrofit without incurring the costs and delays of retrofitting panels, opening walls to install conduit, etc. The residential 2024 IECC has included mandatory electric-ready requirements for water heating, cooktops and clothes drying into the public comment review draft #1. The California Building Energy Efficiency Standards 2022 update (Title 24, Part 6) has also moved in this direction, including electric-ready requirements for heat pump space heating, cooktops and clothes drying in both single family homes and multifamily buildings, and for water heating in single family homes. The Chicago Energy Transformation Code has also included electric-ready requirements for residential single family and multifamily buildings in their energy code. Attached is a letter with others stating the support for this proposal from 50 organizations, 16 of which are from local or state governments and universities, 12 of which are from NGOs, and 22 of which are from design and construction industry. In addition to the letter of support, this proposal includes more than 30 co-proponents.

Requiring buildings to be electric-ready will not only reduce costs for building owners who choose to electrify their building at a later date but it will also give building residents the option to improve their own health. Gas appliances release harmful pollutants like nitrogen dioxide (NO2) and carbon monoxide (CO) either indoors because of gas stoves or outdoors because of space-heating and water heating equipment. A recent study from the Harvard Chang School of Public Health and RMI shows that in Illinois in 2017, air pollution from burning fuels in buildings led to an estimated 1,123 early deaths and $12.574 billion in health impact costs.[2] These emissions can particularly affect children. In a meta-analysis analyzing the connections between gas stoves and childhood asthma, children in homes with gas stoves were 42% more likely to experience asthma symptoms, and 32% more likely to be diagnosed with asthma. [3] Therefore, ensuring all-electric appliances can be installed in our buildings in the future is critical to reducing air pollution, protecting public health, reducing utility and construction costs, and meeting climate goals.

NBI, ACEEE, and 2050 Partners on behalf of the California Investor Owned Utilities worked together to address many of the technical concerns raised when NBI's original proposal, CEPI-22, was discussed by the Commercial Consensus Committee in June of 2022. The main revisions to this proposal include:

1. Separating the original CEPI-22 proposal into three pieces, an electric-ready proposal, an all-electric appendix, and a requirement for more energy efficiency credits in buildings that do not primarily use heat pumps for space and water heating. Each piece stands alone with its own independent support, so each proposal can be discussed and voted on separately.
2. Requiring buildings with central water heating or space heating systems to have the electrical capacity but not conduit for a new system to ensure that unnecessary conduit is not placed in buildings that choose to install distributed and not central systems at a future date.
3. Clear electrical capacity requirements for electric-ready space and water heating based on occupancy type and climate zone to ensure that there is sufficient capacity to install efficient heat pumps for space heating and water heating without requiring full design and sizing of an all-electric alternative to a fuel-based system (though that option remains for flexibility). 2050 Partners is conducting energy modeling to determine capacity requirements. This modeling is not yet complete but will be complete before this proposal is considered by the commercial consensus committee.
4. Clear capacity requirements for commercial cooking appliances based on research conducted by NBI on the minimum branch circuits needed for a variety of commercial cooking appliances.
5. Additional flexibility that allows designers to submit an alternate design for the electrical infrastructure needed for water and space heating that would allow the building to use no energy source other than electricity or on-site renewable energy in the future.
6. Restructuring of the proposal to make it easier to understand and enforce.

Bibliography:

[1] "U.S. Energy Information Administration - EIA - Independent Statistics and Analysis." *Energy and the Environment Explained: Where Greenhouse Gases Come From*, U.S. Energy Information Administration (EIA), https://www.eia.gov/energyexplained/energy-and-the-environment/where-greenhouse-gases-come-from.php#:~:text=In%202021%2C%20petroleum%20accounted%20for,energy%2Drelated%20CO2%20emissions.

[2] *Health Air Quality Impacts of Buildings Emissions*. RMI, 5 May 2021, rmi.org/health-air-quality-impacts-of-buildings-emissions#MI.

[3] *Gas Stoves: Health and Air Quality Impacts and Solutions.* RMI, 1 Feb. 2021, rmi.org/insight/gas-stoves-pollution-health/.

[4]*Cost Study of the Building Decarbonization Code*, New Buildings Institute, Apr. 2022, https://newbuildings.org/wp-content/uploads/2022/04/BuildingDecarbCostStudy.pdf.

[5] *2021 Reach Code Cost-Effectiveness Analysis: Non-Residential Alterations*, California Energy Codes and Standards, 27 Jan. 2022, https://localenergycodes.com/.

Cost Impact:

The code change proposal will increase the cost of construction.

The code change proposal will increase the cost of construction.

Recent analysis by NBI and partners using cost data from RSMeans for a medium office indicates that additional electrical infrastructure costs for water-heating and space-heating would cost a typical office building an additional $0.09 per square foot of conditioned floor area. [4] However, if a building owner were to have to retrofit their building from using combustion equipment to natural gas equipment costs without these requirements in place, costs could be exorbitant. California Energy Codes & Standards “2021 Reach Code Cost-Effectiveness Analysis: Non-Residential Alterations” report estimated labor costs for electrification retrofit of mechanical systems as a 25 to 50% increase from new construction labor cost due to building-specific considerations such as tight conditions, prepping surfaces, elevated work, material handling, specialty rigging, and protecting existing finishes that can vary building to building. [5]

CE2D-90-23

CE2D-91-23

IECC CE: CH101.1, CH101, CH, CH101.2

Proponents:

Shannon Corcoran, representing American Gas Association (corcoransm@att.net)

2024 International Energy Code[CE Project] R3

Revise as follows:

~~CH101.1~~ ~~Intent.~~

~~The intent of this Appendix is to amend the International Energy Conservation Code to reduce future retrofit costs by requiring commercial buildings with combustion equipment to install the electrical infrastructure for electric equipment.~~

~~CH101 — GENERAL~~

~~CH~~ ~~ELECTRIC-READY COMMERCIAL BUILDING PROVISIONS~~

~~CH101 — GENERAL~~

~~CH101.1~~ ~~Intent.~~

~~The intent of this Appendix is to amend the International Energy Conservation Code to reduce future retrofit costs by requiring commercial buildings with combustion equipment to install the electrical infrastructure for electric equipment.~~

~~CH101.2~~ ~~Scope.~~

~~The provisions in this appendix are applicable to commercial buildings. New construction shall comply with Section CH103.~~

Reason Statement:

This proposed revision to include a new adoptable appendix for electric-ready commercial buildings requires electric infrastructure be added wherever gas-fired appliances are located.The International Energy Conservation Code should be fuel neutral and provide for energy savings regardless of the fuel source in the base code. The Code should not promote one energy source at the expense of other fuels, and should reflect the diversity of fuels used, home types, and consumer preferences across the US.

This proposed revision prsumes that electrification is imminent and will be the only method to decarbonize homes. It ignores future advancements in technologies, like gas heat pumps and carbon capture, and dismisses developments in renewable gas and hydrogen.

This proposed revision adds construction costs without adding energy savings for the consumer that opts to use natural gas, propane or fuel oil for space/water heating, cooking, clothes drying and decorative appliances. The original electric-ready proposal, CEP1-22 was disapproved by the consensus committee in part for its lack of economic analysis to account for the full cost of adding this infrastructure. This proposed revision similarly lacks an economic analysis to account for the cost of the infrastructure, including electric panel requirements.

AGA has a procedural objection to this proposal. Initially, it failed to meet the 2/3's majority requirement as required by ICC procedures. The following week, a motion to reconsider was made and approved. Our objection is that according to the current edition of Roberts

Rules of Order the motioner must have voted with the prevailing side. The motioner did not vote on the prevailing side, in fact, he was not present at the meeting and did not vote at all. The motion to reconsider was out of order and should not have been permitted by either the chair or ICC staff.

CECD1-28-22 requires electrical infrastructure installation for electric heat pumps for heating in all climate zones, where technology and energy savings are not yet proven. It also does not take into consideration the advent of new gas-fired heat pumps.

Additionally, there is no guarantee that a consumer will choose to convert from gas appliances to electric ones, leaving stranded assets and wasted costs if a homeowner never converts to an all-electric home.

The rationale statement for the original proposal CEP-22 stated that, “This proposal enhances customer choice by making it easy for homeowners to choose either electric or gas appliances.” If customer choice were truly one of the main reasons for this proposal, it would require that both electric and gas connections be installed at these locations.

The proposals ignore the electric grid’s current and near-future capacity to absorb the additional load that may be required for these proposals in addition to the proposed electric-vehicle charging station proposals.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The code change proposal will neither increase nor decrease the cost of onstruction based onthe 2021 code.

CE2D-91-23

CE2D-92-23

IECC CE: CH101.1, CH101.2, CH102, CH103.1.1.1, CH103.1.1.2, CH103.1.1.3, TABLE CH103.1.1, CH103.1.2.1, CH103.1.2.2, CH103.1.2.3, CH103.1.2.4, TABLE CH103.1.2, CH103.1.3.1, CH103.1.3.2, CH103.1.4.1, CH103.1.4.2

Proponents:

Diana Burk, representing New Buildings Institute (diana@newbuildings.org)

2024 International Energy Code[CE Project] R3

Revise as follows:

CH101.1 Intent.

The intent of this Appendix is to amend the International Energy Conservation Code to reduce future retrofit costs by requiring new commercial buildings and *substantial improvements* with combustion equipment to install the electrical infrastructure for electric equipment.

CH101.2 Scope.

The provisions in this appendix are applicable to commercial buildings. New ~~construction~~ commercial buildings shall comply with Section CH103. Where required by Section CG104, *substantial alterations* shall comply with Section CH103.

CH102 DEFINITIONS.

COMMERCIAL COOKING APPLIANCES. Any *appliance* used in a commercial food service establishment for heating or cooking food and which produce grease vapors, steam, fumes, smoke or odors that are required to be removed through a local exhaust ventilation system. Such *appliances* include deep fat fryers, upright broilers, griddles, broilers, steam-jacketed kettles, hot-top ranges, under-fired broilers (charbroilers), ovens, barbecues, rotisseries, and similar appliances.

CH103.1.1.1 Designated exterior locations for future electric space heating equipment.

Spaces containing combustion equipment for space heating shall be provided with designated exterior location(s) shown on the plans and of sufficient size for outdoor space heating heat pump equipment, with a chase that is sized to accommodate refrigerant lines and electrical conductors between the exterior location and the interior location of the space heating equipment, and with natural drainage for condensate from heating operation or a condensate drain located within 3 feet (914 mm) of the location of the future exterior space heating heat pump equipment.

CH103.1.1.2 Dedicated branch circuits for future electric space heating equipment.

Spaces containing combustion space heating equipment ~~with a capacity not more than 65,000 Btu/h~~ shall be provided with the following:

1.	A dedicated ~~240-volt,~~ branch circuit ~~with ampacity not less than 50~~ rated and sized in accordance with Section CH103.1.1.3.
2.	The branch circuit shall terminate within 3 feet (914 mm) of the space heating equipment and be in a location with *ready access*.
3.	Both ends of the branch circuit shall be labeled with the words “For Future Electric Space Heating Equipment” and be electrically isolated.

~~Spaces containing combustion equipment for space heating with a capacity of not less than 65,000 Btu/h shall be provided with a dedicated branch circuit rated and sized in accordance with Section CH103.1.1.3 terminating in a junction box within 3 feet (914 mm) of the location the space heating equipment in a location with *ready access*. Both ends of the branch circuit shall be labeled "For Future Electric Space Heating Equipment."~~

Exceptions:

~~1.~~	~~Where a branch circuit provides electricity to the space heating combustion equipment and is rated and sized in accordance with Section CH103.1.1.3.~~
~~2.~~1.	Where a branch circuit provides electricity to space cooling equipment and is rated and sized in accordance with Section CH103.1.1.3.
~~3.~~2.	Where future electric space heating equipment would require three-phase power and the space containing combustion equipment for space heating is provided with an electrical panel with a label stating, "For Future Electric Space Heating Equipment" and with a bus bar rated and sized in accordance with Section CH103.1.1.3.
~~4.~~3.	Buildings where the 99.6 percent design heating temperature is not lessthan 50°F (10°C)

CH103.1.1.3 Additional space heating electric infrastructure sizing.

Electric infrastructure for future electric space heating equipment shall be sized to accommodate not less than one of the following:

1.	Where a branch circuit is required by CH103.1.1.2 for spaces containing combustion space heating equipment with a capacity not more than 65,000 Btu/h, the 208/240 volt branch circuit shall be installed with an ampacity of not less than 50.
2.	An electrical capacity not less than the nameplate space heating combustion equipment heating capacity multiplied by the value in Table CH103.1.1.3 $VA_s = Q_{com} \times P_s$ Equation CH-1 VA_s = The required electrical capacity of the electrical infrastructure in volt-amps Q_{com} = The nameplate heating capacity of the combustion equipment in kBtu/h P_s = The VA per kBtu/h from Table CH103.1.1.3 in VA/kBtu/h
3.	An electrical capacity not less than the peak space heating load of the building areas served by the space heating combustion equipment, calculated in accordance with Section C403.1.1, multiplied by the value for the 99.6 percent design heating temperature in Table CH103.1.1.3 per the equation below, or $VA_s = Q_{design} \times P_s$ Equation CH-2 VA_s = The required electrical capacity of the electrical infrastructure in volt-amps Q_{design} = The 99.6 percent design heating load of the spaces served by the combustion equipment in kBtu/h P_s = The VA per kBtu/h from Table CH103.1.1.3 in VA/kBtu/h
4.	An *approved* alternate design that uses no energy source other than electricity or *on-site renewable energy*.

TABLE CH103.1.1.3 ALTERNATE ELECTRIC SPACE HEATING EQUIPMENT CONVERSION FACTORS (VA/kBtu/h)

CH103.1.2.1 ~~(NEED TITLE)~~Dedicated branch circuits for low-capacity future electric heat pump water heating equipment..

~~For each piece of~~ Spaces containing combustion equipment for water heating with an input capacity of not more than 75,000 Btu/h shall comply with the following~~, the following electrical infrastructure is required~~:

1.	An individual 208/240-volt branch circuit with an ampacity of not less than 30 shall be provided.~~ and~~
2.	The branch circuit shall terminate within ~~6 ft (2 m)~~ 3 feet (914 mm) of the *water heater* and shall be in a location with *ready access*~~ready access~~.
~~2.~~3.	The branch circuit overcurrent protection device and the termination of the branch circuit shall be labeled "For future electric water heater".
~~3.~~4.	The space for containing the future *water heater* shall include the space occupied by the combustion equipment and shall have a height of not less than 7 feet (2 m), a width of not less than 3 feet (1 m), a depth of not less than 3 feet (1 m) and with a volume of not less than 700 ft^3 (20 m^3).

Exception: Where the space containing the *water heater* is provided~~s~~ with air ducts or transfer openings for air circulation sufficient for the operation of a heat pump *water heater*, the minimum room volume shall not be required.

CH103.1.2.2 Designated locations for future electric heat pump water heating equipment.

1.	Designated exterior location(s) shown on the plans and of sufficient size for outdoor water heating heat pump equipment, with a chase that is sized to accommodate refrigerant lines between the exterior location and the interior location of the water heating equipment.
2.	An interior location with a minimum volume the greater of 700 cubic feet(2000 L) or 7 cubic feet (200 L) per 1,000 Btu/h combustion equipment water heating capacity. The interior location shall include the space occupied by the combustion equipment.
3.	An interior location with air ducts or transfer openings which provide with sufficient airflow to exhaust cool air from future water heating heat pump equipment~~provided by no less than one 16-inch(406 mm) by 24-inch (610 mm) grill to a heated space and one 8-inch (203mm) duct of no more than 10 feet (3048 mm) in length for cool exhaust air.~~

CH103.1.2.3 Dedicated branch circuits for future electric heat pump water heating equipment.

Spaces containing combustion equipment for water heating with a capacityof greater than 75,000 Btu/h shall be provided with the following:

1.	~~a~~ A dedicated branch circuit rated and sized in accordance with Section CH103.1.2.4.~~ and~~
2.	The branch circuit shall terminat~~e~~ing in a junction box within 3feet (914 mm) of the location the water heating equipment in a location with *ready access*~~ready access~~.
3.	Both ends of the branch circuit shall be labeled “For Future Electric Water Heating Equipment.”

Exception: Where future electric water heating equipment would require threephase power and the main electrical service panel has a reserved space for a bus bar rated and sized in accordance with Section CH103.1.2.4 and labeled "For Future Electric Water Heating Equipment."

CH103.1.2.4 Additional water heating electric infrastructure sizing.

Electric infrastructure water heating equipment with a capacity of greater than 75,000 Btu/hshall be sized to accommodate one of the following:

1.	An electrical capacity not less than the combustion equipment water heating capacity multiplied by the value in Table CH103.1.2.4 plus electrical capacity to serve recirculating loads as shown in the equation below. $VA_w = (Q_{capacity} \times P_w) + (Q_{recirc} \times 293\ (VA/(Btu/h))$ Equation CH-3 VA_w = The required electrical capacity of the electrical infrastructure for water heating in volt-amps $Q_{capacity}$ = The water heating capacity of the combustion equipment in kBtu/h P_w = The VA per kBtu/h from Table CH103.1.2.4 in VA/kBtu/h Q_{recirc} = The capacity required for temperature maintenance by recirculation, if applicable, in Btu/h
2.	An alternate design that complies with this code, that is approved by the authority having jurisdiction, and that uses no energy source other than electricity or *on-site renewable energy.*

TABLE CH103.1.2.4 ALTERNATE ELECTRIC WATER HEATING EQUIPMENT CONVERSION FACTORS (VA/kBtu/h)

CH103.1.3.1 Commercial cooking.

Spaces containing commercial cooking appliances shall be provided with the following:

1.	~~a~~ A dedicated branch circuit with a minimum electrical capacity in accordance with Table CH103.1.3.1 based on the appliance in the space.
2.	The branch circuit shall terminate within 3 feet (914 mm) of the appliance in a location with *ready access*~~ready access~~.
3.	Both ends of the branch circuit shall be labeled with the words "For Future Electric Cooking Equipment" and be electrically isolated.

CH103.1.3.2 All other cooking.

Spaces containing all other cooking equipment not designated as commercial cooking appliances shall be provided with the following:

1.	~~a~~A dedicated branch circuit in compliance with NFPA 70 Section 422.10.
2.	The branch circuit shall terminate within 6 feet (1829 mm) of fossil fuel ranges, cooktops and ovens and be in a location with *ready access*~~ready access~~.
3.	Both ends of the branch circuit shall be labeled with the words "For Future Electric Cooking Equipment" and be electrically isolated.

CH103.1.4.1 Commercial drying.

Spaces containing clothes drying equipment, and end-uses for commercial laundry applications shall be provided with the following:

1.	~~c~~Conduit that is continuous between a junction box located within 3 feet (914 mm) of the equipment and an electrical panel.
2.	The junction box, conduit and bus bar in the electrical panel shall be rated and sized to accommodate a branch circuit with sufficient capacity for an equivalent electric equipment with an equivalent equipment capacity.
3.	The electrical junction box and electrical panel shall be labeled with the words~~have labels stating~~, “For Future Electric Clothes Drying Equipment.”

CH103.1.4.2 Residential drying.

Spaces containing clothes drying equipment, appliances, and end-uses serving multiple dwelling units or sleeping areas with a capacity less than or equal to 9.2 cubic feet shall be provided with the following:

1.	~~a~~A dedicated 240-volt branch circuit with a minimum capacity of 30A. ~~and~~
2.	The branch circuit shall terminate within ~~6 feet (1829 mm)~~ 3 feet (914 mm) of fossil fuel clothes dryers and shall be in a location with *ready access*~~ready access~~.
3.	Both ends of the branch circuit shall be labeled with the words “For Future Electric Clothes Drying Equipment” and be electrically isolated.

Reason Statement:

This proposal is intended to ensure the language in Appendix CH is both clear and enforceable. This proposal includes the following:

- The proposal clarifies that the appendix applies to new buildings unless otherwise specified by a revision proposed by NBI to the all-electric appendix where it would also apply to substantial alterations.
- This proposal clarifies that both 208V or 240V branch circuits meet branch circuit requirements because commercial buildings can operate on either 208V or 240V.
- This proposal clarifies that the branch circuit should terminate 3 feet from the combustion equipment which is consistent with Addendum ac to ASHRAE 189.1.
- This proposal lists requirements instead of leaving them in paragraph form to improve clarity.
- This proposal clarifies the branch circuit requirements for low capacity space heating equipment.
- This proposal renumbers tables so that they are located in the correct section of the code.
- This proposal ensures consistency with airflow requirements for heat pump water heaters internally and with Addendum ac to ASHRAE 189.1

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This proposal simply clarifies the requirements in Appendix CH and does not affect the cost of construction.

CE2D-92-23

CE2D-93-23

IECC CE: CH

Proponents:

Kevin Duell, representing NW Natural (kevin.duell@nwnatural.com)

2024 International Energy Code[CE Project] R3

Delete without substitution:

~~CH ELECTRIC-READY COMMERCIAL BUILDING PROVISIONS~~

Reason Statement:

This proposal assumes that electrification is the only path to decarbonization – in every jurisdiction, every climate zone, every electrical sub-grid – regardless of the electrical generation source and related emissions.

It also effectively forecloses on gaseous technologies – like gas heat pumps currently available on the market, carbon capture, renewable gas, and hydrogen – because it imposes a cost on those technologies before they are installed.

It does this by increasing construction costs for gas infrastructure – but without providing any energy savings. Surely that does not pass the cost-effectiveness test. The proposal comes short in its economic analysis – its does not include all the costs for the electric infrastructure it requires, including electrical panels.

This proposal intends to economically pressure builders and owners who want to use gas technologies into using all-electric technologies. That seems like a violation of the Energy Policy and Conservation on Act given the recent *Berkeley* ruling. So, a jurisdiction that adopts this section would be opening itself to similar litigation. For those builders and owners who are committed to gas technologies, there's no guarantee that they will ever use the electrical infrastructure that this proposal requires, leading to stranded assets.

For these reasons, please delete the changes added from CECD1-28-22.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The cost of construction, especially for commercial buildings, varies widely. The original proposal may or may not change the cost of construction, as does this proposed revision.

CE2D-93-23

CE2D-94-23

IECC CE: CH, CH101, CH101.1, CH101.2, CH102, CH103, CH103.1, CH103.1.1, TABLE CH103.1.1, CH103.1.1.1, CH103.1.1.2, CH103.1.1.3, CH103.1.2, TABLE CH103.1.2, CH103.1.2.1, CH103.1.2.2, CH103.1.2.3, CH103.1.2.4, CH103.1.3, CH103.1.3.1, TABLE CH103.1.3.1, CH103.1.3.2, CH103.1.4, CH103.1.4.1, CH103.1.4.2, CH103.1.5, CH103.2, CH103.3

Proponents:

Renee Lani, representing American Public Gas Association (rlani@apga.org)

2024 International Energy Code[CE Project] R3

Revise as follows:

~~CH ELECTRIC-READY COMMERCIAL BUILDING PROVISIONS~~

~~CH101 — GENERAL~~

Delete without substitution:

~~CH101.1 Intent.~~

~~The intent of this Appendix is to amend the International Energy Conservation Code to reduce future retrofit costs by requiring commercial buildings with combustion equipment to install the electrical infrastructure for electric equipment.~~

~~CH101.2 Scope.~~

~~The provisions in this appendix are applicable to commercial buildings. New construction shall comply with Section CH103.~~

~~CH ELECTRIC-READY COMMERCIAL BUILDING PROVISIONS~~

~~CH102 DEFINITIONS.~~

~~APPLIANCE. A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.~~
~~COMBUSTION EQUIPMENT. Any equipment or appliance used for space heating, *service water heating*, cooking, clothes drying or lighting that uses a fossil fuel.~~
~~COMMERCIAL COOKING APPLIANCES. used in a commercial food service establishment for heating or cooking food and which produce grease vapors, steam, fumes, smoke or odors that are required to be removed through a local exhaust ventilation system. Such *appliances* include deep fat fryers, upright broilers, griddles, broilers, steam-jacketed kettles, hot-top ranges, under-fired broilers (charbroilers), ovens, barbecues, rotisseries, and similar appliances.~~

~~CH ELECTRIC-READY COMMERCIAL BUILDING PROVISIONS~~

~~CH103 — NEW COMMERCIAL BUILDING~~

~~CH103.1 Additional electric infrastructure.~~

~~Electric infrastructure in buildings that contain combustion equipment shall be installed in accordance with this section.~~

~~CH103.1.1 Combustion space heating.~~

~~Spaces containing combustion equipment for space heating shall comply with Sections CH103.1.1.1, CH103.1.1.2 and CH103.1.1.3.~~

TABLE CH103.1.1 ALTERNATE ELECTRIC SPACE HEATING EQUIPMENT CONVERSION FACTORS (VA/kBtu/h)

Delete without substitution:

~~CH103.1.1.1 Designated exterior locations for future electric space heating equipment~~.

~~Spaces containing combustion equipment for space heating shall be provided with designated exterior location(s) shown on the plans and of sufficient size for outdoor space heating heat pump equipment, with a chase that is sized to accommodate refrigerant lines between the exterior location and the interior location of the space heating equipment, and with natural drainage for condensate from heating operation or a condensate drain located within 3 feet (914 mm) of the location of the future exterior space heating heat pump equipment.~~

~~CH103.1.1.2 Dedicated branch circuits for future electric space heating equipment~~.

~~Spaces containing combustion space heating equipment with a capacity not more than 65,000 Btu/h shall be provided with a dedicated 240-volt, branch circuit with ampacity of not less than 50. The branch circuit shall terminate within 6 feet (1829 mm) of the space heating equipment and be in a location with ready access. Both ends of the branch circuit shall be labeled with the words "For Future Electric Space Heating Equipment" and be electrically isolated. Spaces containing combustion equipment for space heating with a capacity of not less than 65,000 Btu/h shall be provided with a dedicated branch circuit rated and sized in accordance with Section CH103.1.1.3, and terminating in a junction box within 3 feet (914 mm) of the location the space heating equipment in a location with ready access. Both ends of the branch circuit shall be labeled "For Future Electric Space Heating Equipment."~~

~~**Exceptions:**~~

1.	Where a branch circuit provides electricity to the space heating combustionequipment and is rated and sized in accordance with Section CH103.1.1.3
2.	Where a branch circuit provides electricity to space cooling equipment andis rated and sized in accordance with Section CH103.1.1.3.
3.	Where future electric space heating equipment would require three-phase power and the space containing combustion equipment for space heating is provided with an electrical panel with a label stating, "For Future Electric Space Heating Equipment" and with a bus bar rated and sized in accordance with Section CH103.1.1.3.
4.	Buildings where the 99.6 percent design heating temperature is not lessthan 50°F (10°C)

~~CH103.1.1.3 Additional space heating electric infrastructure sizing~~.

~~Electric infrastructure for future electric space heating equipment shall be sized toaccommodate not less than one of the following:~~

1.	An electrical capacity not less than the nameplate space heating combustionequipment heating capacity multiplied by the value in Table CH103.1.1 $$VA_s = Q_{com} \text{ x } P_s$$ Equation CH-1 VA_s = The required electrical capacity of the electrical infrastructure in volt-amps Q_{com} = The nameplate heating capacity of the combustion equipment in kBtu/h P_s = The VA per kBtu/h from Table CH103.1 in VA/kBtu/h
2.	An electrical capacity not less than the peak space heating load of the buildingareas served by the space heating combustion equipment, calculated inaccordance with Section C403.1.1, multiplied by the value for the 99.6 percentdesign heating temperature in Table CH103.1.1 per the equation below, or $$VA_s = Q_{design} \text{ x } P_s$$ Equation CH-2 VA_s = The required electrical capacity of the electrical infrastructure in volt-amps Q_{design} = The 99.6 percent design heating load of the spaces served by thecombustion equipment in kBtu/h P_s = The VA per kBtu/h from Table CH103.1.1 in VA/kBtu/h
3.	An *approved* alternate design that uses no energy source other than electricity or *on-site renewable energy*.

~~CH103.1.2 Combustion service water heating~~.

~~Spaces containing combustion equipment for service water heating shall comply with Sections CH103.1.2.1, CH103.1.2.2 and CH103.1.2.3.~~

~~TABLE CH103.1.2 ALTERNATE ELECTRIC WATER HEATING EQUIPMENT CONVERSION FACTORS (VA/kBtu/h)~~

~~CH103.1.2.1 (NEED TITLE)~~.

~~For each piece of combustion equipment for water heating with an input capacity of not more than 75,000 Btu/h, the following electrical infrastructure is required:~~

1.	An individual 240-volt branch circuit with an ampacity of not less than 30 shall be provided and terminate within 6 ft (2 m) of the *water heater* and shall be in a location with ready access.
2.	The branch circuit overcurrent protection device and the termination of the branch circuit shall be labeled "For future electric water heater".
3.	The space for containing the future *water heater* shall include the space occupied by the combustion equipment and shall have a height of not less than 7 ft (2 m), a width of not less than 3 ft (1 m), a depth of not less than 3ft (1 m) and with a volume of not less than 700 ft^3 (20 m^3).

~~**Exception:** Where the space containing the *water heater* is provides for air circulation sufficient for the operation of a heat pump *water heater*, the minimum room volume shall not be required.~~

~~CH103.1.2.2 Designated locations for future electric heat pump water heating equipment~~.

~~1.Designated exterior location(s) shown on the plans and of sufficient size for outdoor water heating heat pump equipment, with a chase that is sized to accommodate refrigerant lines between the exterior location and the interior location of the water heating equipment. 2.An interior location with a minimum volume the greater of 700 cubic feet(2000 L) or 7 cubic feet (200 L) per 1,000 Btu/h combustion equipment water heating capacity. The interior location shall include the space occupied by the combustion equipment. 3.An interior location with sufficient airflow to exhaust cool air from future water heating heat pump equipment provided by no less than one 16-inch(406 mm) by 24-inch (610 mm) grill to a heated space and one 8-inch (203mm) duct of no more than 10 feet (3048 mm) in length for cool exhaust air.~~

~~CH103.1.2.3 Dedicated branch circuits for future electric heat pump water heating equipment~~.

~~Spaces containing combustion equipment for water heating with a capacityof greater than 75,000 Btu/h shall be provided with a dedicated branch circuit rated and sized in accordance with Section CH103.1.2.4 and terminating in a junction box within 3feet (914 mm) of the location the water heating equipment in a location with ready access. Both ends of the branch circuit shall be labeled "For Future Electric Water Heating Equipment."~~

~~**Exception:** Where future electric water heating equipment would require threephase power and the main electrical service panel has a reserved space for a bus bar rated and sized in accordance with Section CH103.1.2.4 and labeled "For Future Electric Water Heating Equipment."~~

~~CH103.1.2.4 Additional water heating electric infrastructure sizing~~.

~~Electric infrastructure water heating equipment with a capacity of greater than 75,000 Btu/hshall be sized to accommodate one of the following:~~

1.	An electrical capacity not less than the combustion equipment water heating capacity multiplied by the value in Table CH103.1.2 plus electrical capacity to serve recirculating loads as shown in the equation below. $VA_w = (Q_{capacity} \text{ x } P_w) + (Q_{recirc} \text{ x } 293 \text{ (VA/(Btu/h))}$ Equation CH-3 VA_w = The required electrical capacity of the electrical infrastructure for water heating in volt-amps $Q_{capacity}$ = The water heating capacity of the combustion equipment in kBtu/h P_w = The VA per kBtu/h from Table CH103.1.2 in VA/kBtu/h Q_{recirc} = The capacity required for temperature maintenance by recirculation, if applicable, in Btu/h
2.	An alternate design that complies with this code, that is approved by the authority having jurisdiction, and that uses no energy source other than electricity or *on-site renewable energy.*

~~CH103.1.3 Combustion cooking~~.

~~Spaces containing combustion equipment for cooking shall comply with either CH103.1.3.1 or CH103.1.3.2~~

~~CH103.1.3.1 Commercial cooking~~.

~~Spaces containing commercial cooking appliances shall be provided with a dedicated branch circuit with a minimum electrical capacity in accordance with Table CH103.1.3.1 based on the appliance in the space. The branch circuit shall terminate within 3 feet (914 mm) of~~

~~the appliance in a location with ready access. Both ends of the branch circuit shall be labeled with the words "For Future Electric Cooking Equipment" and be electrically isolated.~~

~~TABLE CH103.1.3.1 COMMERCIAL COOKING MINIMUM BRANCH CIRCUIT CAPACITY~~

~~CH103.1.3.2 All other cooking.~~

~~Spaces containing all other cooking equipment not designated as commercial cooking appliances shall be provided with a dedicated branch circuit in compliance with NFPA 70 Section 422.10. The branch circuit shall terminate within 6 feet (1829 mm) of fossil fuel ranges, cooktops and ovens and be in a location with ready access. Both ends of the branch circuit shall be labeled with the words "For Future Electric Cooking Equipment" and be electrically isolated.~~

~~CH103.1.4 Combustion clothes drying.~~

~~Spaces containing combustion equipment for clothes drying shall comply with either CH103.1.4.1 or CH103.1.4.2~~

~~CH103.1.4.1 Commercial drying.~~

~~Spaces containing clothes drying equipment, and end-uses for commercial laundry applications shall be provided with conduit that is continuous between a junction box located within 3 feet (914 mm) of the equipment and an electrical panel. The junction box, conduit and bus bar in the electrical panel shall be rated and sized to accommodate a branch circuit with sufficient capacity for an equivalent electric equipment with an equivalent equipment capacity. The electrical junction box and electrical panel shall have labels stating, "For Future Electric Clothes Drying Equipment."~~

~~CH103.1.4.2 Residential drying.~~

~~Spaces containing clothes drying equipment, appliances, and end-uses serving multiple dwelling units or sleeping areas with a capacity less than or equal to 9.2 cubic feet shall be provided with a dedicated 240-volt branch circuit with a minimum capacity of 30A and shall terminate within 6 feet (1829 mm) of fossil fuel clothes dryers and shall be in a location with ready access. Both ends of the branch circuit shall be labeled with the words "For Future Electric Clothes Drying Equipment" and be electrically isolated.~~

~~CH103.1.5 On-site transformers.~~

~~Enclosed spaces and underground vaults containing onsite electric transformers on the building side of the electric utility meter shall have sufficient space to accommodate transformers sized to serve the additional electric loads identified in CH103.1.1, CH103.1.2, CH103.1.3 and CH103.1.4.~~

~~CH103.2 Hydronic heating design requirements.~~

~~For all hydronic space heating systems, the design entering water temperature for coils, radiant panels, radiant floor systems, radiators, baseboard heaters, and any other device that uses hot water to provide heat to a space shall be not more than 130°F (55°C).~~

~~CH103.3 Construction documentation.~~

~~The construction documents shall provide details for additional electric infrastructure, including branch circuits, conduit, pre-wiring, panel capacity, and electrical service capacity, as well as interior and exterior spaces designated for future electric equipment.~~

Reason Statement:

APGA appreciates the opportunity to provide IECC-C Committee this input. APGA is the national trade association for approximately 1,000 communities across the U.S. that own and operate their own retail natural gas distribution entities. They include municipal gas distribution systems, public utility districts, county districts, and other public agencies, all locally accountable to the citizens they serve. Public gas systems focus on providing safe, reliable, resilient, and affordable natural gas service to their customers. APGA members serve their communities by providing sustainable and clean energy to be used for cooking, clothes drying, and space and water heating, as well as for various commercial and industrial applications.

APGA proposes deleting the electric-ready appendix in its entirety, as, if adopted, it would neither guarantee energy use reductions nor emissions reductions, meaning it would fall outside the scope of the IECC-C. Further, the appendix greatly limits a consumer's ability to pick the energy source that best fits their needs and budgets.

The need for fuel neutrality in building codes is underscored by a recent court decision from the United States Court of Appeals for the Ninth Circuit, California Restaurant Association v. City of Berkeley (“CRA v. Berkeley”). No. 21-16278. In CRA v. Berkeley, the court found that the Energy Policy and Conservation Act (“EPCA”) (42 U.S.S. § 6297(c)) preempts the city’s building code that banned natural gas piping in new buildings. The court found that “by its plain language, EPCA preempts Berkeley’s regulation here because it prohibits the installation of necessary natural gas infrastructure on premises where covered natural gas appliances are used.” The court went on to explain that “EPCA does not permit States and localities to dodge preemption by hiding ‘energy use’ regulations in building codes.” Accordingly, any model building codes or standards that expressly prohibit natural gas piping or appliances in new or existing buildings would be a misguided approach. According to judges in the 9th Circuit, such codes or standards are expressly preempted under EPCA.APGA believes that this should also be extended to building codes and standards that create a de facto ban on such infrastructure and appliances within buildings, including, but not limited to, “electric ready” provisions that require electric outlets for appliances and necessary electrical panel capacity to be installed any time gas piping and appliances are installed (but not vice versa). Such code and standard language acts as a ban on gas piping and appliances because of the unnecessary additional costs associated with them and the high potential for stranded resources.

Removing the appendix from the IECC-C will not prohibit those builders who wish to do so from building electric-ready homes as they see fit- it simply will align with federal law, persuasive case law, and consumer choice/affordability.

Cost Impact:

The code change proposal will decrease the cost of construction.

Because unnecessary electric equipment, which may never be used and instead become a stranded cost, will not need to be installed if a fuel-fired appliance is installed, this proposal will decrease the cost of construction.

CE2D-94-23

CE2D-95-23-23 Part I

IECC CE: CG103.2.5.1

Proponents:

Aaron Phillips, representing Asphalt Roofing Manufacturers Association (aphillips@asphaltroofing.org)

2024 International Energy Code[CE Project] R3

Revise as follows:

CG103.2.5.1 Low indoor design conditions.

Space heating systems sized for spaces with indoor design conditions of not greater than 40°F (4.5°C) and intended for freeze protection, including temporary systems in unfinished spaces, shall be permitted to use electric resistance. The *building thermal envelope* ~~building envelope~~ of any such space shall be insulated in compliance with Section C402.1.

CE2D-95-23-23 Part I

CE2D-95-23-23 Part II

IECC RE: R403.9, R405.5.4.1, R405.5.4.2

Proponents:

Aaron Phillips, representing Asphalt Roofing Manufacturers Association (aphillips@asphaltroofing.org)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R403.9 Mechanical systems located outside of the building thermal envelope.

Mechanical systems providing heat outside of the <u>*building thermal envelope*</u> ~~thermal envelope~~ of a building shall comply with Sections R403.9.1 through R403.9.4.

R405.5.4.1 Compliance report for permit application.

A compliance report generated for submission with the application for building permit shall include the following:

1.	*Building* street address, or other *building* site identification.
2.	The name of the individual performing the analysis and generating the compliance report.
3.	The name and version of the compliance software tool.
4.	Documentation of all inputs entered into the software used to produce the results for the *standard reference design*and the *proposed design*.
5.	A certificate indicating that the *proposed design* complies with Section R405.3. The certificate shall document the *building* components' energy specifications that are included in the calculation including: component-level insulation R-values or U-factors; *duct system* and *building* <u>*thermal envelope*</u> ~~envelope~~ air leakage testing assumptions; and the type and rated efficiencies of proposed heating, cooling, mechanical *ventilation* and service water-heating equipment to be installed. Where *on-site renewable energy* systems will be installed, the certificate shall report the type and production size of the proposed system.
6.	Where a site-specific report is not generated, the *proposed design* shall be based on the worst-case orientation and configuration of the rated *dwelling unit*.

R405.5.4.2 Compliance report for certificate of occupancy.

A compliance report generated for submission prior to obtaining the certificate of occupancy shall include the following:

1.	*Building* street address, or other *building* site identification.
2.	Declaration of the *simulated building performance* path on the title page of the energy report and the title page of the *building* plans.
3.	A statement, bearing the name of the individual performing the analysis and generating the report, indicating that the as-built *building* complies with the requirements of Section R405.2.
4.	The name and version of the compliance software tool.
5.	A site-specific *energy analysis* report that is in compliance with the requirements of Section R405.4,where all inputs for the *proposed design* have been replaced in the simulation with confirmed energy features of the as-built *dwelling unit*.

6.	A final confirmed certificate indicating compliance based on inspection, and a statement indicating that the as-built *building* complies with Section R405.2. The certificate shall report the energy features that were confirmed to be in the *building*, including component-level insulation R-values or U-factors; results from any required *duct* system and *building* *thermal envelope* ~~envelope~~ air leakage testing; and the type and rated efficiencies of the heating, cooling, mechanical *ventilation* and service water-heating equipment installed.
7.	When *on-site renewable energy* systems have been installed, the certificate shall report the type and production size of the installed system.

Reason Statement:

Comments CED1-92-22 and RED1-185-22 corrected terminology associated with the defined term "building thermal envelope" throughout the commercial and residential provisions. This comment addresses four instances in new language that was incorporated into the 1st Public Comment Draft to maintain consistent application of the defined term.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The comment inserts a defined term to establish clear understanding of the associated provisions, which is neither intended nor expected to affect cost of construction.

CE2D-95-23-23 Part II

CEC2D-1-23

IECC CE: C403.4.6

Proponents:

Richard Lord, representing Carrier Corporation (richard.lord@carrier.com)

2024 International Energy Code[CE Project] R3

Revise as follows:

C403.4.6 Demand responsive controls.

Also add the requirements to C403.4.1.1 for thermostat dead band and setpoints. Electric heating and cooling systems shall be provided with demand responsive controls capable of executing the following actions in response to a *demand response signal*:

1.	Automatically increasing the *zone* operating cooling set point by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C), and 4°F (2°C).
2.	Automatically decreasing the *zone* operating heating set point by the following values: 1°F (0.5°C), 2°F (1°C), 3°F (1.5°C), and 4°F (2°C).

Where a *demand response signal* is not available the heating and cooling system controls shall be capable of performing all other functions. Where thermostats are controlled by direct digital control including, but not limited to, an energy management system, the system shall be capable of *demand responsive control* and capable of adjusting all thermal set-points to comply. The demand responsive controls shall comply with either Section C403.4.6.1 or Section C403.4.6.2
Exceptions:

1.	Group I occupancies
2.	Group H occupancies
3.	Controls serving *data center* systems
4.	Occupancies or applications requiring precision in indoor temperature control as *approved* by the *code official*
5.	Buildings that comply with Load Management measure G02 in Section C406.3.3
<u>6.</u>	<u>Building that have energy storage that has capacity to allow for a 25% load reduction at peak load for a period of 3 yrs</u>

C403.4.1.2 Deadband. Where used to control both heating and cooling, zone thermostatic controls shall: ~~be configured to provide a temperature range or deadband of not less than 5°F (2.8°C) within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.~~

<u>1.</u>	<u>have separate *set points* for heating and cooling, each individually adjustable,</u>
<u>2.</u>	<u>be capable of and initially configured to provide a temperature range or *dead band* between the two *set points* of not less than 5°F3°C within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum, an</u>

3.	have a minimum *dead band* of not less than 1°F 0.5°C when *set points* are adjusted.

Exceptions:

1.	Thermostats requiring manual changeover between heating and cooling modes.
2.	Occupancies or applications requiring precision in indoor temperature control as approved by the code official

C403.3.4.1.3 Set point Adjustment and Display. Where thermostatic control *set points* are capable of being adjusted by occupants or HVAC system operators, the adjustment shall be independent for the heating *set point* and the cooling *set point*; when one *set point* is changed, the other shall not change except as needed to maintain the minimum *dead band* required by Section 6.4.3.1.2. For *thermostatic controls* that display *set points*, both the heating and cooling *set points* shall be displayed simultaneously, or the *set point* of the currently active mode (heating or cooling) shall be displayed along with an indication of that mode.

C403.4.1.4 Set Point Overlap Restriction. Where heating and cooling to a zone are controlled by separate zone *thermostatic controls* located within the zone, means (such as limit switches; mechanical stops; or, for *DDC systems*, software programming) shall be provided to prevent the heating *set point* from exceeding the cooling *set point*, minus the *dead band* required by Section C403.3.4.1.

C403.4.1.5 Set Point Overlap Restriction. Where heating and cooling to a zone are controlled by separate zone *thermostatic controls* located within the zone, means (such as limit switches; mechanical stops; or, for *DDC systems*, software programming) shall be provided to prevent the heating *set point* from exceeding the cooling *set point*, minus the *dead band* required by Section C403.3.4.1

Reason:

The requirements to thru demand limiting will result in a setup of cooling to a higher temperature to turn on heat and the setback for heating operation could turn on cooling for building thermostats that have a single setpoint which we have found is commonly used in Hotels and some commercial buildings. The proposed text is pulled from a new ASHRAE 90.1 addendum

Also with electrification buildings may have cooling and heating thermal storage which could be used for demand limiting without resulting in comfort problems. We have proposed adding an exception for buildings with thermal storage.

Bibliography:

This change has been proposed for ASHRAE 90.1 and has been thru public review.

Cost Impact:

The code change proposal will increase the cost of construction.

The Capability Exists in Most Thermostats and Control Systems. Most modern controllers already have dual set points since the dead band capability has been a requirement of Standard 90.1 since 1989. And many already have displays that meet the new requirements. Direct digital control systems generally have configurable displays that can be readily modified to meet the proposed requirements. So the primary first cost impact will be to modify the displays of non-DDC (firmware) thermostats, but these are low-cost thermostats to begin with and also the thermostats that this addendum is targeting. The energy savings will more than cover the small first cost in just a few years of demand control.

RE2D-1-23

IECC RE: R101.2.1

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code [RE] [RE Project] R3

Delete without substitution:

~~R101.2.1 Appendices~~.

~~Provisions in the appendices shall not apply unless specifically adopted.~~

Reason Statement:

Appendices are non-mandatory and should not be referred to in the body of code requirements. Other comments on appendices help clarify the informative nature of IECC appendices.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The deletion is largely editorial.

RE2D-1-23

RE2D-2-23

IECC RE: R110.4

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R110.4 Administration.

The *code official* shall take action ~~without delay~~ in accordance with the decision of the board.

Reason Statement:

This change will correlate the provisions of the IECC-R with the IECC-C, which cays this: *"C110.4 Administration The code official shall take action in accordance with the decisions of the board."*

There is no reason for 'without delay.' The code official will act as necessary to comply with the intent of the appeals board; any other conclusion is misinformed about how a building department works.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This is an administrative provision with no direct financial implications.

RE2D-2-23

RE2D-3-23

IECC RE: SECTION 202

Proponents:

Emily Lorenz, representing International Institute of Building Enclosure Consultants (emilyblorenz@gmail.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

IECC2024D3RERE_RE_Ch02_SecR202_DefEMITTANCE EMITTANCE. The ratio of the radiant heat flux emitted by a specimen measured on a scale from 0 to 1, where a value of 1 indicates perfect <u>release of thermal radiation</u>~~emission~~.

Reason Statement:

When changing the definition of "emittance" during the last round of public comments, potential confusion was introduced. The word "emission" is frequently used to describe pollutants. However, in this case, we are referring to the property of a material that is related to the release of thermal radiation (or heat). The edit included in this code change proposal corrects the definition for technical accuracy related to the property of "emittance."

Bibliography:

U.S. Environmental Protection Agency. 2008. "Reducing urban heat islands: Compendium of strategies." Draft. https://www.epa.gov/heat-islands/heat-island-compendium. (see Section 2.2, Properties of Urban Materials)

VanGeem, M. G., and A. E. Fiorato. 1983. "Thermal Properties of Masonry Materials for Passive Solar Design – A State-of-the-Art Review." U.S. Department of Energy Report No. DOE/CE/30739. Also PCA R&D Serial No. 0888, Portland Cement Association. http://www.vangeemconsulting.com/SN_888_Thermal_Properties_of_Masonry_Materials_VanGeem_Fiorato.pdf

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This CCP only clarifies a definition; it does not change any requirements.

RE2D-3-23

RE2D-4-23

IECC RE: CHAPTER 2 [RE], SECTION R202

Proponents:

Rachael Mascolino, representing VEIC (rmascolino@veic.org)

2024 International Energy Code [RE] [RE Project] R3

CHAPTER 2 [RE] DEFINITIONS

SECTION R202 — GENERAL DEFINITIONS

Reason Statement:

The New Buildings Institute has proposed a revision to the residential code language that limits the qualification of biomass energy as a renewable energy source to biomass wastes and offers a definition of Biomass wastes that "excludes wood and wood-derived fuels (including black liquor), biofuel, feedstock, biodiesel, and fuel ethanol." The following is the reasoning provided by NBI in RED1-23-22, Proposal # 1071:

There is currently no definition for biomass in the residential IECC even though biomass was recently listed as a potential renewable energy resource. Because there are many flavors of biomass, it is important for the IECC to clarify which forms of biomass energy count towards reducing a residential buildings' ERI score. The revision limits the biomass sources that count as renewable energy resources to those that are specified as waste products and ensures that virgin material of unknown origin does not count as a steady source of renewable energy. Without an available standard to cite in the IECC for sustainable biomass, it is critical to ensure that biomass used in compliance with the IECC is derived from waste products or byproducts. The definition of biomass waste is taken from the glossary of the Energy Information Administration. ***A similar amendment has been approved by the commercial IECC and is included in the draft code.***

VEIC is a mission-driven sustainable energy non-profit organization with decades of real-world experience in operating energy efficiency utilities and delivering sustainable energy programs and projects across North America. Over this time, the application of advanced wood heating systems relying on locally sourced wood fuels has played a critical role in our ability to meet thermal energy savings targets, provide residential and commercial customers with cost-effective alternatives to heating with fossil fuels, and stimulating the local economies – especially in rural, cold, and forested regions of the country.

While we agree with the intent to bring clarity to the "many flavors of biomass" and certain aspects of the proposed changes, we would like to point out several critical problems with the proposed changes and the rationale for the categorical exclusion of wood and wood-derived fuels. Although there are many forms of biomass energy that have the potential for yielding significant negative impacts, there are also many forms of biomass energy that can and should be promoted. Using local wood fuels sourced from well-managed forests in high-efficiency appliances to provide reliable, cost-effective heating and to directly displace fossil heating fuels, SHOULD NOT be excluded from the standard.

The primary reason given by NBI for the exclusion of wood fuels is to "*ensure that virgin material of unknown origin does not count as a steady source of renewable energy*". There are several points to consider regarding this:

· **The reason given implies virgin (or harvested) wood is bad and not renewable.** Yet, trees regrow after a forest management-driven harvest, and periodic thinning of trees in a forest can actually stimulate growth and help improve forest health. There are many examples of wood fuels sustainably and locally sourced from well-managed forests all across North America. As just one example, in

Vermont where VEIC administers Efficiency Vermont, thousands of homes and commercial buildings are heated with wood fuels sourced from local, well-managed forests. While some wood fuels are derived as wastes from sawmills, a majority of wood fuels, (cordwood, chips, and pellets) are sourced directly from integrated timber harvests according to forest management plans and involving a professional forester. These harvests produce a range of commercial products including veneer, sawlogs, pulpwood, and fuelwood. The economic driver of the harvesting activity is the high-value sawlogs and once the sawlog portion of the tree stem is removed, wood fuels are produced using the left-over upper section of that harvested tree. This may not be considered a “waste” product by the EIA, but it is the left-over portion of the harvested stem. Also, in Vermont (and many other states and regions) forests are growing more new wood annually than is harvested.

· **The reason given implies that all (or at least a majority) of virgin wood comes from “unknown sources”. This is not accurate.** In fact, a large majority of harvested wood sold into the forest products industry (including wood fuel producers) has been tracked. Furthermore, over the past few decades there has been an increasing portion of wood harvested under third-party verification programs to document and confirm the source of the wood products. Programs such as FSC, SFI, and Tree Farm provide rigorous systems and accountability for not only the source of wood, but also the quality of the forest management.

· **The reason given implies that use of virgin wood is a questionable practice and should be discouraged in international code. By this logic, should we not cut trees for timber products and instead build homes and commercial buildings from steel and concrete?** Of course not. So, if constructing buildings from harvested wood instead of steel and concrete is widely recognized as a preferred GHG mitigation choice, why would we exclude wood fuels as a way to displace fossil heating fuel in those same buildings?

· **The proposed change may appear benign, yet there are serious unintended consequences that need to be considered.** If not for harvested wood, then what? Misalignment with state policies, waste sources competition and impacts on other markets like animal bedding are examples of unintended consequences of the proposed edits and the ripple effect of regional adoption of the code. Based on VEIC’s direct experience with industries that have biomass waste as a byproduct, we see the potential for negative impacts of this code revision on the waste biomass market driving a fuel switch from biomass back to fossil fuel for industrial customers. Use of waste products is a result of bottom line, and a waste stream market could disrupt this.

· **The proposed change will impact the most vulnerable population disproportionately.** Based on VEIC’s direct experience providing technical assistance under renewable energy grant funded projects, we see the potential for this revision to disproportionately impact rural, low income, and underfunded communities and municipalities. To effectively decarbonize existing building stock in New England, we have numerous examples of advanced wood heating systems fueled by locally sourced wood fuels as being the only environmentally responsible and sound engineering approach to decarbonization.

In summary, when wood fuels are sourced locally from well-managed forests and used in high efficiency heating application to directly displace fossil fuels, wood heating can be an excellent and vital approach to decarbonizing building energy. Wood heating simultaneously helps achieves multiple benefits – reducing fossil fuel use, increasing local energy security and reliability, retaining wealth in rural communities and regions, and supporting a working forested landscape. The proposed change to the language in the code would eliminate this as a viable strategy. We encourage the committee to not amend the code as proposed by the NBI in proposal number 1071.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

We are proposing that the definition of Renewable Energy Resources remain unchanged. There are no construction cost implications to not changing.

RE2D-5-23

IECC RE: SECTION 202

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code [RE] [RE Project] R3

IECC2024D3RERE_RE_Ch02_SecR202_DefFUEL_GAS FUEL GAS. <u>A natural gas, manufactured gas, liquified petroleum gas or a mixture of these.</u>

Reason Statement:

The ICC PMG CAC is currently developing a revision to its “fuel gas” definition for use across I-Codes to include admixtures of natural gas with up to and including 5% hydrogen. The proposed definition here does not accommodate this proposed change. Action on the definition should be deferred until the PMG CAC work is completed (November of 2023) and the definition can be harmonized.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The definition is largely editorial for the code requirements.

RE2D-5-23

RE2D-6-23

IECC RE: SECTION 202

Proponents:

Jay Crandell, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

IECC2024D3RERE_RE_Ch02_SecR202_DefALTERATION ALTERATION.
<u>Any construction, retrofit or renovation to an existing structure other than *repair* or *addition* . Also, a change in a building, electrical, gas, mechanical or plumbing system that involves an extension, addition or change to the arrangement, type or purpose of the original installation.</u>
~~construction or renovation to an *existing structure* other than a *repair* or *addition*.~~

IECC2024D3RERE_RE_Ch02_SecR202_DefREPAIR REPAIR. The reconstruction~~, replacement~~ or renewal of any part of an existing *building* for the purpose of its maintenance or to correct damage.

Reason Statement:

This proposal is errata (the underlining and strike-out restores the existing code language). Changes to the “alteration” and “repair” definitions as shown in the legislative draft and cdpACCESS were actually removed from the original RED1-264 proposal in its final amended version that the committee approved (as also recommended by the subcommittee from its deliberation on these definitions and their application in Chapter 5). This was the subject of considerable discussion at subcommittee level and changes to these definitions were not made because it creates conflicts in how these terms are coordinated with provisions in Chapter 5. For example, certain alteration requirements in Chapter 5 specifically include or address replacements. If replacements are broadly defined as a “repair” then the definitions will conflict with the provisions and cause confusion in compliance and enforcement. These definitions were purposefully designed for the IECC Chapter 5 to be different than those used in the IEBC which does not include energy efficiency provisions for existing buildings with nuances that require specifically tailored definitions for IECC Chapter 5 application. So, there are both procedural and technical reasons for restoring these definitions to their original form.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This proposal is errata so there is no cost impact. Making this correction will tend to decrease cost of enforcement and compliance simply by ensuring the definitions are restored and are not in conflict with provisions in Chapter 5 of the IECC.

RE2D-6-23

RE2D-7-23

IECC RE: SECTION 202

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

IECC2024D3RERE_RE_Ch02_SecR202_DefEXISTING_BUILDING EXISTING BUILDING. A *building,*under construction or not, at which you can point. ~~erected prior to the date of adoption of the appropriate code, or one for which a legal building permit has been issued~~.

Reason Statement:

The definition of building is more complicated than necessary. If you can point at a building, it must be a building. Wherever you go, there you are.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Editorial

RE2D-7-23

RE2D-8-23

IECC RE: SECTION 202

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

IECC2024D3RERE_RE_Ch02_SecR202_DefSUBSTANTIAL_IMPROVEMENT SUBSTANTIAL IMPROVEMENT. Any *repair*, reconstruction, rehabilitation, *alteration*, *addition* or other improvement of a *building* or structure, the cost of which equals or is more than 50 percent of the market value of the structure before the improvement. Where the structure has sustained substantial damage, as defined in the *International Building Code*, any repairs are considered *substantial improvement* regardless of the actual *repair* work performed. *Substantial improvement* does not include the following:

1. Improvement of a *building* <u>ordered by the *code official*</u> ~~required~~ to correct health, sanitary or safety code violations ~~ordered by the *code official*~~.
2. *Alteration* of a historic *building* where the *alteration* will not affect the designation as a historic *building*.

Reason Statement:

The definition of substantial improvement is substantially improved in terms of clarity.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Editorial

RE2D-8-23

RE2D-9-23

IECC RE: SECTION 202

Proponents:

Alex Smith, representing NPGA (asmith@npga.org)

2024 International Energy Code [RE] [RE Project] R3

Delete without substitution:

~~IECC2024D3RERE_RE_Ch02_SecR202_DefBALANCED_VENTILATION_SYSTEM BALANCED VENTILATION SYSTEM~~. ~~A *ventilation* system that simultaneously supplies outdoor air to and exhausts air from a space, where the mechanical supply airflow rate and the mechanical exhaust airflow rate are each within 10% of the average of the two airflow rates.~~

Reason Statement:

Balanced ventilation is a complex issue. The current definition does not take into account ventilation from range hoods, which would complicate the balancing process. This definition needs further consideration.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

No cost change

RE2D-9-23

RE2D-10-23

IECC RE: R402.1

Proponents:

Alisa McMahon, representing self (mcmahon.gbac@cox.net)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R402.1 General.

The *building thermal envelope* shall comply with the requirements of one of the following:

1.	Sections R402.1.1 through R402.1.4 and R402.1.6, or
2.	Sections R402.1.1, ~~and~~ R402.1.5, and R402.1.6

Exceptions:

1.	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 R402.	
	1.1.	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/ft^2 of floor area for space-conditioning purposes.
	1.2.	Those that do not contain *conditioned space*.
2.	Log homes designed in accordance with ICC 400.	

Reason Statement:

In the last round, R402.5.4 was relocated to R402.1.6, but the change was not reflected in R402.1.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

RE2D-10-23

RE2D-11-23

IECC RE: R402.2.3

Proponents:

Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R402.2.3 Attic knee wall.

Wood attic *knee wall* assemblies that separate *conditioned space* from unconditioned attic spaces shall comply with Table R402.1.3 for wood frame walls <u>or the proposed design R-value</u>. Steel attic *knee wall* assemblies shall comply with Section R402.2.7. Such knee walls shall have an *air barrier* between conditioned and unconditioned space <u>and if the cavity is insulated with air permeable insulation the assembly shall be sheathed on the unconditioned side.</u>

R402.2.3 Attic knee wall.

Wood attic *knee wall* assemblies that separate *conditioned space* from unconditioned attic spaces shall comply with Table R402.1.3 for wood frame walls <u>or the proposed design R-value</u>. Steel attic *knee wall* assemblies shall comply with Section R402.2.7. Such knee walls shall have an *air barrier* between conditioned and unconditioned space <u>and if the cavity is insulated with air permeable insulation the assembly shall be sheathed on the unconditioned side.</u>

Reason Statement:

While the above grade walls of a home may be framed with 2x6 walls it is not uncommon that the knee wall is framed with a 2x4 wall. The current language in section R402.2.3 was intended to be pertinent to all compliance paths, not just the prescriptive compliance path therefore language was added regarding the proposed design R-value.

Most often, because knee walls are adjacent to ventilated attic spaces they are not built like exterior walls when they should be. Section R402.2.3 requires an air barrier but the air barrier could be in the interior side of the assembly or on the exterior side. The energy code views the air barrier as an assembly and uses Table R402.5.1.1 to add supplemental air barrier's when the continuity of the primary interior or exterior air barrier of the assembly is missing. (a belts and suspenders approach). This knee wall section does not require sheathing on the exterior attic side of the assembly when air permeable insulation is installed, therefore this proposal adds this requirement.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

There is not cost impact of this proposal it merely increases clarity of the provision

RE2D-11-23

RE2D-12-23

IECC RE: R402.2.8

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R402.2.8 Floors.

Floor *insulation* shall be installed in accordance with the following:

1.	Table R402.1.2 or Table R402.1.3 and manufacturer's instructions.
2.	Floor framing members that are part of the *building thermal envelope* shall be air sealed to maintain a *continuous air barrier*.
3.	One of the following methods:
3.1.	*Cavity insulation* shall be installed to maintain permanent contact with the underside of the subfloor decking.
3.2.	Cavity insulation shall be installed to maintain contact with the top side of sheathing separating the cavity and the unconditioned space below. ~~Insulation shall extend from the bottom to the top of all perimeter floor framing members.~~
3.3.	A combination of *cavity insulation* and continuous insulation shall be installed such that the *cavity insulation* maintains contact with the top side of sheathing separating the cavity and the unconditioned space below ~~continuous insulation~~ and the continuous insulation maintains contact with the underside of the structural floor system. ~~Insulation shall extend from the bottom to the top of all perimeter floor framing members .~~
3.4.	*Continuous insulation* shall be installed to maintain contact with the underside of the structural floor system. ~~Insulation shall extend from the bottom to the top of all perimeter floor framing members.~~

Reason Statement:

1. Perimeter floor framing may or may not be part of the building thermal envelope. It is inappropriate to require the installation of insulation in locations not part of the thermal envelope.

2. Cavity insulation should not be in contact with continuous insulation, typically. It could violate thermal barrier provisions of the IBC and IRC. Note that the current language is self-contradictory - it requires continuous insulation to be in contact with both cavity insulation and the structural floor system.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Clarification; no new requirement.

RE2D-12-23

RE2D-13-23

IECC RE: R402.2.9.1, R402.2.10.2, R402.2.11.2

Proponents:

Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Code [RE] [RE Project] R3

R402.2.9.1 Basement wall insulation installation.

Where *basement walls* are insulated, the insulation shall be installed from the top of the *basement wall* down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less, or in accordance with the *proposed design* or the *rated design* , as applicable.

R402.2.10.2 Alternative slab-on-grade insulation configurations.

For buildings complying with Sections R405 or R406, slab-on-grade insulation shall be installed in accordance with the proposed design or rated design . The proposed or rated design shall use an alternative insulation configuration and associated F-factor complying with Appendix A of ASHRAE 90.1 or, where adopted, Appendix RF of this code. Where used to comply with Section R401.2.1, the F-factor shall be equal to or less than the F-factor required by Table R402.1.2 for a heated or unheated slab, as applicable.

R402.2.11.2 Alternative crawl space wall insulation configurations.

For buildings complying with Sections R405 or R406 crawl space wall insulation shall be installed in accordance with the proposed design or rated design . The proposed or rated design shall use an alternative insulation configuration and associated U-factor or C-factor complying with Appendix A of ASHRAE 90.1 or, where adopted, Appendix RF of this code. Where used to comply with Section R401.2.1, the U-factor or C-factor shall be equal to or less than the U-factor required by Table R402.1.2 for crawl space walls.

Reason Statement:

There appears to be an assumption in these three sections that the proposed design in R405 and R406 will change the way that the insulation is installed. In my experience the proposed design in the UA alternative, as well as, in R405 and R406 only reflects a change in the required R-value or U-value of an assembly not the way that it should be installed. Therefore, these sections should not exclude the installation requirements for insulation on basement walls, slab edge, and crawl space assemblies. Instead, these sections should include the ability of installations that can also be modeled as currently expressed. Unfortunately, I am not sure how to amend the language so I am just using this as an opportunity to point this issue out.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This proposal does not affect cost of construction

RE2D-13-23

RE2D-14-23

IECC RE: R402.5.1.3, TABLE R405.4.2(1)

Proponents:

Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R402.5.1.3 Maximum air leakage rate.

Where tested in accordance with Section R402.5.1.2, the air leakage rate for buildings or dwelling units shall be not greater than 3.0 air changes per hour. ~~as follows:~~

~~1.~~	~~Where complying with Section R401.2.1, the *building* or *dwelling units* in the *building* shall have an air leakage rate not greater than 4.0 air changes per hour in Climate Zones 0, 1 and 2, 3.0 air changes per hour in Climate Zones 3 through 5, and 2.5 air changes per hour in Climate Zones 6 through 8.~~
~~2.~~	~~Where complying with Section R401.2.2 or R401.2.3, the *building* or dwelling units in the *building* shall have an air leakage rate not greater than 4.0 air changes per hour, or 0.22 cfm/ft^2 (1.1 L/s x m^2) of the *building thermal envelope* area or *dwelling unit enclosure area*, as applicable.~~

Exceptions:

1.	Where *dwelling units* are attached or located in an R-2 occupancy, and are tested without simultaneously testing adjacent *dwelling units*, the air leakage rate is permitted to be not greater than 0.27 cfm/ft^2 (1.35 L/s x m^2) of the *dwelling unit enclosure area*. Where adjacent dwelling units are simultaneously tested in accordance with ASTM E779, the air leakage rate is permitted to be not greater than 0.27 cfm/ft^2 (1.35 L/s x m^2) of the *dwelling unit enclosure area* that separates *conditioned space* from the exterior.
2.	Where *buildings* have 1,500 square feet (139.4 m^2) or less of *conditioned floor area*, the air leakage rate is permitted to be not greater than 0.27 cfm/ft^2 (1.35 L/s x m^2).

TABLE R405.4.2(1) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Above-grade walls	Type: mass where the proposed wall is a mass wall; otherwise wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
	Solar reflectance = 0.25.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl	Type: same as proposed.	As proposed

space walls BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2 , with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar <u>reflectance</u> = <u>0.25</u>.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall or slab extenstion above grade: 1 foot (30 cm) Foundation wall or slab extension below grade: same as proposed Foundation wall or slab perimeter length: same as proposed Soil characteristics: same as proposed.	As proposed
	Foundation wall *U*-factor <u>and slab-on-grade </u>*F*-factor: as specified in Table R402.1.2	
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table R402.1.2 .	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (a) The proposed glazing area, where the proposed glazing area is less than 15 percent of the conditioned floor area. (b) 15 percent of the conditioned floor area, where the proposed glazing area is 15 percent or more of the conditioned floor area.	As proposed
	Orientation: equally distributed to four cardinal compass orientations (N, E, S & W).	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
	SHGC: as specified in Table R402.1.2 except for climate zones without an SHGC requirement, the SHGC shall be equal to 0.40.	As proposed
	Interior shade fraction: 0.92 – (0.21 × SHGC for the standard reference design).	Interior shade fraction: 0.92 – (0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
Air <u>leakage</u> rate	<u>For detached one-family dwellings, the</u> air leakage rate at a pressure of 0.2 inch <u>water gauge</u> (50 Pa) shall be not greater than 3.0 air changes per hour. ~~Climate Zones 0 through 2: 4.0 air changes per hour. Climate Zones 3 , 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour.~~ <u>For detached one-family dwellings that are 1,500 ft2 (139.4 m^2) or smaller and attached *dwelling units*, the *air leakage* rate at a pressure of 0.2 inch water gauge (50 Pa) shall be 0.27 cfm/ft^2 of the *dwelling unit enclosure area*.</u>	The measured air <u>leakage</u> rate.[a]
<u>Mechanical ventilation rate</u>	-	
	The mechanical ventilation rate shall be in addition to the air leakage rate and shall be the same as in the proposed design, but not greater than B x M where: B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air <u>leakage</u> rate is > = 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms.	The <u>measured</u> mechanical ventilation rate[b], <u>Q</u>, shall be in addition to the <u>measured</u> air leakage rate .

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Mechanical ventilation fan energy	The mechanical ventilation system type shall be the same as in the *proposed design*. Heat recovery or energy recovery shall be modeled for mechanical ventilation where required by Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1.Where mechanical ventilation is not specified in the *proposed design*: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (8.76 × B × M)/ef where: B and M are determined in accordance with the Mechanical Ventilation Rate row of this table. e_f = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of B × M. *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed
Internal gains	IGain, in units of Btu/day per dwelling unit, shall equal 17,900 + 23.8 × *CFA* + 4,104 × N_{br} where: *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	Same as *standard reference design*.
Internal mass	Internal mass for furniture and contents: 8 pounds per square foot of floor area.	Same as *standard reference design*, plus any additional mass specifically designed as a thermal storage element[c] but not integral to the *building thermal envelope* or structure.
Structural mass	For masonry floor slabs: 80 percent of floor area covered by R-2 carpet and pad, and 20 percent of floor directly exposed to room air.	As proposed
	For masonry basement walls: as proposed, but with insulation as specified in Table R402.1.3, located on the interior side of the walls.	As proposed
	For other walls, ceilings, floors, and interior walls: wood frame construction.	As proposed
Heating systems[d, e, j, k]	Fuel Type/Capacity: Same as proposed design	As proposed
	Product class: Same as proposed design	As proposed
	Efficiencies:	As proposed
	Heat pump: Complying with 10 CFR §430.32	As proposed
	Fuel gas and *liquid fuel* furnaces: Complying with 10 CFR §430.32	As proposed
	Fuel gas and *liquid fuel* boilers: Complying with 10 CFR §430.32	As proposed

<table>
<tr><th>Cooling systems[d, f, k]
BUILDING COMPONENT</th><th>STANDARD REFERENCE DESIGN</th><th>PROPOSED DESIGN</th></tr>
<tr><td rowspan="2"></td><td>Fuel Type: Electric
Capacity: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Efficiencies: Complying with 10 CFR §430.32</td><td>As proposed</td></tr>
<tr><td rowspan="6">Service water heating[d, g, k]</td><td>Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td><td>Use, in units of gal/day = 25.5 + (8.5 × N_{br}) × (1 – HWDS)
where:
N_{br} = number of bedrooms.
HWDS = factor for the compactness of the hot water distribution system.
<table>
<tr><th colspan="2">Compactness ratio[i] factor</th><th>HWDS</th></tr>
<tr><td>1 story</td><td>2 or more stories</td><td></td></tr>
<tr><td>> 60%</td><td>> 30%</td><td>0</td></tr>
<tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
<tr><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr>
<tr><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
</table></td></tr>
<tr><td>Fuel Type: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Rated Storage Volume: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Draw Pattern: Same as proposed design</td><td>As proposed</td></tr>
<tr><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td>As proposed</td></tr>
<tr><td>Tank Temperature: 120° F (48.9° C)</td><td>Same as standard reference design</td></tr>
<tr><td>Thermal distribution systems</td><td>Duct location:
<table>
<tr><td>Foundation Type</td><td>Slab on grade</td><td>Unconditioned crawl space</td><td>Basement or conditioned crawl space</td></tr>
</table></td><td>Duct location: as proposed[l] .</td></tr>
</table>

<table>
<tr><th>BUILDING COMPONENT</th><th colspan="4">STANDARD REFERENCE DESIGN</th><th>PROPOSED DESIGN</th></tr>
<tr><td rowspan="4"></td><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic

All other: 75% in unconditioned attic and 25% inside conditioned space</td><td>One-story building: 100% in unconditioned crawlspace

All other: 75% in unconditioned crawlspace and 25% inside conditioned space</td><td>75 % inside conditioned space

25 % unconditioned attic</td><td></td></tr>
<tr><td colspan="4">Duct insulation: in accordance with Section R403.3.1.</td><td>Duct insulation: as proposed[m] .</td></tr>
<tr><td colspan="4">Duct system leakage to outside:
For duct systems serving > 1,000ft^2 (92.9 m^2) of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.
For duct systems serving ≤ 1,000ft^2 (92.9 m^2) of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td><td>Duct System Leakage to Outside: The measured total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:
1. Where duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.
2. Where total duct system leakage is measured without the space conditioning equipment installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.</td></tr>
<tr><td colspan="4">Distribution System Efficiency (DSE): For hydronic systems and ductless systems a thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies.</td><td>Distribution System Efficiency (DSE): For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).</td></tr>
<tr><td>Thermostat</td><td colspan="4">Type: Manual, cooling temperature setpoint = 75°F;
Heating temperature setpoint = 72°F.</td><td>Same as standard reference design.</td></tr>
</table>

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Dehumidistat	Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None. Where the proposed design utilizes a mechanical ventilation system with latent heat recovery: Dehumidistat type: manual, setpoint = 60% relative humidity. Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh.	Same as *standard reference design*.

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

a.	Hourly calculations as specified in the ASHRAE *Handbook of Fundamentals,* or the equivalent, shall be used to determine the energy loads resulting from infiltration.
b.	The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE *Handbook of Fundamentals,* page 26.24 and the “Whole-house Ventilation” provisions of 2001 ASHRAE *Handbook of Fundamentals,* page 26.19 for intermittent mechanical ventilation.
c.	Thermal storage element shall mean a component that is not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element shall be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or shall be connected to such a room with pipes or ducts that allow the element to be actively charged.
d.	For a *proposed design* with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.
e.	For a *proposed design* without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the *standard reference design* and *proposed design*.
f.	For a *proposed design* without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the *standard reference design* and the *proposed design*.
g.	For a *proposed design* without a proposed water heater, the following assumptions shall be made for both the proposed design and *standard reference design*. For a proposed design with a heat pump water heater, the following assumptions shall be made for the *standard reference design*, except the fuel type shall be electric. Fuel Type: Same as the predominant heating fuel type Rated Storage Volume: 40 Gallons Draw Pattern: Medium Efficiency: Uniform Energy Factor complying with 10 CFR § 430.32

h.	For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, the following formula shall be used to determine glazing area:

AF	$= A_s \times FA \times F$
where:	
AF	= Total glazing area.
A_s	= *Standard reference design* total glazing area.
FA	= (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 × below-grade boundary wall area).
F	= (above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater.
and where:	
-	Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions.
-	Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.
-	Below-grade boundary wall is any thermal boundary wall in soil contact.
-	Common wall area is the area of walls shared with an adjoining dwelling unit.

i.	The factor for the compactness of the hot water distribution system is the ratio of the area of the rectangle that bounds the source of hot water and the fixtures that it serves (the “hot water rectangle”) divided by the floor area of the dwelling. 1. Sources of hot water include water heaters, or in multiple-family buildings with central water heating systems, circulation loops or electric heat traced pipes. 2. The hot water rectangle shall include the source of hot water and the points of termination of all hot water fixture supply piping. 3. The hot water rectangle shall be shown on the floor plans and the area shall be computed to the nearest square foot. 4. Where there is more than one water heater and each water heater serves different plumbing fixtures and appliances, it is permissible to establish a separate hot water rectangle for each hot water distribution system and add the area of these rectangles together to determine the compactness ratio. 5. The basement or attic shall be counted as a story when it contains the water heater. 6. Compliance shall be demonstrated by providing a drawing on the plans that shows the hot water distribution system rectangle(s), comparing the area of the rectangle(s) to the area of the dwelling and identifying the appropriate compactness ratio and *HWDS* factor.
j.	For a *proposed design* with electric resistance heating, a split system heat pump complying with 10 CFR §430.32 (2021) shall be assumed modeled in the *standard reference design*.
k.	For heating systems, cooling systems, or water heating systems not included in Table R405.4.2(1), the *standard reference design* shall be the same as *proposed design*.
l.	Only sections of *ductwork* that are installed in accordance with Items 1 or 2 of Section R403.3.4, are assumed to be located completely inside *conditioned space*. All other sections of *ductwork* are not assumed to be located completely inside *conditioned space*.
m.	Sections of *ductwork* installed in accordance with Section R403.3.5.1, are assumed to have an effective duct insulation R-value of R-25.

Reason Statement:

Regardless of the climate zone, the single most important aspect of energy efficiency, healthy homes, and the long-term durability of homes it to have control and predictability of the air flow. Regardless of the climate zone, air carries more energy and moisture than leaves the house via conduction or diffusion. Regardless of the climate zone, air in equals air out, and air out equals air in and the tighter the buildings thermal envelope the more control homeowners have over the money that have spent to condition their home. Regardless of the climate zone, building science describes the physics of how the house operates. Regardless of the climate zone, builders are building tighter homes then they ever have.

In 2012 the IECC did not give builders a transition period in Climate zones 3 through 8 to move from seven or greater air changes per hour to 3 air changes per hour. Builders learned how to create tight repeatable building envelopes. This proposal only increases the air leakage requirement in climate zones 0 through 2, but in this case builders in these climate zones have some experience building a tighter home; to 5 ACH50. In addition, they have the collective knowledge base of all the homes and home builders in climate zones 3 through 8.

The primary goal of this proposal it to get the nation on one air leakage rate with the realization that in the future to achieve national and regional climate action goals that that rate will have to be reduced further in order for the IECC to remain a relevant code that jurisdictions will continue to look to as a model.

In Section R405 the reference home has been moved back to 3 ACH50. This means that you have to build tighter than 3 ACH50 in order to affect a tradeoff. I believe there is a misconception with regards to tradeoffs. If builders build leakier homes, they will have to execute a tradeoff by adding more insulation or better windows to the building. This simply is not cost effective and is not how tradeoffs are being used. The one exception to this is if a home does not follow Table R405.2.1.1 and it is not inspected well, and the home achieves an 3.5 ACH50. A builder could possibly add more attic insulation or foundation insulation in the 11 hour in order to receive the C.O. The reality, however, is that the levels of insulation used in the R405 reference home would make the ability to add more insulation difficult is not impossible. Therefore better construction would be promoted throughout the country by having one standard air leakage rate.

Cost Impact:

The code change proposal will increase the cost of construction.

In climate zones 0-2 the cost of construction would increase but in climate zones 3-8 it would not.

RE2D-14-23

RE2D-15-23

IECC RE: SECTION 202, R403.3.4, R403.3.7, TABLE R403.3.8, TABLE R405.4.2(1), R408.2.4

Proponents:

Mike Moore, representing Broan-NuTone (mmoore@statorllc.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

IECC2024D3RERE_RE_Ch02_SecR202_DefDUCT_SYSTEM DUCT SYSTEM. A system that consists of <u>*forced-air*</u> *space conditioning equipment, ductwork*, and includes any apparatus installed in connection therewith.

IECC2024D3RERE_RE_Ch02_SecR202_DefDUCTWORK DUCTWORK. The assemblies of connected *ducts, plenums*, boots, fittings, *dampers*, supply registers, return grilles, and filter grilles through whichair is supplied to or returned from the space to be heated, cooled, or ventilated. Supply *ductwork* delivers air to the spaces from the <u>*forced-air*</u> *space conditioning equipment*. Return *ductwork* conveys air from the spaces back to the <u>*forced-air*</u> *space conditioning equipment*. *Ventilation ductwork* conveys airto or from any space.

IECC2024D3RERE_RE_Ch02_SecR202_DefSPACE_CONDITIONING_EQUIPMENT <u>FORCED-AIR</u> SPACE CONDITIONING EQUIPMENT. The *heat exchangers, air-handling units*, filter boxes, and any apparatus installed in connection therewith used to provide <u>*forced-air*</u> *space conditioning*.

IECC2024D3RERE_RE_Ch02_SecR202_DefSPACE_CONDITIONING SPACE CONDITIONING.
~~The treatment of air so as to control the temperature, humidity, filtration or distribution of the air to meet the requirements of a conditioned space.~~ <u>Heating or cooling of a *conditioned space*.</u>

<u>**FORCED-AIR SPACE CONDITIONING**. The heating or cooling of return air.</u>

CONDITIONED SPACE. An area, room or space that is enclosed within the *building thermal envelope* and that is directly or indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate through openings with conditioned spaces, where they are separated from conditioned spaces by uninsulated walls, floors or ceilings, or where they contain uninsulated *ducts*, piping or other sources of heating or cooling.

R403.3.4 Duct systems located in conditioned space.

For duct systems to be considered inside a *conditioned space*, the <u>*forced-air*</u> *space conditioning equipment* shall be located completely on the conditioned side of the *building thermal envelope*. The *ductwork* shall comply with the following as applicable:

1.	The *ductwork* shall be located completely on the conditioned side of the *building thermal envelope*.

2.	*Ductwork* in ventilated attic spaces or unvented attics with vapor diffusion ports shall be buried within ceiling insulation in accordance with Section R403.3.5 and shall comply with the following : 2.1. The air handler is located completely within the *continuous air barrier* and within the *building thermal envelope*. 2.1 The *ductwork* leakage, as measured either by a rough-in test of the supply and return *ductwork* or a post-construction *duct system* leakage test to outside the *building thermal envelope* in accordance with Section R403.3.5, 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* served by the *duct system*. 2.2 The ceiling insulation *R*-value installed against and above the insulated *ductwork* is greater than or equal to the proposed ceiling insulation *R*-value, less the *R*-value of the insulation on the *ductwork*.
3.	*Ductwork* contained within wall or floor assemblies separating unconditioned from *conditioned space* shall comply with the following: 3.1. A *continuous air barrier* shall be installed as part of the *building* assembly between the *ductwork* and the unconditioned space. 3.2. *Ductwork* shall be installed in accordance with Section R403.3.1. **Exception:** Where the *building* assembly cavities containing *ductwork* have been air sealed in accordance with Section R402.5.1 and insulated in accordance with Item 3.3, *duct* insulation is not required. 3.3. Not less than R-10 insulation, or not less than 50 percent of the required insulation R-value specified in Table R402.1.3, whichever is greater, shall be located between the *ductwork* and the unconditioned space. 3.4 Segments of *ductwork* contained within these building assemblies shall not be considered completely inside conditioned space in Sections R405 or R406.

R403.3.7 Duct system testing.

Each duct system shall be tested for air leakage in accordance with ANSI/RESNET/ICC 380 or ASTM E1554. Total leakage shall be measured with a pressure differential of 0.1 inch water gauge (25 Pa) across the *duct system* and shall include the measured leakage from the supply and return *ductwork* . A written report of the test results shall be signed by the party conducting the test and provided to the *code official*. *Duct system* leakage testing at either rough-in or post-construction shall be permitted with or without the installation of registers or grilles. Where installed, registers and grilles shall be sealed during the test. Where registers and grilles are not installed, the face of the register boots shall be sealed during the test.

Exceptions:

1.	Testing shall not be required for *duct systems* serving *ventilation* systems that are not integrated with *duct systems* serving heating or cooling systems.

2.	Testing shall not be required where there is not more than 10 feet (3.03 m) of total *ductwork* external to the *forced-air space conditioning equipment* and both the following are met: 2.1. The *duct system* is located entirely within *conditioned space*. 2.2 The *ductwork* does not include *plenums* constructed of building cavities or gypsum board.
3.	Where the *forced-air space conditioning equipment* is not installed, testing shall be permitted. The total measured leakage of the supply and return *ductwork* shall be less than or equal to 3.0 cubic feet per minute (85 L/min) per 100 square feet (9.29 m) of *conditioned floor area*.
4.	Where tested in accordance with Section R403.3.9, testing of each *duct system* is not required.

TABLE R403.3.8 MAXIMUM TOTAL DUCT SYSTEM LEAKAGE

Portions of table not shown remain unchanged.

Duct systems serving more than 1,000 ft^2 of conditioned floor area		Duct systems serving 1,000 ft^2 or less of conditioned floor area	
cfm/100 ft^2(LPM/9.29 m^2)		cfm (LPM)	
Number of ducted returns[a]			
<3	≥3	Any	
Forced-air ~~S~~*space conditioning equipment* is not installed [b,c]	3 (85)	4 (113)	30 (850)
All components of the *duct system* are installed[c]	4 (113)	6 (170)	40 (1133)
Forced-air ~~S~~*space conditioning equipment* is not installed, but the *ductwork* is located entirely in conditioned space[c,d]	6 (170)	8 (227)	60 (1699)
All components of the *duct system* are installed and entirely located in *conditoned space* [c]	8 (227)	12 (340)	80 (2265)

a. A ducted return is a duct made of sheet metal or flexible *duct* that connects one or more return grilles to the return-side inlet of the air-handling unit. Any other method to convey air from return or transfer grille(s) to the air-handling unit does not constitute a ducted return for the purpose ofdetermining maximum total *duct system* leakage allowance.

b. Where the *forced-air space conditioning equipment* is not installed, *duct system* testing shall be permitted and shall include the measured leakage from bot hthe supply and return *ductwork*. *Duct system* testing shall not be performed if the return *ductwork* is not installed.

c. For *duct systems* to be considered inside a *conditioned space*, where the *ductwork* is located in ventilated attic spaces or unvented attics with vapor diffusion ports, *duct system* leakage to outside must comply with Item 2.1 of Section R403.3.2.

d. Prior to certificate of occupancy, where the air-handling unit is not verified as being located in *conditioned space*, the total duct system leakage must be re-tested.

TABLE R405.4.2(1) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Portions of table not shown remain unchanged.

<table>
<tr><th>BUILDING COMPONENT</th><th colspan="4">STANDARD REFERENCE DESIGN</th><th>PROPOSED DESIGN</th></tr>
<tr><td rowspan="6">Thermal distribution systems</td><td colspan="4">Duct location:</td><td rowspan="3">Duct location: as proposed[l] .</td></tr>
<tr><td>Foundation Type</td><td>Slab on grade</td><td>Unconditioned crawl space</td><td>Basement or conditioned crawl space</td></tr>
<tr><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic

All other: 75% in unconditioned attic and 25% inside conditioned space</td><td>One-story building: 100% in unconditioned crawlspace

All other: 75% in unconditioned crawlspace and 25% inside conditioned space</td><td>75 % inside conditioned space

25 % unconditioned attic</td></tr>
<tr><td colspan="4">Duct insulation: in accordance with Section R403.3.1.</td><td>Duct insulation: as proposed[m] .</td></tr>
<tr><td colspan="4">Duct system leakage to outside:
For duct systems serving > 1,000ft^2 (92.9 m^2) of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.
For duct systems serving ≤ 1,000ft^2 (92.9 m^2) of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td><td>Duct System Leakage to Outside: The measured total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:
1. Where duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.
2. Where total duct system leakage is measured without the <u>forced-air</u> space conditioning equipment installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.</td></tr>
<tr><td colspan="4">Distribution System Efficiency (DSE): For hydronic systems and ductless systems a thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies.</td><td>Distribution System Efficiency (DSE): For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).</td></tr>
</table>

R408.2.4 More efficient thermal distribution system option.

The thermal distribution system shall comply with one of the following :

1.	The ductless thermal distribution system or hydronic thermal distribution system is located completely on the conditioned side of the *building thermal envelope*.
2.	The *forced-air space conditioning* equipment is located inside conditioned space. In addition, 100 percent of the *ductwork* is located completely inside *conditioned space* as defined by item 1 and item 2 Section R403.3.4.
3.	The *forced-air space conditioning equipment* is located inside *conditioned space* and no less than 80 percent of *ductwork* is located completely inside conditioned space as defined by item 1 and item 2 of Section R403.3.4. In addition, no more than 20 percent of *ductwork* iscontained within building assemblies separating unconditioned from *conditioned space* as defined by item 3 of Section R403.3.4.
4.	Where *ductwork* is located outside *conditioned space*, the total leakage , of the *duct system* measured in accordance with R403.3.7 is one of the following:
4.1	Where the *forced-air space conditioning equipment* is installed at the time of testing, total leakage is not greater than 2.0 cubic feet per minute (0.94 L/s) per 100 square feet (9.29 m^2) of *conditioned floor area*.
4.2	Where the *forced-air space conditioning equipment* is not installed at the time of testing, total leakage is not greater than 1.75 cubic feet per minute (0.83 L/s) per 100 square feet (9.29 m^2) of *conditioned floor area*.

Reason Statement:

PCD2's proposed definition for space conditioning was derived from the IMC definition for air conditioning. This definition is too narrow, as it only applies to forced-air systems, to the exclusion of other methods of space conditioning, such as radiant heating. Instead, a workable definition of space conditioning should be derived from the IECC/IMC definition of conditioned space, an excerpt of which follows:

> CONDITIONED SPACE. An area, room or space that is enclosed within the building thermal envelope and that is directly heated or cooled or that is indirectly heated or cooled...

Starting with this, this comment proposes the following cohesive definition for space conditioning is:

> SPACE CONDITIONING. Heating or cooling of a *conditioned space.*

From here, we need a definition for *forced-air space conditioning* when we want to only address heating or cooling of a space by treating the air in that space (e.g., through the use of typical residential heat pumps, furnaces, and air conditioners). This comment proposes the following definition:

> FORCED-AIR SPACE CONDITIONING. The heating or cooling of return air.

Note that the IMC defines return air as follows: RETURN AIR. Air removed from an approved conditioned space or location and recirculated or exhausted. Based on this definition, we can understand the proposed definition of forced-air space conditioning to mean, "the heating or cooling of air removed from an approved conditioned space or location and recirculated or exhausted."

The last modification needed to the PCD2 definitions is to replace the term "space-conditioning equipment," which is only used within the IECC-R when referring to space conditioning equipment serving forced air systems, with the term, "forced-air space conditioning equipment," as follows:

FORCED-AIR SPACE CONDITIONING EQUIPMENT. The *heat exchangers*, *air-handling units*, filter boxes, and any apparatus installed in connection therewith used to provide *forced-air space conditioning*.

Replacements are then needed within the main body to align the requirements with the proposed modifications to the definitions.

These proposed modifications will better align with existing definitions in the IMC and IECC while providing more precision to assist with compliance and enforcement. The intention is for these proposed changes to apply to the IECC-R and IRC Chapter 11.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The proposal modifies definitions to provide better precision for compliance and enforcement without affecting requirements.

RE2D-15-23

RE2D-16-23

IECC RE: R403.3.4

Proponents:

Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R403.3.4 Duct systems located in conditioned space.

For duct systems to be considered inside *conditioned space,* the *space conditioning equipment* shall be located completely on the conditioned side of the *building thermal envelope* and The *ductwork* shall comply with the following as applicable:

1.	The *ductwork* shall be located completely on the conditioned side of the *building thermal envelope*.	
2.	*Ductwork* in ventilated attic spaces or unvented attics with vapor diffusion ports shall be buried within ceiling insulation in accordance with Section R403.3.5 and shall comply with the following :	
	2.1.	The air handler is located completely within the *continuous air barrier* and within the *building thermal envelope*.
	2.1	The *ductwork* leakage, as measured either by a rough-in test of the supply and return *ductwork* or a post-construction *duct system* leakage test to outside the *building thermal envelope* in accordance with Section R403.3.5, 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* served by the *duct system*.
	2.2	The ceiling insulation *R*-value installed against and above the insulated *ductwork* is greater than or equal to the proposed ceiling insulation *R*-value, less the *R*-value of the insulation on the *ductwork*.

3. *Ductwork* contained within wall or floor assemblies separating unconditioned from *conditioned space* shall comply with the following:

3.1.	A *continuous air barrier* shall be installed as part of the *building* assembly between the *ductwork* and the unconditioned space.
3.2.	*Ductwork* shall be installed in accordance with Section R403.3.1. **Exception:** Where the *building* assembly cavities containing *ductwork* have been air sealed in accordance with Section R402.5.1 and insulated in accordance with Item 3.3 (below), *duct* insulation is not required.
3.3. ~~3.4~~	Not less than R-10 insulation, or not less than 50 percent of the required insulation R-value specified in Table R402.1.3 for wall or floor assemblies, whichever is greater, shall be located between the *ductwork* and the unconditioned space. The remainder of the wall or floor cavity shall be fully insulated to surround the duct and be in complete contact with the finished interior surface. Where duct is installed through exterior walls, penetrates a top plate, and is adjacent to the exterior framing of the rim joist a minimum of R-10 insulation shall be installed between the *ductwork* and the unconditioned space. ~~Segments of duct work contained within these building assemblies shall not be considered completely inside conditioned space in Sections R405 and R406.~~

Reason Statement:

Within an energy model it is crucial to know where to locate the duct work. This is why ducts located in insulated floor and wall cavities were added to section R403.3.4 originally. We can clearly define a duct location when it is hanging above the insulation in a ventilated attic, and we can clearly define the ducts' location when it is in a floor system serving a bedroom in the middle of the house. But when the duct is within the exterior sheathing and the interior drywall it is unclear if the duct is inside or outside the building's thermal envelope. For this reason, the original proposal (I believe for the 2018 IECC) outlined installation instructions to ensure that the duct was well insulated from the exterior when installed within the codes defined assembly building thermal envelope and continuous air barrier approach. (See definitions below) Meaning that the code uses Table R402.5.1.1 to add supplemental air barrier's when the continuity of the primary interior or exterior air barrier of the assembly is missing. (a belts and suspenders approach)

BUILDING THERMAL ENVELOPE. The *basement walls, exterior walls,* floors, ceiling, roofs and any other *building* element assemblies that enclose *conditioned space* or provide a boundary between *conditioned space* and exempt or unconditioned space.

CONTINUOUS AIR BARRIER. A combination of materials and assemblies that restrict or prevent the passage of air through the *building thermal envelope.*

The rational is to ensure that primary air barrier in the wall and floor is defined at the exterior sheathing for walls and the soffit or drywall material for floor. By doing this and also ensuring a solid level of insulation is installed between the duct and outside, in this case either R10 or R15, the duct performs as if it is within the condition space.

This installation is exactly what a tradeoff is supposed to do. Install something more in one location to gain design flexibility somewhere else while keeping a balanced energy budget that is defined by the codes reference home. Since the performance backstops require the building to be 8-15% better than the 2021 reference home this trade off seems reasonable.

Cost Impact:

The code change proposal will increase the cost of construction.

This proposal does require some additional insulation within the building cavities where duct may be installed. however this section of codet is an option not a requirement and that should be considered.

RE2D-16-23

RE2D-17-23

IECC RE: R403.3.8, TABLE R403.3.8

Proponents:

Robert Schwarz, representing BUILDTank, Inc. (robby@btankinc.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R403.3.8 Duct system leakage.

The total measured duct system leakage shall not be greater than

1.	4.0 cubic feet per minute (113.3 L/min)per 100 square feet (9.29 m2) of conditioned floor area where the air handler is installed at the time of the test.
2.	Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3.0 cubic feet per minute (85 L/min) per 100 square feet (9.29 m2) of conditioned floor area.

~~the values in Table R403.3.8, based on the *conditioned floor area*, number of ducted returns, and location of the *duct* system.~~
For buildings complying with Section R405 or R406, where *duct system* leakage to outside is tested in accordance with ANSI/RESNET/ICC 380 or ASTM E1554, the leakage to outside value shall not be used for compliance with this section, but shall be permitted to be used in the calculation procedures of Section R405 and R406.

~~TABLE R403.3.8 MAXIMUM TOTAL DUCT SYSTEM LEAKAGE~~

~~Duct systems serving more than 1,000 ft^2 of conditioned floor area~~		~~Duct systems serving 1,000 ft^2 or less of conditioned floor area~~	
~~cfm/100 ft^2(LPM/9.29 m^2)~~		~~cfm (LPM)~~	
~~Number of ducted returns[a]~~			
~~<3~~	~~≥3~~	~~Any~~	
~~*Space conditioning equipment* is not installed [b,c]~~	~~3 (85)~~	~~4 (113)~~	~~30 (850)~~
~~All components of the *duct system* are installed[c]~~	~~4 (113)~~	~~6 (170)~~	~~40 (1133)~~
~~*Space conditioning equipment* is not installed, but the *ductwork* is located entirely in conditioned space[c,d]~~	~~6 (170)~~	~~8 (227)~~	~~60 (1699)~~
~~All components of the *duct system* are installed and entirely located in *conditoned space* [c]~~	~~8 (227)~~	~~12 (340)~~	~~80 (2265)~~

~~a. A ducted return is a duct made of sheet metal or flexible *duct* that connects one or more return grilles to the return-side inlet of the air-handling unit. Any other method to convey air from return or transfer grille(s) to the air-handling unit does not constitute a ducted return for the purpose ofdetermining maximum total *duct system* leakage allowance.~~

~~b. Where the *space conditioning equipment* is not installed, *duct system* testing shall be permitted and shall include the measured leakage from bot hthe supply and return *ductwork*. *Duct system* testing shall not be performed if the return *ductwork* is not installed.~~
~~c. For *duct systems* to be considered inside a *conditioned space*, where the *ductwork* is located in ventilated attic spaces or unvented attics with vapor diffusion ports, *duct system* leakage to outside must comply with Item 2.1 of Section R403.3.2.~~
~~d. Prior to certificate of occupancy, where the air-handling unit is not verified as being located in *conditioned space*, the total duct system leakage must be re-tested.~~

Reason Statement:

I appreciate all the work that went into creating the Maximum Duct system leakage Rates. However, change to the code will create significant confusion in the market place as it is too complicated. Builders and trade partners tell us all the time just tell me the rule and I can make it happen. In this case there where five rules and a possibility of 12 different results that comply.

In addition, the proposed duct leakage rates often resulted in worst performing systems than the 2021 IECC requires.

Lastly the use of the number of returns to set the leakage rate came from the EnergyStar program. EnergyStar has to balance performance and market dynamics and therefore they introduced this method to ensure participation in the program and keep participation numbers up not because they do not believe in tighter duct systems. The IECC does not have the same market dynamics and should be solely concerned with performance and energy savings.

Two simple tried and true Maximum Duct system leakage Rates are simple to communicate and, as we have been seeing, achievable in the field.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This proposal simplifies the code without adding cost

RE2D-17-23

RE2D-18-23

IECC RE: R403.7.1

Proponents:

Mike Moore, representing Broan-NuTone (mmoore@statorllc.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R403.7.1 Electric-resistance space heating.

Detached one- and two-family dwellings and townhouses in Climate Zones 4 through 8 using all-electric space heating that includes electric-resistance space heating shall limit the total installed heating capacity of all electric-resistance space heating serving the *dwelling unit* to no more than 2.0 kW, or shall install a heat pump to service ~~in~~ the largest space that is not used as a bedroom.

Reason Statement:

The initial proposal that added Section R403.7.1 in this cycle was REPI-99, which proposed to limit the capacity of electric-resistance heaters in dwelling units "using electric (resistance) zonal heating as the primary heat source." The cost-effectiveness of the measure was also based on electric-resistance space heating being the primary heat source. Following approval of REPI-99, REDI-325 was then approved to modify this section with the intention "to retain the intent of the original requirement as introduced and justified by REPI-99, but to use simpler, clearer language." However, while REPI-99 only applied to dwelling units using electric resistance zonal heating as the primary heat source, REDI-325 (and the current PCD2 language) expanded the scope of R403.7.1 to apply to dwelling units regardless of the primary heating source. A practical effect is that PCD2 will prohibit dwelling units heated with fuel fired forced-air furnaces from being able to install more than one electric resistance bathroom fan/heater within dwelling units. The capacity of such units is often in the neighborhood of 1.5 kW. Based on the rationale of REPI-99, this was not the intent, and no cost effectiveness analysis was presented to justify this scope change. Arguably, in such dwelling units, providing zoned electric resistance heating in bathrooms could support thermostat setbacks for the centrally zoned fuel fired forced air furnace while maintaining occupant comfort by optimizing the spatial and temporal aspects of heat delivery.

For these reasons, this proposal seeks to revert to the initial scope of REPI-99. This proposal is intended to apply to both the IECC-R and IRC Chapter 11.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This proposal permits more design options and therefore will not increase the cost of construction. Maintaining design options can help to decrease construction costs.

RE2D-18-23

RE2D-19-23

IECC RE: R404.6.2.1

Proponents:

Alex Smith, representing NPGA (asmith@npga.org)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R404.6.2.1 General.

A solar-ready zone shall be located on the roof of residential buildings that are oriented between 110 degrees and 270 degrees of true north or have low-slope roofs. Solar-ready zones shall comply with Sections R404.6.2.2 through R404.6.2.8.

Exceptions:

1.	A *building* with a permanently installed *on-site renewable energy* system.
2.	A *building* with a *solar-ready zone* area that is shaded for more than 70 percent of daylight hours annually.
3.	A *building* where an *approved* party certifies that the incident solar radiation available to the *building* is not suitable for a *solar-ready zone*.
4.	A *building* where an *approved* party certifies that the *solar-ready zone* area required by Section R404.6.2.3 cannot be met because of rooftop equipment, skylights, vegetative roof areas or other obstructions.
5.	A *building* that complies with Appendix RC.
6.	A *building* ~~with a renewable energy power purchase agreement with a duration of not less than 15 years from a utility or a community renewable energy facility and for not less than 80 percent of the estimated electric use of the residential occupancy portion of the building on an annual basis.~~ <u>that complies with R408.2.8 Off-site renewable energy.</u>

Reason Statement:

A direct reference to R408.2.8 seemed more appropriate than repeating the same text.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

No cost change

RE2D-19-23

RE2D-20-23

IECC RE: R404.7.1, R404.7.2, R404.7.5, R404.7.6

Proponents:

Alisa McMahon, representing self (mcmahon.gbac@cox.net)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R404.7.1 Quantity.

New one- and two-family dwellings and townhouses with a designated attached or detached garage or other onsite private parking provided adjacent to the *dwelling unit* shall be provided with one *EV-capable*, *EV-ready*, or *EVSE* space per *dwelling unit*. R-2 occupancies or allocated parking for R-2 occupancies in mixed-use buildings shall be provided with an *EV capable space*, *EV ready space*, or *EVSE spac*e for 40 percent of ~~each~~ *dwelling units* or *automobile parking spaces*, whichever is less.
Exceptions:

1.	Where the local electric distribution entity ~~has certified~~ <u>certifies</u> in writing that it is not able to provide 100 percent of the necessary distribution capacity within 2 years after the estimated ~~date of the~~ certificate of occupancy <u>date</u>. The required EV charging infrastructure shall be reduced based on the available existing electric distribution capacity.
2.	Where substantiation ~~has been~~ <u>is</u> *approved* that meeting the requirements of Section R404.7.5 will alter the local utility infrastructure design requirements on the utility side of the meter so as to increase the utility side cost to the builder or developer by more than $450.00 per *dwelling unit*.

R404.7.2 EV Capable Spaces.

Each *EV capable space* used to meet the requirements of Section R404.7.1 shall comply with all of the following:

1.	A continuous raceway or cable assembly shall be installed between ~~an enclosure or outlet located within 6 feet (1828mm) of the *EV capable space* and~~ a suitable panelboard or other onsite electrical distribution equipment <u>and an enclosure or outlet located within 6 feet (1828mm) of the *EV capable space*</u>.
2.	Installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with Section R404.7.5.
3.	The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-pole circuit breaker or set of fuses.
4.	The electrical enclosure or outlet and the electrical distribution equipment directory shall be marked: "For future electric vehicle supply equipment (EVSE)."

R404.7.5 Electrical distribution system capacity.

The branch circuits and electrical distribution system serving *each EV capable space, EV ready space* and *EVSE space* used to comply with Section R404.7.1 <u>shall</u> comply with one of the following:

1.	Sized for a calculated EV charging load of not less than 6.2 kVA per *EVSE, EV ready,* or *EV capable space*. Where a circuit is shared or managed it shall be in accordance with NFPA 70.
2.	The capacity of the electrical distribution system and each branch circuit serving multiple *EVSE spaces, EV ready spaces*, or *EV capable spaces* designed to be controlled by an energy management system in accordance with NFPA 70, shall be sized for a calculated EV charging load of not less than 2.1 kVA per space. Where an energy management system is used to control EV charging loads for the purposes of this section, it shall not be configured to turn off electrical power to *EVSE* or *EV ready spaces* used to comply with Section R404.7.1.

R404.7.6 EVSE installation.

For one- and two-family dwellings and townhouses, EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. For R-2 occupancies, EVSE shall be installed in accordance with NFPA 70 and Section R404.7.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.

Reason Statement:

Any certification from a local electric distribution entity should be current, not from the past.

In R404.7.6:

- Should the reference to Section R404.7.5.1 be R404.7.5?
- Does R404.7.5 apply to one- and two-family dwellings and townhouses as well?

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

RE2D-20-23

RE2D-21-23

IECC RE: R404.7.6

Proponents:

Daniel Carroll, representing Department of State (daniel.carroll@dos.ny.gov); Hendrik Shank, representing NYS Dept. of State (hendrikus.shank@dos.ny.gov)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R404.7.6 EVSE installation.

~~For one- and two-family dwellings and townhouses,~~ EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. ~~For R-2 occupancies, EVSE shall be installed in accordance with NFPA 70 and Section R404.7.5.1 and shall be listed and labeled in accordance with UL 2202 and UL 2594.~~

Reason Statement:

The reference to Section R404.7.5.1 for R-2 occupancies is wrong. That section does not exist. I believe it was meant to be R404.7.6.1 which required a minimum charging rate and is proposed to be deleted. If Section R404.7.6.1 is deleted, then there is no need for the extra language in Section R404.7.6. There will be no difference in the requirements for one- and two-family dwellings and townhouses and the requirements for R-2 buildings.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Editorial Change

RE2D-21-23

RE2D-22-23

IECC RE: R405.1

Proponents:

Vladimir Kochkin, representing NAHB (vkochkin@nahb.org); Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R405.1 Scope.

This section establishes criteria for compliance using simulated building performance analysis. Such analysis shall include heating, cooling, mechanical *ventilation* and service water-heating energy only. Such analysis shall be limited to *dwelling units*. Spaces other than *dwelling units* in Group R-2, R-3, or R-4 buildings shall comply with Sections R402 through R404 <u>or an *approved* equivalent</u>.

Reason Statement:

This modification adds an option for establishing an approved equivalent design for common spaces. The current provisions for common spaces specify only a single prescriptive option for use under the performance path.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This change adds an option for establishing an approved equivalent design.

RE2D-22-23

RE2D-23-23

IECC RE: R405.2

Proponents:

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

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R405.2 Simulated building performance compliance.

Compliance based on simulated building performance requires that a *building* comply with the following:

<table>
<tr><td>1.</td><td>The requirements of the sections indicated within Table R405.2.</td></tr>
<tr><td>2.</td><td>The proposed total building thermal envelope thermal conductance TC shall be less than or equal to the building thermal envelope thermal conductance TC using the prescriptive U-factors and F-factors from Table R402.1.2 multiplied by 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2 and Section R402.1.5. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.

$$\text{For Climate Zones 0-2:}\ \underline{TC}\cancel{UA}_{\text{Proposed design}} \le 1.08 \text{ x } \underline{TC}\cancel{UA}_{\text{Prescriptive reference design}}$$

$$\text{For Climate Zones 3-8:}\ \underline{TC}\cancel{UA}_{\text{Proposed design}} \le 1.15 \text{ x } \underline{TC}\cancel{UA}_{\text{Prescriptive reference design}}$$
</td></tr>
<tr><td>3.</td><td>For each dwelling unit with one or more fuel burning appliances for space heating, or water heating, or both, the annual energy cost of the dwelling unit shall be less than or equal to 80 percent of the annual energy cost of the standard reference design. For all other dwelling units, the annual energy cost of the proposed design shall be less than or equal to 85 percent of the annual energy cost of the standard reference design. For each dwelling unit with greater than 5,000 square feet (465 m^2) of living space located above grade plane, the annual energy cost of the dwelling unit shall be reduced by an additional 5 percent of annual energy cost of the standard reference design. Energy prices shall be taken from an approved source , such as the Department of Energy, Energy Information Administration’s State Energy Data System Prices and Expenditures reports. Code officials shall be permitted to require time-of-use pricing in energy cost calculations.

Exceptions:
<table>
<tr><td>1.</td><td>The energy use based on source energy expressed in Btu or Btu per square foot of conditioned floor area shall be permitted to be substituted for the energy cost. The source energy multiplier for electricity shall be taken from an approved source or shall be 2.51. The source energy multiplier for fuels other than electricity shall be taken from an approved source or shall be 1.09.</td></tr>
<tr><td>2.</td><td>The energy use based on site energy expressed in Btu or Btu per square foot of conditioned floor area shall be permitted to be substituted for the energy cost.</td></tr>
</table>
</td></tr>
</table>

Reason Statement:

This proposed language is needed for the following reasons:

-The default values are for the US only, a national average for electricity only, a national average for domestic natural gas only, and are for one historic year (2019) only. They do not account for the variations by country, region, or locality, or data from more recent years.

-The proposed language is consistent with the language used for energy costs, which rely on published data and does not show any sort of national average energy cost.

-The proposed language will provide the flexibility needed for a code official to use values that have been estimated for their city, county, locality, or region (if in the United States), or country (if outside of the US).

-The proposed language will prevent conflicts with localities or countries that have estimates that are different from the default values shown, by allowing the use of more appropriate estimates.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This only allows different estimated source energy factors to be used and will not affect the cost of construction.

RE2D-23-23

RE2D-24-23

IECC RE: R405.2

Proponents:

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

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R405.2 Simulated building performance compliance.

Compliance based on simulated building performance requires that a *building* comply with the following:

1.	The requirements of the sections indicated within Table R405.2.
2.	The proposed total *building thermal envelope* thermal conductance TC shall be less than or equal to the *building thermal envelope* thermal conductance TC using the prescriptive U-factors and F-factors from Table R402.1.2 multiplied by 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2 and Section R402.1.5. The area-weighted maximum *fenestration* SHGC permitted in Climate Zones 0 through 3 shall be 0.30. For Climate Zones 0-2: $\underline{TC}\cancel{UA}_{\text{Proposed design}} \leq 1.08 \times \underline{TC}\cancel{UA}_{\text{Prescriptive reference design}}$ For Climate Zones 3-8: $\underline{TC}\cancel{UA}_{\text{Proposed design}} \leq 1.15 \times \underline{TC}\cancel{UA}_{\text{Prescriptive reference design}}$
3.	For each *dwelling unit* with one or more fuel burning appliances for space heating, or water heating, or both, the annual *energy cost* of the *dwelling unit* shall be less than or equal to 80 percent of the annual *energy cost* of the *standard reference design*. For all other *dwelling units*, the annual *energy cost* of the *proposed design* shall be less than or equal to 85 percent of the annual *energy cost* of the *standard reference design*. For each dwelling unit with greater than 5,000 square feet (465 m^2) of *living space* located above *grade plane*, the annual *energy cost* of the *dwelling unit* shall be reduced by an additional 5 percent of annual *energy cost* of the standard reference design. Energy prices shall be taken from an *approved* source , such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. Code officials shall be permitted to require time-of-use pricing in *energy cost* calculations. **Exceptions:** 1. The energy use based on source energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the energy cost. The source energy multiplier for electricity shall be 2.51. The source energy multiplier for ~~fuels other than electricity~~ <u>natural gas</u> shall be 1.09 <u>and shall be 1.15 for propane and shall be 1.19 for fuel oil and shall be 1.30 for imported liquified natural gas</u>. 2. The energy use based on site energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the energy cost.

Reason Statement:

Based on the information provided in ASHRAE Standards 105, 189.1, and 240P, different fossil fuels have significantly different source energy factors.

This proposed change updates the language to be consistent with the estimates in other published standards.

Bibliography:

ASHRAE Standard 105-2021

ASHRAE Standard 189.1-2020 and addenda

ASHRAE 240P Advisory Public Review April 2023

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This only updates the estimated source energy factors and does not affect the cost of construction.

RE2D-24-23

RE2D-25-23

IECC RE: R405.3

Proponents:

Alisa McMahon, representing self (mcmahon.gbac@cox.net)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R405.3 Compliance documentation.

The following compliance reports, which document that the performance of the *proposed design* and as-built *dwelling unit* complies with the requirements of Section R405, shall be submitted to the *code official*.

1.	A compliance report, in accordance with Section R405.5.4.1, shall be submitted with the application for the *building* permit.
2.	~~Upon completion of the *building*, a confirmed~~ A compliance report, in accordance with Section R405.5.4.2~~, based on the confirmed condition of the *building*~~ shall be submitted ~~to the *code official*~~ before a certificate of occupancy is issued.

Reason Statement:

This section was created in the last round. The first sentence speaks only to the proposed design; it does not include the other half of the compliance documentation.

The proposed change makes clear that compliance reports apply to both the proposed design and the as-built dwelling unit (or as-built building, if preferred).

The language is consistent with the language approved in RED1-249 for R405.3.2. (In the reconciliation between RED1-249 and RECD1-8, R405.3.2 was deleted.)

The changes made to (2) are not technical. But perhaps they can be considered with the other. They make (1) and (2) parallel and remove excess words. For example, "submitted to the code official" is in the first sentence.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

RE2D-25-23

RE2D-26-23

IECC RE: R405.4.2

Proponents:

Vladimir Kochkin, representing NAHB (vkochkin@nahb.org)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R405.4.2 Residence specifications.

The *standard reference design, proposed design, and as-built dwelling unit* shall be configured and analyzed as specified by Table R405.4.2(1). Table R405.4.2(1) shall include, by reference, all notes contained in Table R402.1.2. Proposed *U*-factors and slab-on-grade *F*-factors shall be taken from Appendix RF or ANSI/ASHRAE/IES Standard 90.1 Appendix A or determined using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials.

Reason Statement:

This modification adds IECC Appendix RF to the list of compliance options.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Clarification of intent.

RE2D-26-23

RE2D-27-23

IECC RE: TABLE R405.4.2(1)

Proponents:

Theresa Weston, representing Air Barrier Association of America (ABAA) (holtweston88@gmail.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

TABLE R405.4.2(1) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Above-grade walls	Type: mass where the proposed wall is a mass wall; otherwise wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
	Solar <u>reflectance</u> = <u>0.25</u>.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2 , with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar <u>reflectance</u> = <u>0.25</u>.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
	Foundation wall or slab extenstion above grade: 1 foot (30 cm) Foundation wall or slab extension below grade: same as proposed Foundation wall or slab perimeter length: same as proposed Soil characteristics: same as proposed.	As proposed
	Foundation wall *U*-factor <u>and slab-on-grade </u>*F*-factor: as specified in Table R402.1.2	
Opaque doors	Area: 40 ft^2.	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified in Table R402.1.2 .	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (a) The proposed glazing area, where the proposed glazing area is less than 15 percent of the conditioned floor area. (b) 15 percent of the conditioned floor area, where the proposed glazing area is 15 percent or more of the conditioned floor area.	As proposed
	Orientation: equally distributed to four cardinal compass orientations (N, E, S & W).	As proposed
	U-factor: as specified in Table R402.1.2.	As proposed
	SHGC: as specified in Table R402.1.2 except for climate zones without an SHGC requirement, the SHGC shall be equal to 0.40.	As proposed
	Interior shade fraction: 0.92 – (0.21 × SHGC for the standard reference design).	Interior shade fraction: 0.92 – (0.21 × SHGC as proposed)
	External shading: none	As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
Air <u>leakage</u> rate	<u>For detached one-family dwellings, the</u> air leakage rate at a pressure of 0.2 inch <u>water gauge</u> (50 Pa) shall be Climate Zones 0 through 2: <u>4.0</u> air changes per hour. Climate Zones 3 , 4, and 5: 3.0 air changes per hour. Climate Zones 6 through 8: 2.5 air changes per hour. ~~For detached one-family dwellings that are 1,500 ft2 (139.4 m²) or smaller and attached *dwelling units*, the *air leakage* rate at a pressure of 0.2 inch water gauge (50 Pa) shall be 0.27 cfm/ft² of the *dwelling unit enclosure area*.~~	The measured air <u>leakage</u> rate.[a]
<u>Mechanical ventilation rate</u>	-	

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
	The mechanical ventilation rate shall be in addition to the air leakage rate and shall be the same as in the proposed design, but not greater than B x M where: B = 0.01 × CFA + 7.5 × (Nbr + 1), cfm. M = 1.0 where the measured air leakage rate is > = 3.0 air changes per hour at 50 Pascals, and otherwise, M = minimum (1.7, Q/B) Q = the proposed mechanical ventilation rate, cfm. CFA = conditioned floor area, ft2. Nbr = number of bedrooms.	The measured mechanical ventilation rate[b], Q, shall be in addition to the measured air leakage rate .
Mechanical ventilation fan energy	The mechanical ventilation system type shall be the same as in the *proposed design*. Heat recovery or energy recovery shall be modeled for mechanical ventilation where required by Section R403.6.1. Heat recovery or energy recovery shall not be modeled for mechanical ventilation where not required by Section R403.6.1.Where mechanical ventilation is not specified in the *proposed design*: None Where mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal (8.76 × B × M)/ef where: B and M are determined in accordance with the Mechanical Ventilation Rate row of this table. e_f = the minimum fan efficacy, as specified in Table 403.6.2, corresponding to the system type at a flow rate of B × M. *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed
Internal gains	IGain, in units of Btu/day per dwelling unit, shall equal 17,900 + 23.8 × *CFA* + 4,104 × N_{br} where: *CFA* = conditioned floor area, ft^2. N_{br} = number of bedrooms.	Same as *standard reference design*.
Internal mass	Internal mass for furniture and contents: 8 pounds per square foot of floor area.	Same as *standard reference design*, plus any additional mass specifically designed as a thermal storage element[c] but not integral to the *building thermal envelope* or structure.
Structural mass	For masonry floor slabs: 80 percent of floor area covered by R-2 carpet and pad, and 20 percent of floor directly exposed to room air.	As proposed
	For masonry basement walls: as proposed, but with insulation as specified in Table R402.1.3, located on the interior side of the walls.	As proposed
	For other walls, ceilings, floors, and interior walls: wood frame construction.	As proposed

<table>
<tr><th>BUILDING COMPONENT</th><th>STANDARD REFERENCE DESIGN</th><th colspan="3">PROPOSED DESIGN</th></tr>
<tr><td rowspan="6">Heating systems[d, e, j, k]</td><td>Fuel Type/Capacity: Same as proposed design</td><td colspan="3">As proposed</td></tr>
<tr><td>Product class: Same as proposed design</td><td colspan="3">As proposed</td></tr>
<tr><td>Efficiencies:</td><td colspan="3">As proposed</td></tr>
<tr><td>Heat pump: Complying with 10 CFR §430.32</td><td colspan="3">As proposed</td></tr>
<tr><td>Fuel gas and liquid fuel furnaces: Complying with 10 CFR §430.32</td><td colspan="3">As proposed</td></tr>
<tr><td>Fuel gas and liquid fuel boilers: Complying with 10 CFR §430.32</td><td colspan="3">As proposed</td></tr>
<tr><td rowspan="2">Cooling systems[d, f, k]</td><td>Fuel Type: Electric
Capacity: Same as proposed design</td><td colspan="3">As proposed</td></tr>
<tr><td>Efficiencies: Complying with 10 CFR §430.32</td><td colspan="3">As proposed</td></tr>
<tr><td rowspan="12">Service water heating[d, g, k]</td><td rowspan="7">Use, in units of gal/day = 25.5 + (8.5 × N_{br})
where: N_{br} = number of bedrooms.</td><td colspan="3">Use, in units of gal/day = 25.5 + (8.5 × N_{br}) × (1 – HWDS)
where:
N_{br} = number of bedrooms.
HWDS = factor for the compactness of the hot water distribution system.</td></tr>
<tr><td colspan="2">Compactness ratio[i] factor</td><td>HWDS</td></tr>
<tr><td>1 story</td><td>2 or more stories</td><td></td></tr>
<tr><td>> 60%</td><td>> 30%</td><td>0</td></tr>
<tr><td>> 30% to ≤ 60%</td><td>> 15% to ≤ 30%</td><td>0.05</td></tr>
<tr><td>> 15% to ≤ 30%</td><td>> 7.5% to ≤ 15%</td><td>0.10</td></tr>
<tr><td>< 15%</td><td>< 7.5%</td><td>0.15</td></tr>
<tr><td>Fuel Type: Same as proposed design</td><td colspan="3">As proposed</td></tr>
<tr><td>Rated Storage Volume: Same as proposed design</td><td colspan="3">As proposed</td></tr>
<tr><td>Draw Pattern: Same as proposed design</td><td colspan="3">As proposed</td></tr>
<tr><td>Efficiencies: Uniform Energy Factor complying with 10 CFR §430.32</td><td colspan="3">As proposed</td></tr>
<tr><td>Tank Temperature: 120° F (48.9° C)</td><td colspan="3">Same as standard reference design</td></tr>
<tr><td>Thermal</td><td>Duct location:</td><td colspan="3">Duct location: as proposed[l].</td></tr>
</table>

<table>
<tr><th>BUILDING COMPONENT</th><th colspan="4">STANDARD REFERENCE DESIGN</th><th>PROPOSED DESIGN</th></tr>
<tr><td>distribution systems</td><td>Foundation Type</td><td>Slab on grade</td><td>Unconditioned crawl space</td><td>Basement or conditioned crawl space</td><td></td></tr>
<tr><td></td><td>Duct location (supply and return)</td><td>One-story building: 100% in unconditioned attic

All other: 75% in unconditioned attic and 25% inside conditioned space</td><td>One-story building: 100% in unconditioned crawlspace

All other: 75% in unconditioned crawlspace and 25% inside conditioned space</td><td><u>75</u> % inside conditioned space

<u>25</u> % unconditioned attic</td><td></td></tr>
<tr><td></td><td colspan="4">Duct insulation: in accordance with Section R403.3.1.</td><td>Duct insulation: as proposed<u>m</u> .</td></tr>
<tr><td></td><td colspan="4">Duct system leakage to outside:
For duct systems serving > 1,000ft² (92.9 m²) of conditioned floor area, the duct leakage to outside rate shall be 4 cfm (113.3 L/min) per 100 ft² (9.29 m²) of conditioned floor area.
For duct systems serving ≤ 1,000ft² (92.9 m²) of conditioned floor area, the duct leakage to outside rate shall be 40 cfm (1132.7 L/min).</td><td>Duct System Leakage to Outside: The measure<u>d</u> total duct system leakage rate shall be entered into the software as the duct system leakage to outside rate.
Exceptions:
1. <u>Where</u> duct system leakage to outside is tested in accordance ANSI/ RESNET/ICC 380 or ASTM E1554, the measured value shall be permitted to be entered.
2. <u>Where</u> total duct system leakage is measured without the <u>space conditioning equipment</u> installed, the simulation value shall be 4 cfm (113.3 L/min) per 100 ft² (9.29 m²) of conditioned floor area.</td></tr>
</table>

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
	<u>Distribution System Efficiency (DSE):</u> For hydronic systems and ductless systems a thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies.	<u>Distribution System Efficiency (DSE):</u> For hydronic systems and ductless systems, DSE shall be as specified in Table R405.4.2(2).
Thermostat	Type: Manual, cooling temperature setpoint = 75°F; Heating temperature setpoint = 72°F.	Same as *standard reference design*.
Dehumidistat	Where a mechanical ventilation system with latent heat recovery is not specified in the proposed design: None. Where the proposed design utilizes a mechanical ventilation system with latent heat recovery: Dehumidistat type: manual, setpoint = 60% relative humidity. Dehumidifier: whole-dwelling with integrated energy factor = 1.77 liters/kWh.	Same as *standard reference design*.

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L, °C = (°F-32)/1.8, 1 degree = 0.79 rad.

a.	Hourly calculations as specified in the ASHRAE *Handbook of Fundamentals,* or the equivalent, shall be used to determine the energy loads resulting from infiltration.
b.	The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE *Handbook of Fundamentals,* page 26.24 and the "Whole-house Ventilation" provisions of 2001 ASHRAE *Handbook of Fundamentals,* page 26.19 for intermittent mechanical ventilation.
c.	Thermal storage element shall mean a component that is not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element shall be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or shall be connected to such a room with pipes or ducts that allow the element to be actively charged.
d.	For a *proposed design* with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.
e.	For a *proposed design* without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the *standard reference design* and *proposed design*.
f.	For a *proposed design* without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the *standard reference design* and the *proposed design*.

g.	For a *proposed design* without a proposed water heater, the following assumptions shall be made for both the proposed design and *standard reference design*. For a proposed design with a heat pump water heater, the following assumptions shall be made for the *standard reference design*, except the fuel type shall be electric. Fuel Type: Same as the predominant heating fuel type Rated Storage Volume: 40 Gallons Draw Pattern: Medium Efficiency: Uniform Energy Factor complying with 10 CFR § 430.32
h.	For residences with conditioned basements, R-2 and R-4 residences, and for townhouse units, the following formula shall be used to determine glazing area:

AF	= $A_s \times FA \times F$
where:	
AF	= Total glazing area.
A_S	= *Standard reference design* total glazing area.
FA	= (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 × below-grade boundary wall area).
F	= (above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater.
and where:	
-	Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions.
-	Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.
-	Below-grade boundary wall is any thermal boundary wall in soil contact.
-	Common wall area is the area of walls shared with an adjoining dwelling unit.

<table>
<tr><td>i.</td><td>The factor for the compactness of the hot water distribution system is the ratio of the area of the rectangle that bounds the source of hot water and the fixtures that it serves (the “hot water rectangle”) divided by the floor area of the dwelling.
<table>
<tr><td>1.</td><td>Sources of hot water include water heaters, or in multiple-family buildings with central water heating systems, circulation loops or electric heat traced pipes.</td></tr>
<tr><td>2.</td><td>The hot water rectangle shall include the source of hot water and the points of termination of all hot water fixture supply piping.</td></tr>
<tr><td>3.</td><td>The hot water rectangle shall be shown on the floor plans and the area shall be computed to the nearest square foot.</td></tr>
<tr><td>4.</td><td>Where there is more than one water heater and each water heater serves different plumbing fixtures and appliances, it is permissible to establish a separate hot water rectangle for each hot water distribution system and add the area of these rectangles together to determine the compactness ratio.</td></tr>
<tr><td>5.</td><td>The basement or attic shall be counted as a story when it contains the water heater.</td></tr>
<tr><td>6.</td><td>Compliance shall be demonstrated by providing a drawing on the plans that shows the hot water distribution system rectangle(s), comparing the area of the rectangle(s) to the area of the dwelling and identifying the appropriate compactness ratio and HWDS factor.</td></tr>
</table></td></tr>
<tr><td>j.</td><td>For a proposed design with electric resistance heating, a split system heat pump complying with 10 CFR §430.32 (2021) shall be assumed modeled in the standard reference design.</td></tr>
<tr><td>k.</td><td>For heating systems, cooling systems, or water heating systems not included in Table R405.4.2(1), the standard reference design shall be the same as proposed design.</td></tr>
<tr><td>l.</td><td>Only sections of ductwork that are installed in accordance with Items 1 or 2 of Section R403.3.4, are assumed to be located completely inside conditioned space. All other sections of ductwork are not assumed to be located completely inside conditioned space.</td></tr>
<tr><td>m.</td><td>Sections of ductwork installed in accordance with Section R403.3.5.1, are assumed to have an effective duct insulation R-value of R-25.</td></tr>
</table>

Reason Statement:

This proposal removes the separate air leakage requirement for dwelling units < 1500 sq ft. in the standard reference design. The exception for dwelling units < 1500 sq ft is already applied to the maximum air leakage rate for these buildings under R402.5.1.3 and to apply it to the standard reference design in addition would be a duplicate application.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This is basically a clarification of the application of an exception. The original proposal in which this was added had a stated cost impact of to 'not either increase or decrease the cost of construction".

RE2D-28-23

IECC RE: R405.5.2

Proponents:

Shane Hoeper, representing SEHPCAC

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R405.5.2 Testing required by software vendors.

Prior to approval, software tools shall be tested by the software vendor in accordance with ANSI/ASHRAE Standard 140 Class II, Tier 1 test procedures. During testing, hidden inputs that are not normally ~~accessible~~ <u>available</u> to the user shall be permitted to avoid introducing source code changes strictly used for testing. Software vendors shall publish, on a publicly available website, the following ANSI/ASHRAE Standard 140 test results, input files, and modeler reports for each tested version of a software tool:

1.	Test results demonstrating the software tool was tested in accordance with ANSI/ASHRAE Standard 140.
2.	The modeler report in ANSI/ASHRAE Standard 140, Annex A2, Attachment A2.7.

Reason Statement:

Because the term 'accessible' is most commonly understood as requiring access for persons with disabilities we are making the changes to delete the word accessible from the remaining codes and replace it with other words, defined terms or phrases that are not attributed to requiring access for the physically disabled. Many of the codes use the defined term 'access (to)' or 'ready access (to)' for access by maintenance and service personnel or fire departments. This proposal provides clarity and consistency in the remaining codes where those coordination modifications missed or came in as part of new code changes.

This a correlation piece for proposals over the last couple of cycles. This effort was started by the CACs in 2015/16 code change cycle, and continued in 2018/19. This proposal is to provide coordination with the action taken with -P84-15, M2-15, RB2-16, F12-16, CE137-16 Part 1, CE29-19 Part 1 and 2 . G1-21 Part 1 was disapproved; however Part 2 through 7 were approved

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Editorial. Will not change the cost of construction.

RE2D-28-23

RE2D-29-23

IECC RE: TABLE R406.5, RG101.1, RG101.2, TABLE RG101.2, RI103.1.2, TABLE RI103.1.2, RI103.1.3

Proponents:

Jay Crandell, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

TABLE R406.5 MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX NOT INCLUDING OPP	ENERGY RATING INDEX WITH OPP
0-1	51	27~~35~~
2	51	26 ~~34~~
3	50	24 ~~33~~
4	53	32 ~~40~~
5	54	37 ~~43~~
6	53	39 ~~43~~
7	52	43 ~~46~~
8	52	43 ~~46~~

RG101.1 SIMULATED BUILDING PERFORMANCE COMPLIANCE.

Compliance based on simulated building performance requires that a building comply with of the following:

1.	The requirements of the sections indicated within Table R405.2. 2.The proposed total building thermal envelope thermal conductance TC, shall be less than or equal to the building thermal envelope thermal conductance TC using the prescriptive U-factors and F-factors from Table R402.1.2 multiplied by 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2 and Section R402.1.5. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.
2.	The proposed total *building thermal envelope* thermal conductance TC, shall be less than or equal to the *building thermal envelope* thermal conductance TC using the prescriptive U-factors and F-factors from Table R402.1.2 in accordance with Section R402.1.5. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.
3.	For each *dwelling unit* with one or more fuel burning *appliances* for space heating or water heating, or both, the annual *energy cost* of the *dwelling unit* shall be less than or equal to 70 percent of the annual *energy cost* of the *standard reference design*. For all other *dwelling units*, the annual *energy cost* of the *dwelling unit* shall be less than or equal to 75 percent of the annual *energy cost* of the *standard reference design*. For each *dwelling unit* with greater than 5,000 square feet (465 m2) of *living space* located above *grade plane*, the annual *energy cost* of the *dwelling unit* shall be reduced by an additional 5 percent of annual *energy cost* of the *standard reference design*. Energy prices shall be taken from an *approved* source, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. *Code officials* shall be permitted to require time-of-use pricing in *energy cost* calculations.

Exceptions:

1.	The energy use based on source energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the *energy cost*. The source energy multipliers for electricity shall be 2.51. The source energy multiplier for fuels other than electricity shall be 1.09.
2.	The energy use based on site energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the *energy cost*.

RG101.2 ERI-based compliance.

Compliance based on an ERI analysis requires that the rated design and each confirmed as-built dwelling unit be shown to have an ERI less than or equal to ~~the applicable~~ both values indicated in Table RG101.2 ~~R406.5 where compared to the ERI reference design as follows:~~

~~1.~~	~~Where on-site renewables are not installed, the maximum ENERGY RATING INDEX NOT INCLUDING OPP applies.~~
~~2.~~	~~Where on-site renewables are installed, the maximum ENERGY RATING INDEX INCLUDING OPP applies.~~

Exception~~s~~:

~~1.~~	~~Where the ERI analysis excludes OPP, the maximum ENERGY RATING INDEX NOT INCLUDING OPP shall be permitted.~~
~~2.~~	For *buildings* with twenty or more *dwelling units*, where *approved* by the *code official*, compliance shall be permitted using the Average Dwelling Unit Energy Rating Index, as calculated in accordance with ANSI/RESNET/ICC 301.

TABLE RG101.2 MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX NOT INCLUDING OPP	ENERGY RATING INDEX WITH OPP
0-1	46	19 ~~27~~
2	46	18 ~~26~~
3	45	15 ~~24~~
4	48	25 ~~32~~
5	49	32 ~~37~~
6	48	35 ~~39~~
7	47	40 ~~43~~
8	47	40 ~~43~~

RI103.1.2 ERI With OPP Requirements.

Where compliance is demonstrated in accordance with Section R406.5 using the Energy Rating Index With OPP, a project shall comply with the requirements of this Appendix if the rated proposed design and confirmed built dwelling are shown to have an ERI less than or equal to the values in Table RI103.1.2 ~~RP103.1.2~~.

TABLE RI103.1.2 MAXIMUM ENERGY RATING INDEX INCLUDING OPP

CLIMATE ZONE	ENERGY RATING INDEX WITH OPP
0-1	27 ~~35~~
2	26 ~~34~~
3	24 ~~33~~
4	32 ~~40~~
5	37 ~~43~~
6	39 ~~43~~
7 & 8	43 ~~46~~

~~RI103.1.3 ERI With OPP Requirements~~.

~~Where compliance is demonstrated in accordance with Section N1106.5 using the Energy Rating Index With OPP, a project shall comply with the requirements of this Appendix if the rated proposed design and confirmed built dwelling are shown to have an ERI less than or equal to the values in Table RI103.1.3.~~

Reason Statement:

The current values for ERI w/OPP are based on a meager 2kW PV installation for Section R406.5 ERI compliance. Today, the average PV installation on homes is a ~6 kW system, partly because mobilization costs and wiring costs are the same and, therefore, it makes sense to maximize output and return on investment. A typical minimum installation is a 4 kW PV system. This proposal for Table R406.5 is based on values for a smaller 3kW system which is at least closer to the current minimum practice and will avoid creating a situation where renewable power production benefits of PV for typical-sized systems may be used instead to trade-off other measures resulting in increased energy consumption and lower efficiency of the building through the ERI compliance path. This proposal will reduce the conflict caused by using energy production resources (which may not be replaced at end of life or maintained by home-owners) in a way that degrades the efficient use of energy resources (renewable and non-renewable) and diminishes the long-standing energy conservation intent of the code.

The proposed change to Table R406.5 is coordinated with changes in Appendices RG and RI which will help these two appendices be used as more than just a token effort at providing adoptable options for renewable energy or a stretch code (which currently is more like a yawn than a meaningful stretch). This also creates a reasonable step toward net zero performance which is addressed in Appendix RC as a separate adoptable appendix. For Table RG101.2, the target ERI w/OPP values are based on a typical minimum installation of a 4kW PV system. Section RG101.2 is modified to be consistent with Appendix RC (Net Zero) whereby both ERI targets (with and without OPP) must be satisfied which is equally appropriate for a stretch code using a step in between current code (Section R406) and net zero (Appendix RC). A correction is also made to an errant table reference in Appendix RG Section RG101.2. Also, a missing Item #2 in Section RG101.1 is restored with edits to align it with the intent of this proposal for a robust stretch code.

For Appendix RI, Section RI103.1.3 is deleted because it appears to be redundant (repeats) Section RI103.1.2 and also references a table that does not exist in the draft. ERI with OPP targets in Table RI103.1.2 are revised to be consistent with those proposed for Table R406.5 consistent with a minimum 3 kW PV system.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This proposal will likely be argued by some as an increase in cost, but it is not changing the prescriptive or other performance paths in the IECC (so there is no cost impact in that regard). It is also not changing cost of ERI compliance path where OPP is not used as is very common. The appendices are new so there is no cost impact relative to existing (2021) code in that regard either. This proposal seeks to provide and protect a meaningful use of both energy efficiency and renewable energy, supporting both of these "pillars" of sustainable energy use and production.

RE2D-29-23

RE2D-30-23

IECC RE: TABLE R406.5

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

TABLE R406.5 MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX NOT INCLUDING OPP	ENERGY RATING INDEX WITH OPP
0-1	51	~~35~~
2	51	~~34~~
3	50	~~33~~
4	53	~~40~~
5	54	~~43~~
6	53	~~43~~
7	52	~~46~~
8	52	~~46~~

Reason Statement:

Delete the proposed table changes to maximum ERI limits. The proposed revisions to maximum energy ratings are unsubstantiated by transparent and reviewable analysis or reviewable citations presenting supporting calculations.

Cost Impact:

The code change proposal will decrease the cost of construction.

Rollback of maximum ERI thresholds will reduce costs of construction by not imposing overly costly building envelope and equipment measures.

RE2D-30-23

RE2D-31-23

IECC RE: TABLE R407.1; IRCECC: TABLE N1107.1

Proponents:

Glen Clapper, representing National Roofing Contractors Association (gclapper@nrca.net)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

TABLE R407.1 MINIMUM LOW SLOPE ROOF REFLECTANCE AND EMITTANCE OPTIONS[a]

Three-year-aged solar reflectance[b] of 0.55 and 3-year aged thermal emittance[c] of 0.75
Three-year-aged solar reflectance index[d] of 64

a.	The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for either solar reflectance or thermal *emittance* shall be assigned both a 3-year-aged solar reflectance in accordance with Section C402.4.1 and a 3-year-aged thermal *emittance* of 0.90.
b.	Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.
c.	Aged thermal *emittance* tested in accordance with ASTM C1371 or ASTM E408 or CRRC-S100.
d.	Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h × ft^2 × °F (12 W/m^2 × K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal *emittance*.

IRC Chapter 11 ENERGY R3

Revise as follows:

TABLE N1107.1 MINIMUM LOW SLOPE ROOF REFLECTANCE AND EMITTANCE OPTIONS[a]

a.	The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for either solar reflectance or thermal emittance shall be assigned both a 3-year-aged solar reflectance in accordance with Section C402.4.1 and a 3-year-aged thermal emittance of 0.90.
b.	Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.
c.	Aged thermal emittance tested in accordance with ASTM C1371 or ASTM E408 or CRRC-S100.
d.	Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h × ft^2 × °F (12 W/m^2 × K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance.

Reason Statement:

This table and it's requirements were formerly referenced and now imported from Section C402.4 and Table C402.4, which specifically stated only applied to low slope roofs.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This proposal will neither increase nor decrease the cost of construction.

RE2D-31-23

RE2D-32-23

IECC RE: R407.2; IRCECC: N1107.2

Proponents:

Glen Clapper, representing National Roofing Contractors Association (gclapper@nrca.net)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R407.2 Tropical climate region.

Compliance with this section requires the following:

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* (SHGC) 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 low slope roof surface complies with one of the options in Table R407.1 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 $^{1}/_{4}$ unit vertical in 12 units horizontal (2-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.

IRC Chapter 11 ENERGY R3

Revise as follows:

N1107.2 Tropical climate region.

Compliance with this section requires the following:

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 (SHGC) 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 N1104.
6.	The exterior low slope roof surface complies with one of the options in Table N1107.1 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 $^1/_4$ unit vertical in 12 units horizontal (2-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.

Reason Statement:

This proposal clarifies that the requirements contained in Table C407.1 (N1107.1) apply only to low slope roofs.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This proposal will neither increase nor decrease the cost of construction.

RE2D-32-23

RE2D-33-23

IECC RE: TABLE R407.1

Proponents:

Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

TABLE R407.1 MINIMUM ROOF REFLECTANCE AND EMITTANCE OPTIONS[a]
Portions of table not shown remain unchanged.

a.	The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for either solar reflectance or thermal *emittance* shall be assigned both a 3-year-aged solar reflectance in accordance with Section R408.2.1.3.1 ~~C402.4.1~~ and a 3-year-aged thermal *emittance* of 0.90.
b.	Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.
c.	Aged thermal *emittance* tested in accordance with ASTM C1371 or ASTM E408 or CRRC-S100.
d.	Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h × ft^2 × °F (12 W/m^2 × K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal *emittance*.

Reason Statement:

This comment replaces a reference to the IECC-C with an internal reference to the IECC-R. There is no technical change - R408.2.1.3.1 and Section C402.4.1 have identical formula and content.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

No technical change is made.

RE2D-33-23

RE2D-34-23

IECC RE: TABLE R408.2

Proponents:

Gary Heikkinen, representing NW Natural (gary.heikkinen@nwnatural.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

a.	Where the measure is selected, each dwelling unit, sleeping unit, and common areas where the measure is applicable must have the measure installed.
b.	Where multiple heating or cooling systems are installed, credits shall be determined using a weighted average of the square footage served by each system.
c.	Where the measure is selected, each dwelling unit and sleeping unit must comply with the measure.
d.	Where the measure is selected, each dwelling unit shall be served by a water heater meeting the applicable requirements. Where multiple service water heating systems are installed, credits shall be determined using a weighted average of the square footage served by each system.

SEER2: Seasonal Energy Efficiency Ratio, HSPF2: Heating Season Performance Factor, EER2: Energy Efficiency Ratio, COP: Coefficient of Performance

Reason Statement:

Use actual calculated credits from PNNL analysis and do not arbitrarily assign zeroes to the gas furnace and heat pump options where the actual calculations show positive credits. There is no economic or energy savings justification for the assignment of zero for these options. These options provide legitimate energy savings potential for home owners and should be allowed. Use the same changeover temperature for options for the cold climate heat pumps using either gas or electric back-up rather than a different economic changeover temperature for the gas furnace option, For options with savings less than 0.5%, show NA rather than 0 (zero).

Cost Impact:

The code change proposal will decrease the cost of construction.

This proposal will decrease the cost of construction by allowing more cost effective options to use gas furnaces in colder climates.

RE2D-34-23

RE2D-35-23

IECC RE: TABLE R408.2

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code [RE] [RE Project] R3

Delete without substitution:

~~TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY~~

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4 except Marine	Climate Zone 4 Marine	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.1.1(1)	≥2.5% Reduction in total TC	0	0	0	1	1	1	1	1	1
R408.2.1.1(2)	≥5% reduction in total TC	0	1	1	2	2	3	3	3	3
R408.2.1.1(3)	>7.5% reduction in total TC	0	1	2	2	2	3	3	4	4
R408.2.1.1(4)	>10% reduction in total TC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.1.1(5)	>15% reduction in total TC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.1.1(6)	>20% reduction in total TC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.1.1(7)	>30% reduction in total TC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.1.2(2)	U-factor and SHGC for vertical fenestration per Table R408.2.1	1	1	1	1	1	1	1	2	
R408.2.1.3	Roof reflectance (roof is part of the *building thermal envelope* and directly above cooled, conditioned space)	TBD	TBD	TBD	TBD	TBD	0	0	0	0
R408.2.1.3	Roof reflectance (roof is above an unconditioned space that contains a duct system)	TBD	TBD	TBD	TBD	TBD	0	0	0	0
R408.2.1.4	Reduced air leakage	TBD	TBD	TBD	TBD	TBD	TBD	0	0	0

R408.2.2(1)[b]	Ground source heat pump	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(2)[b]	Cooling (Option 1)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(3)[b]	(Cooling Option 2)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(4)[b]	Gas furnace (Option 1)	0	0	0	0	0	TBD	TBD	TBD	0
R408.2.2(5)[b]	Gas furnace (Option 2)	TBD	TBD	TBD	TBD	TBD	0	0	0	TBD
R408.2.2(6)[b]	Gas furnace (Option 3)	TBD	TBD	TBD	TBD	-	-	-	-	-
R408.2.2(7)[b]	Gas furnace and cooling (Option 1)	TBD	TBD	TBD	TBD	-	-	-	-	-
R408.2.2(8)[b]	Gas furnace and cooling (Option 2)	TBD	TBD	TBD	TBD	-	-	-	-	-
R408.2.2(9)[b]	Gas furnace and heat pump (Option 1)	TBD	TBD	TBD	TBD	-	-	-	-	-
R408.2.2(10)[b]	Heat pump (Option 1)	TBD	TBD	TBD	TBD	-	-	-	-	-
R408.2.2(11)[b]	Gas furnace and cooling (Option 3)	-	-	-	-	TBD	TBD	TBD	TBD	TBD
R408.2.2(12)[b]	Gas furnace and cooling (Option 4)	-	-	-	-	TBD	TBD	TBD	TBD	TBD
R408.2.2(13)[b]	Gas furnace and heat pump (Option 2)	-	-	-	-	TBD	TBD	TBD	TBD	TBD
R408.2.2(14)[b]	Heat pump (Option 2)	TBD -	-	-	-	TBD	TBD	TBD	TBD	TBD
R408.2.3(1)[d]	Gas-fired storage water heaters	7	6	5	3	3	2	2	3	1
R408.2.3(2)[d]	Gas-fired instantaneous water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(3)[d]	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(4)[d]	Electric water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.3(5)[d]	Solar hot water heating system	4	5	6	6	6	6	5	5	4
R408.2.3(6) [c]	Compact hot water distribution	2	2	2	2	2	2	2	2	2
R408.2.4(1)[c]	More efficient distribution system	4	6	7	10	10	12	13	15	16
R408.2.4(2)[c]	100% of *duct systems* in conditioned space	4	6	8	12	12	15	17	19	20

R408.2.4(3)[c]	≥80% of ductwork inside *conditioned space*	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.4(4)[c]	Reduced total duct leakage	1	1	1	1	1	1	2	2	2
R408.2.5(1)	ERV or HRV installed	TBD	TBD	TBD	TBD	TBD	TBD	0	0	0
R408.2.5(2)[c]	≤2.0 ACH50 with ERV or HRV installed	1	4	5	10	10	13	TBD	TBD	TBD
R408.2.5(3)[c]	≤2.0 ACH50 with a *balanced ventilation system*	2	3	2	4	4	5	TBD	TBD	TBD
R408.2.5(4)[c]	≤1.5 ACH50 with ERV or HRV installed	2	4	6	12	12	15	TBD	TBD	TBD
R408.2.5(5)[c]	≤1.0 ACH50 with ERV or HRV installed	2	5	6	14	14	17	TBD	TBD	TBD
R408.2.6[a]	Energy efficient appliances	9	8	8	7	7	5	5	5	4
R408.2.7	On-site renewable energy measures	17	16	17	11	11	9	8	7	4
R408.2.8	Off-site renewable energy measures	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.9[c]	Demand responsive thermostat	1	1	1	1	1	1	1	1	1
R408.2.11	Whole home lighting control	1	1	1	1	1	1	1	1	1
R408.2.12	Higher efficacy lighting	1	1	1	1	1	1	1	1	1

~~a. Where the measure is selected, each dwelling unit, sleeping unit, and common areas where the measure is applicable must have the measure installed.~~

~~b. Where multiple heating or cooling systems are installed, credits shall be determined using a weighted average of the square footage served by each system.~~

~~c. Where the measure is selected, each dwelling unit and sleeping unit must comply with the measure.~~

~~d. Where the measure is selected, each dwelling unit shall be served by a water heater meeting the applicable requirements. Where multiple service water heating systems are installed, credits shall be determined using a weighted average of the square footage served by each system.~~

~~SEER2: Seasonal Energy Efficiency Ratio, HSPF2: Heating Season Performance Factor, EER2: Energy Efficiency Ratio, COP: Coefficient of Performance~~

Reason Statement:

Delete all 'TBD' table entries. Credit value entries are incomplete and, where provided, are unsubstantiated by transparent or reviewable citations presenting supporting calculations. At a June 28, 2023 Residential Consensus Committee meeting, it was concluded that the full table needs to be provided for public review and with accompanying site energy savings estimates, not just credit values. Additionally, Pacific Northwest National Laboratory (PNNL) reported that the table credit values and energy savings estimates are based upon site energy consumption calculations. This use of site energy for buildings is contradictory to the recommendation of the National Academies of Science, Engineering, and Medicine (NASEM) recommendations for use of full fuel cycle energy as the basis for appliance and building energy efficiency policy and a subsequent “Statement of Policy” by the U. S. Department of Energy regarding full fuel cycle energy versus use of site energy metrics. As a result, the current credit values developed by PNNL contradict federal policy and sound science.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Cost of construction from unspecified 'TBD' credits cannot be evaluated.

RE2D-35-23

RE2D-36-23

IECC RE: TABLE R408.2, R408.2.2

Proponents:

Alex Smith, representing NPGA (asmith@npga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Credit Value								
		Climate Zone 0 & 1	Climate Zone 2	Climate Zone 3	Climate Zone 4 except Marine	Climate Zone 4 Marine	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
R408.2.2(1)[b]	Ground source heat pump	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(2) [b]	Cooling (Option 1)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(3)[b]	(Cooling Option 2)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.2(4) [b]	Gas furnace (Option 1)	0	0	0	0	0	TBD	TBD	TBD	0
R408.2.2(5)[b]	Gas furnace (Option 2)	TBD	TBD	TBD	TBD	TBD	0	0	0	TBD
R408.2.2(6)[b]	Gas furnace (Option 3)	TBD	TBD	TBD	TBD	-	-	-	-	-
R408.2.2(7)[b]	Gas furnace and cooling (Option 1)	TBD	TBD	TBD	TBD	-	-	-	-	-
R408.2.2(8)[b]	Gas furnace and cooling (Option 2)	TBD	TBD	TBD	TBD	-	-	-	-	-
R408.2.2(9)[b]	Gas furnace and heat pump (Option 1)	TBD	TBD	TBD	TBD	-	-	-	-	-
R408.2.2(10)[b]	Heat pump (Option 1)	TBD	TBD	TBD	TBD	-	-	-	-	-

R408.2.2(11)[b]	Gas furnace and cooling (Option 3)	-	-	-	-	TBD	TBD	TBD	TBD	TBD
R408.2.2(12)[b]	Gas furnace and cooling (Option 4)	-	-	-	-	TBD	TBD	TBD	TBD	TBD
R408.2.2(XX)[b]	Gas furnace and cooling (Option 5)	-	-	-	-	TBD	TBD	TBD	TBD	TBD
R408.2.2(13)[b]	Gas furnace and heat pump (Option 2)	TBD	TBD	TBD	TBD	TBD				
R408.2.2(14)[b]	Heat pump (Option 2)	TBD -	-	-	-	TBD	TBD	TBD	TBD	TBD
R408.2.3(1)[d]	Gas-fired storage water heaters	7	6	5	3	3	2	2	3	1
R408.2.3(2)[d]	Gas-fired instantaneous water heaters	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

a.	Where the measure is selected, each dwelling unit, sleeping unit, and common areas where the measure is applicable must have the measure installed.
b.	Where multiple heating or cooling systems are installed, credits shall be determined using a weighted average of the square footage served by each system.
c.	Where the measure is selected, each dwelling unit and sleeping unit must comply with the measure.
d.	Where the measure is selected, each dwelling unit shall be served by a water heater meeting the applicable requirements. Where multiple service water heating systems are installed, credits shall be determined using a weighted average of the square footage served by each system.

SEER2: Seasonal Energy Efficiency Ratio, HSPF2: Heating Season Performance Factor, EER2: Energy Efficiency Ratio, COP: Coefficient of Performance

R408.2.2 More efficient HVAC equipment performance option.

Heating and cooling *equipment* shall meet one of the following efficiencies as applicable for the *climate zone*. Where multiple heating or cooling systems are installed serving different zones, credits shall be earned based on the weighted average of square footage of the *zone* served by the system.

HVAC options applicable to all climate zones:

1.	Ground source Heat Pump -Greater than or equal to 16.1 EER and 3.1 COP ground source heat pump.
2.	Cooling (Option 1)-Greater than or equal to 15.2 SEER2 and 12.0 EER2 air conditioner.

3.	Cooling (Option 2)-Greater than or equal to 16.0 SEER2 and 12.0 EER2 air conditioner.
4.	Gas Furnace (Option 1)-Greater than or equal to 97 % AFUE *fuel gas* furnace.
5.	Gas Furnace (Option 2)- Greater than or equal to 95% AFUE *fuel gas* furnace.

HVAC options applicable to climate zones 0, 1, 2, and 3:

6.	Gas Furnace (Option 3)-Greater than or equal to 90% AFUE *fuel gas* furnace.
7.	Gas Furnace and Cooling (Option 1)- Greater than or equal to 90% AFUE *fuel gas* furnace and 15.2 SEER2 and 10.0 EER2 air conditioner.
8.	Gas Furnace and Cooling (Option 2) - Greater than or equal to 95% AFUE *fuel gas* furnace and 16.0 SEER2 and 10.0 EER2 air conditioner.
9.	Gas Furnace and Heat Pump (Option 1) - Greater than or equal to 90% AFUE *fuel gas* furnace and 7.8 HSPF2, 15.2 SEER2 and 10.0 EER2 air source heat pump.
10.	Heat Pump (Option 1)–Greater than or equal to 7.8 HSPF2, 15.2 SEER2, and 11.7 EER2 air source heat pump.

HVAC options applicable to climate zones 4, 5, 6, 7, and 8:

11.	Gas Furnace and Cooling (Option 3)-Greater than or equal to 95% AFUE *fuel gas* furnace and 15.2 SEER2 and 12.0 EER2 air conditioner.
12.	Gas Furnace and Cooling (Option 4)-Greater than or equal to 97% AFUE *fuel gas* furnace and 16.0 SEER2 and 12.0 EER2 air conditioner.
13.	Gas Furnace and Cooling (Option 5)-Greater than or equal to 98% AFUE *fuel gas* furnace and 16.0 SEER2 and 13.0 EER2 air conditioner.
14.	Gas Furnace and Heat Pump (Option 2)- Greater than or equal to 95% AFUE *fuel gas* furnace and 8.1 HSPF2 and 15.2 SEER2 air source heat pump capable of meeting a capacity ratio ≥ 70% of heating capacity at 5 °F versus rated heating capacity at 47 °F.
15.	Heat Pump (Option 2)-Greater than or equal to 8.1 HSPF2 and 15.2 SEER2 air source heat pump capable of meeting a capacity ratio ≥ 70% of heating capacity at 5 °F versus rated heating capacity at 47 °F.

Reason Statement:

It is the goal of the NPGA to encourage the continued research and development of higher efficiency fuel gas furnaces and air conditioners. While we acknowledge that credit for 95% and 97% AFUE fuel gas furnaces is a great addition to the code, we believe that 98% AFUE should be recognized with additional points. It requires years of research and millions of investment dollars to make additional advancements in fuel gas furnace efficiency. As we approach higher and higher AFUE values, every additional percentage point earned is a great achievement in energy conservation. We should be recognizing and rewarding the effort to go from 97% to 98% AFUE. In addition, we have further increased the air conditioner requirements to 13.0 EER2.

As the code currently stands, if someone were to install a 98% AFUE furnace and 13.0 EER2 air conditioner, they would receive 1 credit point over someone who installed a 95% AFUE furnace and 10 EER2 air conditioner. We do not think this does an effective job of promoting energy efficiency as is intended by the IECC code.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This proposal does not effect costs.

RE2D-36-23

RE2D-37-23

IECC RE: TABLE R408.2, R408.2.1, R408.2.1.1, R408.2.1.4, R408.2.3

Proponents:

Alisa McMahon, representing self (mcmahon.gbac@cox.net)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

TABLE R408.2 CREDITS FOR ADDITIONAL ENERGY EFFICIENCY
Portions of table not shown remain unchanged.

R408.2.3(6) [c]	Compact hot water distribution	2	2	2	2	2	2	2	2	2
R408.2.4(1)[c]	More efficient distribution system	4	6	7	10	10	12	13	15	16
R408.2.4(2)[c]	100% of *duct systems* in conditioned space	4	6	8	12	12	15	17	19	20
R408.2.4(3)[c]	≥80% of ductwork inside *conditioned space*	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
R408.2.4(4)[c]	Reduced total duct leakage	1	1	1	1	1	1	2	2	2
R408.2.5(2)[c]	≤2.0 ACH50 with ERV or HRV installed	1	4	5	10	10	13	TBD	TBD	TBD
R408.2.5(3)[c]	≤2.0 ACH50 with a *balanced ventilation system*	2	3	2	4	4	5	TBD	TBD	TBD
R408.2.5(4)[c]	≤1.5 ACH50 with ERV or HRV installed	2	4	6	12	12	15	TBD	TBD	TBD
R408.2.5(5)[c]	≤1.0 ACH50 with ERV or HRV installed	2	5	6	14	14	17	TBD	TBD	TBD

a. Where the measure is selected, each dwelling unit, sleeping unit, and common ~~areas~~ area where the measure is applicable must have the measure installed.
b. Where multiple heating or cooling systems are installed, credits shall be determined using a weighted average of the square footage served by each system.

c. Where the measure is selected, each dwelling unit and sleeping unit must comply with the measure.

d. Where the measure is selected, each dwelling unit shall be served by a water heater meeting the applicable requirements. Where multiple service water heating systems are installed, credits shall be determined using a weighted average of the square footage served by each system.

~~SEER2: Seasonal Energy Efficiency Ratio, HSPF2: Heating Season Performance Factor, EER2: Energy Efficiency Ratio, COP: Coefficient of Performance~~

R408.2.1 Enhanced building thermal envelope options.

~~For the enhanced envelope credits, the~~ The *building thermal envelope* shall comply with one or more of the following:

1.	Either Section R408.2.1.1 or R408.2.1.2. Credit shall only be permitted from one measure.
2.	Section R408.2.1.3.

3.	Section R408.2.1.4.

R408.2.1.1 Enhanced building thermal envelope performance.

The total *building thermal envelope* thermal conductance TC shall be calculated for the proposed *building* in accordance with Section R402.1.5 and ~~it~~ shall be reduced by not less than the percentage indicated in Table R408.2 in comparison to the reference *building*.

R408.2.1.4 Reduced air leakage.

~~For the reduced air leakage credit, the~~ The building shall have a measured air leakage rate no less than 2.0 ACH50 and no greater than 2.5 ACH50 or the dwelling units in the building shall have an average measured air leakage rate no greater than 0.24 cfm50/ft2.

R408.2.3 Reduced energy use in service water-heating options.

For ~~measure numbers~~ measures R408.2.3 (1) through R408.2.3(7), the installed hot water system shall meet one of the Uniform Energy Factors (UEF) or Solar Uniform Energy Factors (SUEF) in Table R408.2.3. For measure ~~number~~ R408.2.3(8), a compact hot water distribution system shall comply with R408.2.3.1.

Reason Statement:

The "technical" aspect of this proposal is the request for review of the inclusion of footnote "c" in certain rows of Table R408.2. Footnotes "a" through "d" were an excellent addition. However, they were approved en masse, with very little to no discussion regarding their application to individual rows. Footnote "c" may not apply to the nine rows listed above.

As to the stricken line, it is unclear why it is under the footnotes beneath Table R408.2. It is not labeled as a footnote and the abbreviations do not appear in the table. The abbreviations are used in R408.2.2 and R408.2.3. The few editorial changes can be processed quickly.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

RE2D-37-23

RE2D-38-23

IECC RE: R408.2.1.3

Proponents:

Alisa McMahon, representing self (mcmahon.gbac@cox.net)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R408.2.1.3 Roof reflectance.

Roofs in Climate Zones 0-2~~4 and 4C~~ shall comply with one or more of the options in Table R408.2.1.3. The following roofs and portions of roofs are excluded from the roof reflectance credit:

<table>
<tr><td>1.</td><td>Portions of the roof that include or are covered by the following:
<table>
<tr><td>1.1</td><td>Photovoltaic systems or components.</td></tr>
<tr><td>1.2</td><td>Solar air or water-heating systems or components.</td></tr>
<tr><td>1.3</td><td>Vegetative roofs or landscaped roofs.</td></tr>
<tr><td>1.4</td><td>Above-roof decks or walkways.</td></tr>
<tr><td>1.5</td><td>Skylights.</td></tr>
<tr><td>1.6</td><td>HVAC systems and components, and other opaque objects mounted above the roof.</td></tr>
</table>
</td></tr>
<tr><td>2.</td><td>Portions of the roof shaded during the peak sun angle on the summer solstice by permanent features of the building or by permanent features of adjacent buildings.</td></tr>
<tr><td>3.</td><td>Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot (74 kg/m^2) or 23 psf (117 kg/m^2) pavers.</td></tr>
<tr><td><s>4.</s></td><td><s>Roofs where not less than 75 percent of the roof area complies with one or more of the exceptions to this section.</s></td></tr>
</table>

Reason Statement:

This measure needs further development before it's ready for rollout.

For example, the measure needs to specify what percentage of roof area is required to meet the reflectance criteria, and that percentage must be in line with the points available.

The list of exclusions comes from the IECC-C where they exempt roofs from a **requirement**. That is very different from qualifying for a

credit. R408.2.1.3(4) provides that a roof could qualify for credit with only 25% of the roof area available to meet the reflectance criteria.

The measure does not reference the two rows in Table R408.2.

Per PNNL analysis and RECD1-13-22, the measure will be applicable only to Climate Zones 0-2.

A modification will be submitted shortly, taking into account the results of PNNL's analysis (RECD1-13-22), in addressing these and other issues.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

RE2D-38-23

RE2D-39-23

IECC RE: R408.2.1.3

Proponents:

Aaron Phillips, representing Asphalt Roofing Manufacturers Association (aphillips@asphaltroofing.org)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R408.2.1.3 Roof reflectance.

Roofs in Climate Zones 0-2~~4 and 4C~~ shall comply with one or more of the options in Table R408.2.1.3. The following roofs and portions of roofs are excluded from the roof reflectance credit:

<table>
<tr><td>1.</td><td>Portions of the roof that include or are covered by the following:
<table>
<tr><td>1.1</td><td>Photovoltaic systems or components.</td></tr>
<tr><td>1.2</td><td>Solar air or water-heating systems or components.</td></tr>
<tr><td>1.3</td><td>Vegetative roofs or landscaped roofs.</td></tr>
<tr><td>1.4</td><td>Above-roof decks or walkways.</td></tr>
<tr><td>1.5</td><td>Skylights.</td></tr>
<tr><td>1.6</td><td>HVAC systems and components, and other opaque objects mounted above the roof.</td></tr>
</table>
</td></tr>
<tr><td>2.</td><td>Portions of the roof shaded during the peak sun angle on the summer solstice by permanent features of the building or by permanent features of adjacent buildings.</td></tr>
<tr><td>3.</td><td>Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot (74 kg/m^2) or 23 psf (117 kg/m^2) pavers.</td></tr>
<tr><td>4.</td><td>Roofs where not less than 75 percent of the roof area complies with one or more of the exceptions to this section.</td></tr>
</table>

Reason Statement:

The climate zones in R408.2.1.3, which are associated with the roof reflectance additional energy efficiency credits in Table R408.2, are revised to align with the climate zones determined to qualify for a roof reflectance credit via PNNL's analysis. The climate zones identified in Section R408.2.1.3 should coordinate with the climate zones in Table R408.2 for which a credit is available.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This comment coordinates climate zones between Table R408.2 and Section R408.2.1.3. There is no impact on cost of construction.

RE2D-40-23

IECC RE: R408.2.11

Proponents:

Michael Jouaneh, representing Lutron Electronics Co., Inc. (mjouaneh@lutron.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R408.2.11 Whole home lighting control.

The dwelling unit shall have a ~~switch~~ *manual* control by the main entrance that turns off all the permanently installed interior lighting or have a lighting control system that has the capability to turn off all permanently installed interior lighting from remote locations.
Exceptions:

1.	Up to 5 percent of the total lighting power may remain uncontrolled.
2.	Spaces where lighting is controlled by a count-down timer or *occupant sensor control*.

Reason Statement:

This change provides some clarity as the term "switch" has a specific meaning in the NEC. The provision did not intend to require only a toggle switch but any manual control that can provide the functionality. It could be a toggle switch but more often it would be a keypad or button not a toggle switch. So manual control is the more appropriate word.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

editorial change.

RE2D-40-23

RE2D-41-23

IECC RE: R408.2.2

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code [RE] [RE Project] R3

Delete without substitution:

~~R408.2.2 More efficient HVAC equipment performance option.~~

~~Heating and cooling *equipment* shall meet one of the following efficiencies as applicable for the *climate zone* . Where multiple heating or cooling systems are installed serving different zones, credits shall be earned based on the weighted average of square footage of the *zone* served by the system.~~

~~HVAC options applicable to all climate zones:~~

1.	Ground source Heat Pump -Greater than or equal to 16.1 EER and 3.1 COP ground source heat pump.
2.	Cooling (Option 1)-Greater than or equal to 15.2 SEER2 and 12.0 EER2 air conditioner.
3.	Cooling (Option 2)-Greater than or equal to 16.0 SEER2 and 12.0 EER2 air conditioner.
4.	Gas Furnace (Option 1)-Greater than or equal to 97 % AFUE *fuel gas* furnace.
5.	Gas Furnace (Option 2)- Greater than or equal to 95% AFUE *fuel gas* furnace.

~~HVAC options applicable to climate zones 0, 1, 2, and 3:~~

6.	Gas Furnace (Option 3)-Greater than or equal to 90% AFUE *fuel gas* furnace.
7.	Gas Furnace and Cooling (Option 1)- Greater than or equal to 90% AFUE *fuel gas* furnace and 15.2 SEER2 and 10.0 EER2 air conditioner.
8.	Gas Furnace and Cooling (Option 2) - Greater than or equal to 95% AFUE *fuel gas* furnace and 16.0 SEER2 and 10.0 EER2 air conditioner.
9.	Gas Furnace and Heat Pump (Option 1) - Greater than or equal to 90% AFUE *fuel gas* furnace and 7.8 HSPF2, 15.2 SEER2 and 10.0 EER2 air source heat pump.
10.	Heat Pump (Option 1)–Greater than or equal to 7.8 HSPF2, 15.2 SEER2, and 11.7 EER2 air source heat pump.

~~HVAC options applicable to climate zones 4, 5, 6, 7, and 8:~~

11.	Gas Furnace and Cooling (Option 3)-Greater than or equal to 95% AFUE *fuel gas* furnace and 15.2 SEER2 and 12.0 EER2 air conditioner.

12.	Gas Furnace and Cooling (Option 4)-Greater than or equal to 97% AFUE *fuel gas* furnace and 16.0 SEER2 and 12.0 EER2 air conditioner.
13.	Gas Furnace and Heat Pump (Option 2)- Greater than or equal to 95% AFUE *fuel gas* furnace and 8.1 HSPF2 and 15.2 SEER2 air source heat pump capable of meeting a capacity ratio ≥ 70% of heating capacity at 5 °F versus rated heating capacity at 47 °F.
14.	Heat Pump (Option 2)-Greater than or equal to 8.1 HSPF2 and 15.2 SEER2 air source heat pump capable of meeting a capacity ratio ≥ 70% of heating capacity at 5 °F versus rated heating capacity at 47 °F.

Reason Statement:

Delete the proposed table changes for more efficient HVAC equipment performance options. Table entries are incomplete (represented by ‘TBD’) and, where provided, are unsubstantiated by transparent or reviewable citations presenting supporting calculations. At a June 28, 2023 Residential Consensus Committee meeting, it was concluded that the full table needs to be provided for public review and with accompanying site energy savings estimates, not just credit values. HVAC threshold “TBD” values do not provide useful options for AHJs and are unsubstantiated for inclusion in the section and Table R408.2.

Cost Impact:

The code change proposal will decrease the cost of construction.

Deletion of new additional measures would reduce cost of construction by allowing installation of cost effective measures that may be above minimum efficiency standards.

RE2D-41-23

RE2D-42-23

IECC RE: TABLE R408.2.3

Proponents:

Shilpa Surana, representing California Investor Owned Utilities (shilpasurana@2050partners.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

TABLE R408.2.3 Service water-heating efficiencies

Measure Number	Water Heater	Size and Draw Pattern	Type	Efficiency
R408.2.3(1)(a)	Gas-fired storage water heaters (option 1)	All storage volumes, all draw patterns	UEF ≥0.81	
R408.2.3(1)(b)	Gas-fired storage water heaters (option 2)	~~≤ 55 gallons, Medium~~	~~UEF ≥0.81~~	
		≤ 55 gallons, High	UEF ≥0.86	
		>55 gallons, Medium or High	UEF ≥0.86	
Rated input capacity > 75,000 Btu/h	UEF ≥0.86 or E_t ≥94%			
R408.2.3 (2)(a)	Gas-fired instantaneous water heaters (option 1)	All storage volumes, Medium or High	UEF ≥ 0.92	
R408.2.3(2)(b)	Gas-fired instantaneous water heaters (option 2)	All storage volumes, Medium or High	UEF ≥0.95	
R408.2.3 (3)(a)	Electric water heaters(option 1)	All storage volumes, Low, Medium, or High	Integrated HPWH	UEF ≥ 3.30
R408.2.3(3)(b)	Electric water heaters(option 2)	All storage volumes, Low, Medium, or High	Integrated HPWH	UEF ≥ 3.75
R408.2.3 (4)	Electric water heaters(option 3)	All storage volumes, Low, Medium, or High	Integrated HPWH, 120 Volt/15 Amp Circuit	UEF ≥ 2.20
R408.2.3(5)(a)	Electric water heaters(option 4)	All storage volumes, Low, Medium, or High	Split-system HPWH	UEF ≥ 2.20
R408.2.3(5)(b)	Electric water heaters(option 5)	All storage volumes, Low, Medium, or High	Split-system HPWH	UEF ≥ 3.75
R408.2.3(~~5~~6)	Electric water heaters (option 6)	Rated input capacity >12 kW	COP≥3.00	
R408.2.3(~~6~~7)(a)	Solar water heaters(option 1)	All storage volumes, all draw patterns	Electric backup	SUEF ≥ 3.00
R408.2.3(~~6~~7)(b)	Solar water heaters(option 2)	All storage volumes, all draw patterns	Gas backup	SUEF ≥ 1.80

UEF = Uniform Energy Factor, E_t = Thermal Efficiency, COP = Coefficient of Performance

Reason Statement:

This proposal deletes R408.2.3(1)(b) Option 2 as it is redundant to the measure (R408.2.3(1)(a) Option 1) above. It fixes a few formatting errors and introduces the language 'all storage volumes' before the draw patterns to ensure consistency with the options above.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This proposal makes editorial clarifications only.

RE2D-42-23

RE2D-43-23

IECC RE: R408.2.3.1

Proponents:

Alisa McMahon, representing self (mcmahon.gbac@cox.net)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R408.2.3.1 Compact hot water distribution system option.

The pipe shall store not more than 16 ounces of water between the nearest source of heated water and the termination of the fixture supply pipe when calculated using section R408.2.3.1.1. Where the source of heated water is a circulation loop, the loop shall be primed with a *demand recirculation water system* <u>that complies with R403.5.1.1.1</u>. There shall be a dedicated return line for the loop that begins after the branch to the last fixture on the supply portion of the loop and runs back to the water heater.

Reason Statement:

In the last round, measures were added to R403.5.1.1.1 to modestly increase the energy efficiency of *demand recirculation water systems*. A demand recirculation system qualifying for R408 credit should be at least as efficient as one that does not qualify for that credit.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

RE2D-43-23

RE2D-44-23

IECC RE: R408.2.6, TABLE R408.2.6

Proponents:

Alisa McMahon, representing self (mcmahon.gbac@cox.net)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R408.2.6 Energy efficient appliances.

All appliances of the types listed in Table R408.2.6 installed in a *residential building* shall comply with the efficiency requirements specified in ~~Table R408.2.6~~ that table. ~~Not less than~~ All three appliance types from Table R408.2.6 shall be installed.
~~Exception~~ Exceptions:

1.	Compact size appliances shall not be used to comply with this section.
2.	In Group R-2 occupancies where a dishwasher is not installed in each *dwelling unit*, not less than two appliance types complying with Table R408.2.6 shall be installed. In *common areas*, all appliances of each appliance type shall comply with Table R408.2.6.

TABLE R408.2.6 MINIMUM EFFICIENCY REQUIREMENTS: APPLIANCES

APPLIANCE TYPES	EFFICIENCY IMPROVEMENT	TEST PROCEDURE
Refrigerator	Maximum Annual Energy Consumption (AEC)~~, No~~ no greater than 620 kWh/yr	10 CFR 430, Subpart B, Appendix A
Dishwasher	Maximum Annual Energy Consumption (AEC)~~, No~~ no greater than 240 kWh/yr	10 CFR 430, Subpart B, Appendix C1
Clothes washer	Clothes washer located within *dwelling units*: Maximum Annual Energy Consumption (AEC)~~, No~~ no greater than 130 kWh/yr,and Integrated Modified Energy Factor (IMEF) > 1.84 cu.ft/kWh/cycle Clothes washer not located within dwelling units and where *dwelling units* are not provided with ~~laundry facilities~~ rough-in plumbing for washers: Modified Energy Factor (MEF)>2.0 cu.ft/kWh/cycle Clothes washers shall be installed at all locations plumbed for clothes washers.	10 CFR 430 Subpart B, Appendix J2 and 10 CFR 430, Subpart B, Appendices D1 and D2

Reason Statement:

A new version of R408.2.6 was approved in the last round. Like many new code sections, it has some loopholes. This proposal closes those loopholes.

A modification will be submitted shortly, taking into account the results of PNNL's analysis (RECD1-13-22). This reason statement covers the revisions submitted herein.

Compact Appliances Loophole

R408.2.6 criteria are based on standard-size appliances. The annual energy use of compact appliances is much lower. Compact appliances are not chosen to save energy. Rather, they are used when there is limited space and/or no need for standard-size appliances. Allowing compacts to qualify for R408 credit would not incentivize lower energy use; it would provide freebie credit for smaller appliances that will be used in those locations regardless. Therefore, compacts should not qualify for R408 credit.

-

All Appliances Must Comply To Earn Credit

Many larger homes have multiple appliances of one or more types. R408.2.6 does not require that all appliances in each type comply, nor does it exclude compacts. So, for example, a compact refrigerator in a wet bar can qualify a home for R408 credit even when the energy consumption of the standard-size refrigerator in the kitchen exceeds the maximum allowed!

Table R408.2footnote "a" does not protect against this situation. It requires the measure (in this case, a qualifying appliance) to be installed in each location listed. However, it does not require that all appliances in each location comply. So, for example, the footnote does not prevent the installation of just one qualifying washer in a common area laundry room with ten washers.

Clothes Washers Located Outside Dwelling Units

"Where dwelling units are not provided with laundry facilities" in Table R408.2.6 is commonly interpreted as 'where dwelling units are not provided with a common area laundry room.' That is not what the proponents intended. The proposed change conveys the proponents' intent.

Reference: IRC definition of "rough-in."

Prevent Future Installation of Less-Efficient Clothes Washers at Plumbed Locations

-

In some buildings, some (typically the larger) dwelling units are plumbed for washers and common area laundry facilities are provided. In this situation, footnote "a" to Table R408.2 provides that washers must be installed in both the plumbed dwelling units and the common area(s). But that should be stated explicitly in this section. The idea is to avoid future (e.g., post-COO) installation of less efficient appliances in plumbed dwelling units.

Exception 2 Loophole

An early version of RED1-360 included a footnote that made clear that all washers in a common area must comply. That footnote was deleted. Footnote "a" to Table R408.2 does not ensure this. Thus, Exception 2 could be interpreted that compliance is achieved by a single appliance of each appliance type.

All the loopholes described above are closed by the proposed changes.

Clarifications

-

The term "appliance types" is used three times. Its meaning is clarified by changing the left column heading to "appliance types."

"Not less than three appliance types . . ." is a remnant from PCD#1 when the Table contained four appliance types. Since there are now only three, to avoid confusion, that phrase has been replaced by "all."

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

RE2D-44-23

RE2D-45-23

IECC RE: R503.1.1

Proponents:

Lucyna de Barbaro, representing Rebuilding Together Pittsburgh (ldbarbaro@rtpittsburgh.org)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R503.1.1 Building thermal envelope.

Alterations of existing *building thermal envelope* assemblies shall comply with this section. New *building thermal envelope* assemblies that are part of the *alteration* shall comply with Section R402. The R-value of insulation shall not be reduced, nor the U-factor of a *building thermal envelope* assembly increased as part of a *building thermal envelope alteration* except where the *building* after the *alteration* complies with Section R405 or R406.

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.	*Roof recover*.
3.	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.
4.	Roof replacement where *roof assembly* insulation is <u>present and is either</u> integral to or located below the structural roof deck.

Reason Statement:

This proposal adds a qualifier / excludes from exception the case where there is absolutely no roof insulation. I think this clarification is consistent be the intent of the code language in R503.1.1.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This proposal addresses clarification of the intended use of the code.

RE2D-45-23

RE2D-46-23

IECC RE: R503.1.1.3

Proponents:

Amy Martino, representing Building Site Synergy (amartino@buildingsitesynergy.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R503.1.1.3 Above-grade wall alterations.

Above-grade wall alterations shall comply with the following :

1.	Where wall cavities are exposed, and the exposed cavities shall be filled with insulation complying with Section R303.1.4. New cavities created shall be insulated in accordance with Section R402.1 or an *approved* design that minimizes deviation from Section R402.1. An interior vapor retarder shall be provided where required in accordance with Section R702.7 of the *International Residential Code* or Section 1404.3 of the *International Building Code,* as applicable.
2.	Where *exterior wall* coverings and *fenestration* are added or replaced for the full extent of any exterior , facade of one or more elevations of the *building*, ~~continuous~~ insulation shall be provided where required in accordance with Section R402.1 or the wall insulation shall be in accordance with an *approved* design; that minimizes deviation from Section R402.1; Where specified, the ~~continuous~~ insulation requirement also shall comply with Section R702.7 of the *International Residential Code*. Replacement exterior wall coverings shall comply with the water resistance requirements of Section R703.1.1 of the *International Residential Code* or Section 1402.2 of the *International Building Code*, as applicable, *and manufacturers' instructions.*
3.	Where new interior finishes or *exterior wall* coverings are applied to the full extent of any exterior wall assembly of mass construction, insulation shall be provided in accordance with Section R402.1 or an approved design that minimizes deviation from Section R402.1.

Reason Statement:

Every climate zone offers a cavity only alternative. By specifying “continuous” insulation it is confusing and more restrictive than new construction. With existing construction there are many instances that make adding continuous insulation difficult to install without affecting the existing construction not part of the alteration (ex. Existing decks & attachment to the structure, changes in materials such as water tables, porch roofs, flush roof rakes, etc.) which may create a moisture intrusion and flashing problem. If an *approved* design is permitted, specifying “continuous” insulation is not required. “Full extent” is poor code language and should be better quantified. Lastly, in anticipation that local jurisdictions may make amendments, it is likely alternatives which allow cavity only insulation may be adopted.

Bibliography:

none

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

Editorial for clarification and consistency.

RE2D-46-23

RE2D-47-23

IECC RE: R503.1.1.4

Proponents:

Lucyna de Barbaro, representing Rebuilding Together Pittsburgh (ldbarbaro@rtpittsburgh.org)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R503.1.1.4 Floor alterations.

Where cavities in a floor or floor overhang are exposed and the floor or floor overhang is part of the *building thermal envelope*, the floor or floor overhang shall comply with Section R402.1 or an *approved* design.
<u>Where a floor over unconditioned space is uninsulated and a new floor covering is installed without exposing the cavities, the cavities shall be insulated in accordance with Section R402.1 or an *approved* design.</u>

Reason Statement:

Floors are sometimes replaced without removing prior floor, therefore the floor cavity may not be actually exposed, whereas it is clear that it should not be left without insulation if the floor is part of the building thermal envelope.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This proposal addresses clarification of the intended use of code.

RE2D-47-23

RE2D-48-23

IECC RE: R503.1.1.5

Proponents:

Amy Martino, representing Building Site Synergy (amartino@buildingsitesynergy.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R503.1.1.5 Below-grade wall alterations.

Where an unconditioned below-grade space is changed to *conditioned space*, ~~the~~ new or existing uninsulated *building thermal envelope* walls enclosing such space shall be insulated in accordance with Section R402.1. Where the below-grade space is *conditioned space* and where *building thermal envelope* walls enclosing such space are altered to expose the wall cavity they shall be insulated in accordance with Section R402.1.

Reason Statement:

Alterations may be minor or major. Substantial alteration has been now defined by RED1- 263. Specifying that insulation only applies to building thermal envelope walls which are new, uninsulated or with exposed wall cavities is necessary. Existing walls that are finished should not be required to be changed. Above grade walls are specified in **R503.1.1.3 #1** and only specify wall cavities which are exposed.

Below grade walls should be treated the same. I have suggested only text working with the current language. Ideally this section would mirror R503.1.1.3 #1

GENERAL REASONING: The proponents claim for the "Cost Impact: The code change proposal will neither increase nor decrease the cost of construction." is completely inaccurate.

Bibliography:

none

Cost Impact:

The code change proposal will decrease the cost of construction.

This clarification will assist code officials to be more consistent and not require unnecessary construction.

RE2D-48-23

RE2D-49-23

IECC RE: RG101.3

Proponents:

Vladimir Kochkin, representing NAHB (vkochkin@nahb.org)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

RG101.3 Additional energy efficiency credit requirements.

Residential buildings shall earn not less than **twenty credits** from not less than two measures specified in Table R408.2. Five additional credits shall be earned for dwelling units with more than 5,000 square feet (465 m2) of living space located above grade plane . To earn credit as specified in Table R408.2 for the applicable Climate Zone, each measure selected for compliance shall comply with the applicable subsections of Section R408. Each dwelling unit or sleeping unit shall comply with the selected measure to earn credit. Interpolation of credits between measures shall not be permitted.

Reason Statement:

The stretch code's 20-credit threshold should be reasonably achievable without the use of federally preempted high efficiency equipment. PNNL was requested at the June 29th call of the consensus committee to complete this analysis similar to how they have done so for the main body of the code. This public comment serves as a reminder to make sure that the appendix does not create preemption issues at jurisdictional level.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The public comment points out federal preemption considerations.

RE2D-49-23

RE2D-50-23

IECC RE: SECTION R202, RG101.3, RG101.3.1 (New)

Proponents:

Vladimir Kochkin, representing NAHB (vkochkin@nahb.org); Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

SECTION R202 GENERAL DEFINITIONS.

COMMUNITY RENEWABLE ENERGY FACILITY (CREF). A facility that produces energy from renewable energy resources and that is qualified as a community energy facility under applicable jurisdictional statutes and rules.

FINANCIAL RENEWABLE ENERGY POWER PURCHASE AGREEMENT (FPPA). A financial arrangement between a renewable electricity generator and a purchaser wherein the purchaser pays or guarantees a price to the generator for the project's renewable generation. Also known as a financial power purchase agreement and virtual power purchase agreement.

PHYSICAL RENEWABLE ENERGY POWER PURCHASE AGREEMENT (PPPA). A contract for the purchase of renewable electricity from a specific renewable electricity generator to a purchaser of renewable electricity.

RG101.3 Additional energy efficiency credit requirements.

Residential buildings shall earn not less than twenty credits from not less than two measures specified in Table R408.2. Five additional credits shall be earned for dwelling units with more than 5,000 square feet (465 m2) of living space located above grade plane . To earn credit as specified in Table R408.2 for the applicable Climate Zone, each measure selected for compliance shall comply with the applicable subsections of Section R408. Each dwelling unit or sleeping unit shall comply with the selected measure to earn credit. Interpolation of credits between measures shall not be permitted.

Add new text as follows:

RG101.3.1 **Renewable Energy Power Purchase Agreements.**.

This section shall be permitted to be used to meet the requirements for one of the two measures for compliance with Section RG101.3. A renewable energy power agreement shall be in accordance with Section RG101.3.1.1 or RG101.3.1.2. The agreement shall have a duration of not less than 15 years and for not less than 1.0 kWh per square foot of *conditioned floor area* on an annual basis. The contract shall be structured to survive a partial or full transfer of ownership of the building property. Not more than 7 credits shall be allocated for compliance with Section RG101.3.1.1 or RG101.3.1.2. Where the building complies with Section R404.6.2 using a *physical renewable energy power purchase agreement* (PPPA) or a *financial renewable energy power purchase agreement* (FPPA), the purchase agreement shall be for sufficient *renewable energy* to satisfy the combined requirements of Section R404.6.2 and this section. Renewable energy certificate (REC) documentation shall comply with Section R404.4.

RG101.3.1.1 One- and two- family dwellings and townhouses. For one- and two- family dwellings and townhouses, *renewable energy* shall be purchased from a *community renewable energy facility (CREF)* using a PPPA.

RG101.3.1.2 Group R-2. For Group R-2 occupancies, *renewable energy* shall be purchased from a utility or a *CREF* using a PPPA or a FPPA.

Reason Statement:

The stretch code appendix takes a substantial step towards zero net energy goal. At this level of performance, renewable generation becomes an essential part of the design toolbox. This proposal adds offsite renewable energy as an optional compliance practice for buildings required to meet the increased number of credits.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The proposal adds a compliance option. It has the potential to reduce cost through optimized design.

RE2D-50-23

RE2D-51-23

IECC RE: APPENDIX RE, (New)

Proponents:

Vladimir Kochkin, representing NAHB (vkochkin@nahb.org); Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com); Laura Petrillo-Groh, representing Air-Conditioning, Heating, and Refrigeration Institute (lpetrillo-groh@ahrinet.org)

2024 International Energy Code [RE] [RE Project] R3

APPENDIX RE ALL-ELECTRIC RESIDENTIAL BUILDINGS

Add new text as follows:

<u>User Note</u>.

<u>**User Note:** Federal statutes preempt local regulation of some non-electric equipment. Jurisdictions considering adopting Appendix RE should verify that the provisions are not preempted.</u>

Reason Statement:

This proposal adds a User Note to Appendix RE to help jurisdictions make informed decisions when evaluating adoption of the all-electric provisions. Since this appendix was voted on by the committee earlier in the development cycle, the U.S. District Court of Appeals for the Ninth Circuit issued a unanimous opinion in the case of California Restaurant Association v. City of Berkeley, finding that the Berkeley ordinance is preempted by EPCA. The Ninth Circuit Decision has potential implications for state and local jurisdictions considering similar measures aimed at eliminating the end-use of natural gas in homes and businesses. Therefore, either a User Note should be added or the appendix should be deleted in its entirety.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The proposal adds a user note.

RE2D-51-23

RE2D-52-23

IECC RE: APPENDIX RE, RE102, RE102.1

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code [RE] [RE Project] R3

Delete without substitution:

~~APPENDIX RE ALL-ELECTRIC RESIDENTIAL BUILDINGS~~

~~RE102 — GENERAL DEFINTITIONS~~

~~RE102.1~~ .

~~**ALL-ELECTRIC BUILDING.**~~
~~A building that contains no combustion equipment, or plumbing for combustion equipment, installed within the building, or~~

~~*building site*~~

~~.~~

~~**APPLIANCE.** A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.~~
~~**COMBUSTION EQUIPMENT.** Any equipment or appliance used for space heating, *service water heating*, cooking, clothes drying and/or lighting that uses fuel gas or *fuel oil*.~~
~~**EQUIPMENT.** Piping, ducts, vents, control devices and other components of systems other than appliances that are permanently installed and integrated to provide control of environmental conditions for buildings. This definition shall also include other systems specifically regulated in this code.~~
~~**FUEL OIL.** Kerosene or any hydrocarbon oil having a flash point not less than 100°F (38°C).~~

Reason Statement:

Delete proposed changes to Appendix RE. As proposed, this Appendix could be enforced as normative requirements of the IECC RE, not as “informative.” The “intent” as written would likely serve only to push climate-related emissions upstream through the delivered energy chain. No analysis of this unintended consequence is evidenced. The Appendix, if enforced, would prescribe energy decisions and force energy choice in the direction of grid electricity, thereby subsidizing electric utilities at the expense of building owners and occupances by monopolizing energy use. As a broader solution beyond the scope of this public review, the Appendix should be removed since it does not belong in the IECC RE as a minimum energy code and would be better considered in the an electrical building code and perhaps a “stretch” or “green” building code if analysis would justify electricity (grid and renewable onsite) as singular option.

Cost Impact:

The code change proposal will decrease the cost of construction.

If adopted as normative requirements, builders would be required to install energy equipment and system at additional cost for many applications.

RE2D-52-23

RE2D-53-23

IECC RE: APPENDIX RG, RG101, RG101.1, RG101.2, TABLE RG101.2, RG101.3

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code [RE] [RE Project] R3

Delete without substitution:

~~APPENDIX RG 2024 IECC STRETCH CODE~~

~~RG101 — COMPLIANCE~~

~~RG101.1 SIMULATED BUILDING PERFORMANCE COMPLIANCE.~~

~~Compliance based on simulated building performance requires that a building comply with of the following:~~
~~1.The requirements of the sections indicated within Table R405.2. 2.The proposed total building thermal envelope thermal conductance TC, shall be less than or equal to the building thermal envelope thermal conductance TC using the prescriptive U-factors and F-factors from Table R402.1.2 multiplied by 1.08 in Climate Zones 0, 1, and 2, and 1.15 in Climate Zones 3 through 8 in accordance with Equation 4-2 and Section R402.1.5. The area-weighted maximum fenestration SHGC permitted in Climate Zones 0 through 3 shall be 0.30.~~

- ~~3.For each *dwelling unit* with one or more fuel burning *appliances* for space heating or water heating, or both, the annual *energy cost* of the *dwelling unit* shall be less than or equal to 70 percent of the annual *energy cost* of the *standard reference design* . For all other *dwelling units*, the annual *energy cost* of the *dwelling unit* shall be less than or equal to 75 percent of the annual *energy cost* of the *standard reference design* . For each *dwelling unit* with greater than 5,000 square feet (465 m2) of *living space* located above *grade plane*, the annual *energy cost* of the *dwelling unit* shall be reduced by an additional 5 percent of annual *energy cost* of the *standard reference design* . Energy prices shall be taken from an *approved* source, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. *Code officials* shall be permitted to require time-of-use pricing in *energy cost* calculations.~~

~~**Exceptions:**~~

1.	The energy use based on source energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the *energy cost*. The source energy multipliers for electricity shall be 2.51. The source energy multiplier for fuels other than electricity shall be 1.09.
2.	The energy use based on site energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the *energy cost*.

~~RG101.2 ERI-based compliance.~~

~~Compliance based on an ERI analysis requires that the rated design and each confirmed as-built dwelling unit be shown to have an ERI less than or equal to the applicable value indicated in Table R406.5 where compared to the ERI reference design as follows:~~

1.	Where on-site renewables are not installed, the maximum ENERGY RATING INDEX NOT INCLUDING OPP applies.
2.	Where on-site renewables are installed, the maximum ENERGY RATING INDEX INCLUDING OPP applies.

~~**Exceptions:**~~

1.	Where the ERI analysis excludes OPP, the maximum ENERGY RATING INDEX NOT INCLUDING OPP shall be permitted.
2.	For *buildings* with twenty or more *dwelling units*, where *approved* by the *code official* , compliance shall be permitted using the Average Dwelling Unit Energy Rating Index, as calculated in accordance with ANSI/RESNET/ICC 301.

~~TABLE RG101.2 MAXIMUM ENERGY RATING INDEX~~

~~RG101.3 Additional energy efficiency credit requirements.~~

~~Residential buildings shall earn not less than twenty credits from not less than two measures specified in Table R408.2. Five additional credits shall be earned for dwelling units with more than 5,000 square feet (465 m2) of living space located above grade plane . To earn credit as specified in Table R408.2 for the applicable Climate Zone, each measure selected for compliance shall comply with the applicable subsections of Section R408. Each dwelling unit or sleeping unit shall comply with the selected measure to earn credit. Interpolation of credits between measures shall not be permitted.~~

Reason Statement:

As minimum energy efficiency code, the IECC should not include “stretch” or “green” requirements even as informative materials. As proposed, this Appendix could be enforced as normative requirements of the IECC RE, not as “informative.”

Cost Impact:

The code change proposal will decrease the cost of construction.

If adopted as normative code coverage, the requirements would increase energy efficiency measures beyond minimum code levels and accrue associated additional construction costs.

RE2D-53-23

RE2D-54-23

IECC RE: APPENDIX RH, RH101

Proponents:

Eric Tate, representing Atmos Energy (eric.tate@atmosenergy.com)

2024 International Energy Code [RE] [RE Project] R3

Delete without substitution:

~~APPENDIX RH OPERATIONAL CARBON RATING AND ENERGY REPORTING~~

~~RH101 GENERAL DEFINITIONS~~.

~~CO2e INDEX. A numerical integer value, calculated in accordance with ANSI / RESNET / ICC 301 that represents the relative Carbon Dioxide equivalence (CO2e) emissions of a rated design as compared with the CO2e emissions of the CO2e reference design and where an Index value of 100 represents the CO2e performance of the CO2e reference design and an Index value of 0 (zero) represents a home that emits zero net CO2e annually.~~

Reason Statement:

The proposed rating procedure and reporting requirements are *ad hoc* and do not represent the product of a deliberative consensus process of an ANSI-recognized standards development organization (SDO). ASHRAE would be a logical source for such rating and performance technical criteria but are not referenced here. Specific to the Appendix values proposed, the requirements lack justification from transparent and reviewable analysis or citations supporting calculations.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

It is unknown how this rating scheme would affect construction costs.

RE2D-54-23

RE2D-55-23

IECC RE: RH101, RH102.3, RH406.2

Proponents:

Ram Dharmarajan, representing GTI Energy (rdharmarajan@gti.energy)

2024 International Energy Code [RE] [RE Project] R3

Delete and substitute as follows:

~~RH101~~ ~~GENERAL DEFINITIONS~~.

~~CO2e INDEX. A numerical integer value, calculated in accordance with ANSI / RESNET / ICC 301 that represents the relative Carbon Dioxide equivalence (CO2e) emissions of a rated design as compared with the CO2e emissions of the CO2e reference design and where an Index value of 100 represents the CO2e performance of the CO2e reference design and an Index value of 0 (zero) represents a home that emits zero net CO2e annually.~~

RH101 GENERAL DEFINITIONS.

CO2e INDEX. A numerical integer value, that represents the relative Carbon Dioxide equivalence (CO2e) emissions of a rated design as compared with the CO2e emissions of the CO2e reference design and where an Index value of 100 represents the CO2e performance of the CO2e reference design and an Index value of 0 (zero) represents a home that emits zero net CO2e annually. The CO2e Index is calculated using the most recent eGRID emission factors for electricity and the current emission factors for fuels, in conjunction with the hourly purchased energy for both rated and reference home.

Revise as follows:

RH102.3 ERI and $CO2_e$ Index compliance.

Compliance based on the ERI and CO2e Index requires that the rated design and as-built dwelling unit meet all of the following:

1.	The requirements of the sections indicated within Table R406.2.
2.	Maximum ERI values indicated in Table R406.5.
3.	For all dwelling units, maximum $CO2_e$ Index of 65, not including OPP.

RH406.2 ERI and CO_2e Index compliance.

Compliance based on ERI and CO2e Index requires that the rated design and as-built dwelling unit meet all of the following:

1.	The requirements of the sections indicated within Table N1106.2.
2.	Maximum ERI values indicated in Table N1106.5.
3.	For all ~~electric~~ dwelling units, maximum CO_2e Index of 65, not including OPP~~, determined in accordance with ANSI/RESNET/ICC 301. For mixed fuel dwelling units, a maximum CO_2e Index established at the time of adoption of this Appendix by the authority having jurisdiction based on the CO_2e emissions data specific to the jurisdiction.~~

Reason Statement:

Appendix RH requires residential buildings to comply with an operation carbon rating index specified by ANSI/RESNET/ICC 301 index. This CO2 rating index is calculated using the annual hourly CO2 emissions for the rated home relative to the reference home. However, the methodology being considered for deriving the emission factors is not consistent across energy sources. The emission factors for electricity are derived from a levelized calculation of the Cambium Low RE cost scenario run, which accounts for a progressively cleaner grid until 2050. However, the emission factors for fuels such as natural gas, fuel oil and LPG are static i.e. consider historic values published in US EPA AP42. It is important to have an apple to apples comparison between the CO2 emissions from an electric home and a mixed fuel home.

The proposed revision would recommend the use of the most recent eGRID emissions factors for electricity and the current emission factors for fuels, in conjunction with the hourly purchased energy by fuel type for both homes as a means to calculate the CO2 rating index. These factors should also recognize that emission factors for low carbon fuels (renewable natural gas, renewable propane and hydrogen blends etc.) can be incorporated into the CO2 rating index calculations whenever applicable for a mixed fuel home.

The proposed revision also proposes that CO2 rating index requirement is either specified and not left up to the AHJ's discretion, either use 65 for all homes or incorporate a dual baseline rating requirement.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The proposal change does not impact cost of construction.

RE2D-55-23

RE2D-56-23

IECC RE: RH101, RH406.2

Proponents:

Shannon Corcoran, representing American Gas Association (corcoransm@att.net)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

RH101 GENERAL DEFINITIONS.

CO2e INDEX. A numerical integer value, calculated in accordance with ANSI / RESNET / ICC 301 that represents the relative Carbon Dioxide equivalence (CO2e) emissions of a rated design as compared with the CO2e emissions of the CO2e reference design and where an Index value of 100 represents the CO2e performance of the CO2e reference design and an Index value of 0 (zero) represents a home that emits zero net CO2e annually.

<u>The CO2e Index shall be calculated in accordance with ANSI/RESNET/ICC 301, except that, data for the sub-region annual non-baseload output emission rates for the most recent year eGrid database published by Environmental Protection Agency's for electricity generation shall be used rather than the Cambium database to calculate emissions associated with electricity.</u>

RH406.2 ERI and CO_2e Index compliance.

Compliance based on ERI and CO2e Index requires that the rated design and as-built dwelling unit meet all of the following:

1.	The requirements of the sections indicated within Table N1106.2.
2.	Maximum ERI values indicated in Table N1106.5.
3.	For all ~~electric~~ dwelling units, maximum CO_2e Index of 65, not including OPP, determined in accordance with ANSI/RESNET/ICC 301. ~~For mixed-fuel dwelling units, a maximum CO_2e Index established at the time of adoption of this Appendix by the authority having jurisdiction based on the CO_2e emissions data specific to the jurisdiction.~~

Reason Statement:

This proposal would add an **APPENDIX RH, Operational Carbon Rating and Energy Reporting** which would allow a local jurisdiction to adopt as mandatory a requirement that all residential buildings certify compliance based on the ERI and CO2e Index in accordance with ANSI/RESNET/ICC 301.

The requirement that a residential building complies with a CO2e Index is not an issue if that index is calculated properly and fairly. The methodology being used in Addendum B of ANSI/RESNET/ICC 301 is flawed and does not treat different energy sources fairly. For example, the emission factors for combustion fuels are historical factors and do not take into account advancements in renewable fuels and hydrogen which will both contribute to a reduction in carbon intensity in future years.

Emissions factors for electricity in the RESNET standard use NREL's Cambium database to project out 25 years into the future and then levelized that factor based on an optimistic scenario and low discount rate. This results in an emissions factor for electricity that is much lower than current emissions factors, sometimes lower by half or more. A homeowner will be misled to believe that an all-electric home has a much lower CO2e Index as compared to a mixed-fuel home, even though that is not necessarily the case.

In addition, RED1-28-22 requires an all-electric home to have a maximum CO2e Index of 65, but for a mixed-fuel home, allows the AHJ to establish both the CO2e Index and CO2e emissions factor. This will allow for extreme gaming of this compliance requirement, rendering it meaningless.

Our recommendation would be to use the most current emissions factors for fuels and the most recent eGrid subregion non-baseload emissions factors for electricity to create the CO2e Index. These factors can be updated on an annual basis. Recommended language is shown below.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The proposal neither increases nor decreases the cost of construction

RE2D-56-23

RE2D-57-23

IECC RE: RH101, RH406.2

Proponents:

Renee Lani, representing American Public Gas Association (rlani@apga.org)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

RH101 GENERAL DEFINITIONS.

CO2e INDEX. A numerical integer value~~, calculated in accordance with ANSI / RESNET / ICC 301~~ that represents the relative Carbon Dioxide equivalence (CO2e) emissions of a rated design as compared with the CO2e emissions of the CO2e reference design and where an Index value of 100 represents the CO2e performance of the CO2e reference design and an Index value of 0 (zero) represents a home that emits zero net CO2e annually.

The CO2e Index shall be calculated in accordance with ANSI/RESNET/ICC 301, except that, data for the sub-region annual non-baseload output emission rates for the most recent year eGrid database published by Environmental Protection Agency's for electricity generation shall be used rather than the Cambium database to calculate emissions associated with electricity.

RH406.2 ERI and CO_2e Index compliance.

Compliance based on ERI and CO2e Index requires that the rated design and as-built dwelling unit meet all of the following:

1.	The requirements of the sections indicated within Table N1106.2.
2.	Maximum ERI values indicated in Table N1106.5.
3.	For all ~~electric~~ dwelling units, maximum CO_2e Index of 65, not including OPP, determined in accordance with ANSI/RESNET/ICC 301. ~~For mixed-fuel dwelling units, a maximum CO_2e Index established at the time of adoption of this Appendix by the authority having jurisdiction based on the CO_2e emissions data specific to the jurisdiction.~~

Reason Statement:

APGA appreciates the opportunity to provide IECC-C Committee this input. APGA is the national trade association for approximately 1,000 communities across the U.S. that own and operate their own retail natural gas distribution entities. They include municipal gas distribution systems, public utility districts, county districts, and other public agencies, all locally accountable to the citizens they serve. Public gas systems focus on providing safe, reliable, resilient, and affordable natural gas service to their customers. APGA members serve their communities by providing sustainable and clean energy to be used for cooking, clothes drying, and space and water heating, as well as for various commercial and industrial applications.

APGA is concerned with the IECC's use of Addendum B of ANSI/RESNET/ICC 300, as we believe it is flawed because it does not treat different energy sources in the same manner. This is demonstrated by the fact that the natural gas industry's current efforts to decarbonize with increases in the use of RNG and H2 (as well as future commitments to further utilize these fuels) are not reflected in the relevant emission factors, but those for electricity are based on the Cambium database that projects out 25 years and assumes a very optimistic and low-emission electric generation sector.

APGA is also concerned that this provision would explicitly assign a max. CO2e Index to all-electric homes but leave it to the AHJ for mixed-energy homes, such as those using natural gas, as it could unfairly (and potentially impermissibly) be used to greatly deter mixed-energy construction.

APGA encourages the committee to make the suggested edits to remedy these concerns.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

This proposal has no direct impact on cost of construction.

RE2D-57-23

RE2D-58-23

IECC RE: APPENDIX RI, RI103, RI103.1, RI103.1.1, RI103.1.1.1, RI103.1.2, TABLE RI103.1.2, RI103.1.3, RI103.2

Proponents:

Bronte Payne, representing Bronte Payne (bronte.payne@sunpower.com)

2024 International Energy Code [RE] [RE Project] R3

APPENDIX RI ON-SITE RENEWABLE ENERGY

RI103 — ON-SITE RENEWABLE ENERGY

RI103.1 General.

Buildings shall shall comply with Section N1101.2 and the requirements of this section.

RI103.1.1 Installed capacity.

An on-site renewable energy system shall be installed on, or at the site of, the building with a peak rated capacity, measured under standard test conditions, in accordance with one of the following:

1.	For one- and two- family dwellings, townhouses and other Group R-3 occupancies, the peak rated capacity shall be no less than 2kW.
2.	For Group R-2 or R-4 residential buildings, the peak rated capacity shall be no less than 0.75 W/ft^2 multiplied by the gross *conditioned floor area*.
3.	Where a building includes both commercial occupancies and R-2 or R-4 occupancies required to comply with this Code, the peak capacity shall be no less than 0.75 W/ft^2 multiplied by the gross *conditioned floor area* of the Group R-2 and R-4 occupancies.

The capacity of installed *on-site renewable energy* systems used to comply with this Appendix shall be in addition to the total capacity of installed *on-site renewable energy* systems used to comply with all other requirements of this Code.

Exceptions:

1.	A building with a permanently installed domestic solar water heating system sized with a solar savings fraction of not less than 0.5 based on the total *service water heating* load of all residential occupancies.
2.	One and two family dwellings, townhouses and other Group R-3 Occupancies in *climate zone* 4C, 5C or 8.
3.	Group R-2 or R-4 occupancies in *climate zone* 8.
4.	Buildings where the potential solar zone area is less than 300 square feet (28 m^2)
5.	Buildings with a physical renewable energy power purchase agreement with a duration of not less than 15 years from a utility or a community renewable energy facility and for not less than 80 percent of the estimated whole-building electric use on an annual basis. This exception shall not apply where off-site renewable energy credits are used to comply with the requirements of Section N1108.

6.	Buildings that demonstrate compliance in accordance with Section RI103.1.1.1

RI103.1.1.1 Alternate capacity determination.

Where compliance is demonstrated in accordance with Section N1105 Simulated Building Performance and the proposed design and standard reference design are adjusted in accordance with Items (1) and (2), the required capacity of the installed renewable energy systems shall be permitted to differ.

1.	*Proposed Design*. Where applicable, the *proposed design* shall comply with one of the following:	
	1.1	Where one or more systems providing *on-site renewable energy* are included in the *construction documents*, the systems shall be modeled in the *proposed design* with a design capacity not greater than the required capacity in accordance with Section RI103.1.1. A combination of *on-site renewable energy* systems shall be permitted to be included in the *proposed design*.
	1.2	Where no *on-site renewable energy* systems are specified in the *construction documents*, no *on-site renewable energy* systems shall be modeled in the *proposed design*.
2.	Standard Reference Design. Where applicable, the *standard reference design* shall comply with one of the following:	
	2.1	Where a *proposed design* includes one or more *on-site renewable energy* systems the same systems shall be modeled identically in the *standard reference design* except the total rated capacity of all systems shall be equal to the required capacity in accordance with Section RI103.1.1. Where more than one type of *on-site renewable energy* system is modeled, the total capacity of each system shall be allocated in the same proportion as in the *proposed design*.
	2.2	Where the *proposed design* does not include any *on-site renewable energy* systems, an unshaded photovoltaic system shall be modeled in the *standard reference design* in accordance with the performance criteria in Table RI103.1.1.1(1).

RI103.1.2 ERI With OPP Requirements.

Where compliance is demonstrated in accordance with Section R406.5 using the Energy Rating Index With OPP, a project shall comply with the requirements of this Appendix if the rated proposed design and confirmed built dwelling are shown to have an ERI less than or equal to the values in Table RP103.1.2.

TABLE RI103.1.2 MAXIMUM ENERGY RATING INDEX INCLUDING OPP

RI103.1.3 ERI With OPP Requirements.

Where compliance is demonstrated in accordance with Section N1106.5 using the Energy Rating Index With OPP, a project shall comply with the requirements of this Appendix if the rated proposed design and confirmed built dwelling are shown to have an ERI less than or equal to the values in Table RI103.1.3.

RI103.2 Renewable energy certificate (REC) documentation.

Where RECs are associated with renewable energy power production required by Section RI103.2 or RI103.3, documentation shall comply with Section N1104.4 Renewable energy certificate (REC) documentation.

Attached Files

- **Residential Solar Letter 6.30.23.pdf**
  https://energy.cdpaccess.com/proposal/1820/3563/files/download/553/

Reason Statement:

NA

Bibliography:

NA

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

NA

RE2D-58-23

REC2D-1-23

IECC RE: R402.2.9.1, R402.2.9.2 (New), R402.2.10.2, R402.2.11.2, R402.1.5, R405.4.2, RF105, RF105.1 (New), TABLE RF105.1 (New), RF106, RF107, RF106.1 (New), TABLE RF106.1 (New)

Proponents:

Jay Crandell, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

2024 International Energy Code [RE] [RE Project] R3

Revise as follows:

R402.2.9.1 Basement wall insulation installation.

Where *basement walls* are insulated, the insulation shall be installed from the top of the *basement wall* down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less, or in accordance with Section R402.2.9.2 ~~the *proposed design* or the *rated design*, as applicable~~.

Add new text as follows:

R402.2.9.2 Alternative basement wall insulation configurations..

For *buildings* complying with Sections R405 or R406, basement wall insulation shall be installed in accordance with the *proposed design* or *rated design*. The proposed or *rated design* shall use an alternative insulation configuration and associated C-factor or U-factor complying with Appendix A of ANSI/ASHRAE/IES 90.1 or associated U-factor complying with Section RF105 of Appendix RF of this code. Where used to comply with Table R402.1.2, the proposed basement wall U-factor shall be equal to or less than the U-factor required by Table R402.1.2 for basement walls. Where used to comply with Section R402.1.5 or Section R408.2.1, effective U-factors for the basement wall reference and proposed design shall be applied in accordance with Section R402.1.5.

Revise as follows:

R402.2.10.2 Alternative slab-on-grade insulation configurations.

For buildings complying with Sections R405 or R406, slab-on-grade insulation shall be installed in accordance with the proposed design or rated design . The proposed or rated design shall use an alternative insulation configuration and associated F-factor complying with Appendix A of ANSI/ASHRAE/IES 90.1 or~~, where adopted,~~ Section RF105 of Appendix RF of this code. Where used to comply with Table R402.1.2 ~~Section R401.2.1~~, the proposed F-factor shall be equal to or less than the F-factor required by Table R402.1.2 for a heated or unheated slab, as applicable. Where used to comply with Section R402.1.5 or Section R408.2.1, F-factors for the slab-on-grade reference and proposed design shall be applied in accordance with Section R402.1.5.

R402.2.11.2 Alternative crawl space wall insulation configurations.

For buildings complying with Sections R405 or R406 crawl space wall insulation shall be installed in accordance with the proposed design or rated design . The proposed or rated design shall use an alternative insulation configuration and associated U-factor or C-factor complying with Appendix A of ANSI/ASHRAE/IES 90.1 or~~, where adopted,~~ Appendix RF of this code. Where used to comply with Section R401.2.1, the U-factor or C-factor shall be equal to or less than the U-factor required by Table R402.1.2 for crawl space walls. Where used to comply with Section R402.1.5 or Section R408.2.1, effective U-factors for the crawlspace wall reference and proposed designs shall be applied in accordance with Section R402.1.5.

R402.1.5 Component performance alternative.

Where the proposed total *building thermal envelope thermal conductance* TC_p is less than or equal to the required total *building* *thermal envelope* thermal conductance TC_r using factors in Table R402.1.2 the *building* shall be considered to be in compliance with Table R402.1.2. The total thermal conductance TC shall be determined in accordance with Equation 4-1. Proposed *U*-factors and slab-on-grade *F*-factors shall be taken from ANSI/ASHRAE/IES Standard 90.1 Appendix A or determined using a method consistent with the ASHRAE *Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials. In addition to total thermal conductance TC compliance, the SHGC requirements of Table R402.1.2 and the maximum *fenestration U*-factors of Section R402.6 shall be met.

$$\cancel{(Up\ A + Fp\ P) \leq (Ur\ A + Fr\ P)}\underline{TC_p \leq TC_r}$$

(Equation 4-1)

Exception: Use of an *approved* component performance methodology addressing the same *building thermal envelope* components of this section and criteria of this code in a manner consistent with the envelope performance factor methodology of ANSI/ASHRAE/IES 90.1 Appendix C.

$TC_p = U_p A + F_p P$

$TC_r = U_r A + F_r P$

$U_p A$ = the sum of proposed U-factors times the assembly areas in the proposed *building*.

$F_p P$ = the sum of proposed F-factors times the slab-on-grade perimeter lengths in the proposed *building*.

$U_r A$ = the sum of U-factors in Table R402.1.2 times the same assembly areas as in the proposed *building*.

$F_r P$ = the sum of F-factors in Table R402.1.2 times the same slab-on-grade perimeter lengths as in the proposed building.

Exception: Exception: For Climate Zones 0, 1, and 2, the value of F_rP shall equal the value of F_pP

Where U-factors for below-grade basement and crawlspace walls are included in the calculation of TCp and TCr, the U-factors for the reference and proposed design shall be based on effective U-factors in accordance with Section RF105.1 of Appendix RF. The effective U-factor for the reference design shall be based on the insulation R-value and configuration of Table R402.1.3. For slabs on grade, the reference F-factor shall be based on Table R402.1.2 and the proposed F-factor shall be based on Section RF106.1 of Appendix RF or an *approved* source.

R405.4.2 Residence specifications.

The *standard reference design, proposed design, and as-built dwelling unit* shall be configured and analyzed as specified by Table R405.4.2(1). Table R405.4.2(1) shall include, by reference, all notes contained in Table R402.1.2.Proposed *U*-factors and slab-on-grade *F*-factors shall be taken from Appendix RF of this code, ANSI/ASHRAE/IES Standard 90.1 Appendix A or determined using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials.

RF105 — BASEMENT AND CRAWLSPACE WALLS ~~RESERVED~~

Add new text as follows:

RF105.1 Basement and crawlspace walls..

U-factors for basement and crawlspace walls shall comply with insulation R-values and configurations specified in Table RF105.1. Where used to substitute alternative basement and crawlspace wall insulation R-values and configurations for compliance with Table 401.1.2, the applicable wall U-factor of Table RF105.1 shall be used. Where used with Section R402.1.5 to determine overall building thermal envelope conductance (TC), the applicable effective U-factors from Table RF105.1 shall be used for basement and crawlspace walls for the reference and proposed design. Basement slabs and crawlspace slabs or gravel floor shall be separately addressed in accordance with Section RF106, including adjustment for the floor depth below exterior finish grade. Effective U-factors shall not be used for compliance with Sections R405 and R406.

TABLE RF105.1 BASEMENT AND CRAWLSPACE WALLS

Insulation Configurations[c]	Wall U-factor (Btu/hr-ft^2-F)	Wall Effective U-factor[d] by Percentage of Wall Height Projecting Above Grade (Btu/hr-ft2-F)			
		50%	35%	20%	5%
BASEMENT WALLS					
Uninsulated & unfinished basement wall	0.360	0.324	0.288	0.252	0.216
Continuous Insulation	-	-	-	-	-
R-5ci	0.122	0.109	0.097	0.085	0.073
R-7.5ci	0.093	0.084	0.075	0.065	0.056
R-10ci	0.076	0.068	0.060	0.053	0.045
R-15ci	0.055	0.049	0.044	0.038	0.033
R-20ci	0.043	0.039	0.034	0.030	0.026
R-25ci	0.035	0.032	0.028	0.025	0.021
Cavity Insulation	-	-	-	-	-
R-11	0.076	0.068	0.060	0.053	0.045
R-13	0.067	0.060	0.054	0.047	0.040
R-15	0.060	0.054	0.048	0.042	0.036
R-19	0.050	0.045	0.040	0.035	0.030
R-21	0.045	0.041	0.036	0.032	0.027
Cavity + Continuous Insulation	-	-	-	-	-
R-13 + R-5ci	0.050	0.045	0.040	0.035	0.030
R-13 + R-7.5ci	0.045	0.040	0.036	0.031	0.027
R-13 + R-10ci	0.040	0.036	0.032	0.028	0.024
R-19 + R-5ci	0.040	0.036	0.032	0.028	0.024
R19 + R-7.5ci	0.036	0.033	0.029	0.025	0.022
R19 + R-10ci	0.033	0.030	0.027	0.023	0.020
CRAWLSPACE WALLS					
Unisulated crawlspace wall	0.477	0.429	0.382	0.334	n/a

Continuous Insulation	-	-	-	-	-
R-5ci	0.141	0.127	0.113	0.099	n/a
R-7.5ci	0.104	0.094	0.083	0.073	n/a
R-10ci	0.083	0.074	0.066	0.058	n/a
R-15ci	0.058	0.053	0.047	0.041	n/a
R-20ci	0.045	0.041	0.036	0.032	n/a
R-25ci	0.037	0.033	0.030	0.026	n/a
Cavity Insulation	-	-	-	-	-
R-11	0.083	0.074	0.066	0.058	n/a
R-13	0.072	0.065	0.058	0.051	n/a
R-15	0.065	0.058	0.052	0.045	n/a
R-19	0.054	0.049	0.043	0.038	n/a
R-21	0.048	0.043	0.038	0.033	n/a
Cavity + Continuous Insulation	-	-	-	-	-
R-13 + R-5ci	0.053	0.048	0.043	0.037	n/a
R-13 + R-7.5ci	0.047	0.042	0.038	0.033	n/a
R-13 + R-10ci	0.042	0.038	0.034	0.029	n/a
R19 + R-5ci	0.043	0.038	0.034	0.030	n/a
R19 + R-7.5ci	0.039	0.035	0.031	0.027	n/a
R19 + R-10ci	0.035	0.032	0.028	0.025	n/a

n/a = not applicable

a.	The wall U-factor excludes exterior air-film R-value and, for insulated assemblies, includes the following: 0.68 R for interior air film, 0.45 R for ½” gypsum panel finish (insulated basement walls only), and 2.1 R for 12” block basement wall or 1.4 R for 8” block crawlspace wall, both with empty cells. Where cavity insulation is included between 2x4 or 2x6 framing on the interior side of a foundation wall, wood stud material with thermal resistivity of R-1.25/in is assumed to be spaced at minimum 16-inches on center with an assumed framing factor of no greater than 0.15.
b.	Interpolation between R-values and percentage of wall height projecting above grade within a given insulation configuration type is permissible.
c.	All insulation configurations extend from top of foundation wall to floor of basement or crawlspace. Extrapolation to partial height insulation shall not be permitted; U-factors for such insulation configurations shall be determined by accepted engineering practice for modeling of thermal bridging and ground-coupled assemblies with results converted to an equivalent air-to-air annual heat transfer basis to determine effective U-factors.

c.	Effective U-factors are adjusted to account for ground-coupling effects to provide equivalency to U-factors used for above-grade building thermal envelope assemblies. The effective U-factors are provided for use with Section R402.1.5 for evaluation of trade-offs with above-grade assemblies and components of the building thermal envelope. The effective U-factor shall apply to the foundation wall area from interior floor or ground surface to top of wall.

Revise as follows:

~~RF106 — CRAWLSPACE WALLS~~ ~~RESERVED~~

RF106 ~~RF107~~ — SLABS-ON-GRADE

Add new text as follows:

RF106.1 Slabs-on-grade..

F-factors for unheated and heated slabs-on-grade shall comply with the insulation R-values and configurations specified in Table RF106.1. All applicable adjustment factors in the table footnotes shall apply.

TABLE RF106.1 F-FACTORS FOR SLABS-ON-GRADE[a,b,c,d,e,f]

Unheated Slabs-on-Grade -- Insulation Configurations	F-factor (Btu/hr-ft-F)
Uninsulated Slab	0.73
Horizontal Insulation Under Slab at Slab Perimeter -- Slab Edge Not Insulated	-
>= R-5 for 2ft	0.70
R-5 for 4ft	0.67
>= R-10 for 4ft	0.64

Vertical Insulation on Exterior Face[g] -- Slab Edge Insulated[h]	-
R-2.5 for 2ft	0.66
R-5 for 2ft	0.58
R-7.5 for 2ft	0.56
R-10 for 2ft	0.54
R-15 for 2ft	0.52
R-5 for 3 ft	0.56
R-7.5 for 3ft	0.54
R-10 for 3ft	0.51
R-15 for 3ft	0.49
R-5 for 4ft	0.54
R-7.5 for 4ft	0.51
R-10 for 4ft	0.48
R-15 for 4ft	0.45
Fully Insulated Slab - Full Slab Area and Slab Edge Continuously Insulated	-
R-5 entire slab area and R-3.5 edge	0.48
R-5 entire slab area and edge	0.46
R-7.5 entire slab area and R-3.5 edge	0.45
R-7.5 entire slab area and edge	0.41
R-10 entire slab area and R-5 edge	0.40
R-10 entire slab area and edge	0.36
R-15 entire slab area and R-5 edge	0.35
R-15 entire slab area and edge	0.30
R10 slab edge and under slab perimeter inward 4ft; R-5 remaining slab area	0.42
R-15 slab edge and under slab perimeter inward 4ft; R-5 remaining slab area	0.40
R-15 slabe edge and under slab perimeter inward 4ft; R-10 remaining slab area	0.34
Heated Slabs-on-Grade -- Insulation Configurations	F-factor (Btu/hr-ft-F)
Uninsulated	1.35

Fully Insulated Slab -- Full Slab Area and Slab Edge Continuously Insulated	-
R-5 entire slab area and R-3.5 edge	0.77
R-5 entire slab area and edge	0.74
R-7.5 entire slab area and R-3.5 edge	0.71
R-7.5 entire slab area and edge	0.64
R-10 entire slab area and R-5 edge	0.62
R-10 entire slab area and edge	0.55
R-15 entire slab area and R-5 edge	0.54
R-15 entire slab area and edge	0.44
R-20 entire slab area and R-7.5 edge	0.44
R-20 entire slab area and edge	0.37
R-5 entire slab area and R-10 slab edge extending downward for min. 3ft	0.66
R-10 slab edge and under slab perimeter inward 4ft; R-5 remaining slab area	0.66
R-15 slab edge and under slab perimeter inward 4ft; R-5 remaining slab area	0.62
R-15 slab edge and under slab perimeter inward 4ft; R-10 remaining slab area	0.51

a . For alternative slab-on-grade insulation configurations, F-factors shall be determined in accordance with accepted engineering practice for modeling three dimensional ground-coupled building assemblies using project-specific building and site conditions to estimate annual energy use attributed to foundation heat transfer and converting the result to an equivalent air-to-air F-factor basis.

b. Interpolation between R-values for a given insulation configuration type is permissible.

c . Tabulated F-factors are based on a typical soil thermal conductivity of 0.75 Btu/hr-ft-F and shall be multiplied by one of the following adjustment factors as applicable to site soil conditions: (1) rock or any soil on sites with poor drainage or high water table – 1.2; (2) sandy soils – 1.1; (3) loam or clay soils on well-drained sites in dry climate regions – 0.85; and (3) for all other soil or site conditions – 1.00. Where soil conditions are unknown, use of 1.00 shall be permitted.

d . Tabulated F-factors are based on a slab area to perimeter length ratio of 9:1 and shall be multiplied by one of the following adjustment factors as applicable to a slab's area to perimeter length ratio: 5:1 – 0.7; 6:1 – 0.8; 7:1 – 0.9; 8:1 – 0.95; 9:1 – 1.0; 10:1 – 1.05; 15:1 – 1.2; 20:1 – 1.35; 30:1 – 1.5; and for ≥ 40:1 – 1.7.

e . Tabulated F-factors are based on a slab perimeter edge projection above exterior finish grade of 6 inches. For portions of slab perimeter projecting 12 inches or more above grade, multiply the tabulated F-factors by one of the following adjustment factors as applicable: 12 inches – 1.05; 18 inches – 1.1; 24 inches – 1.15; and 30 inches – 1.2.

f . For basement floor slabs and crawlspaces slabs or gravel floors, the tabulated F-factors shall be multiplied by one of the following adjustment factors based on the depth of the floor surface below exterior finish grade: 1 ft – 0.95; 3 ft – 0.9; and 6 ft or more – 0.8.

g. Vertical insulation on the exterior shall extend for the indicated depth below finish grade and above grade to the top of slab or stem wall. Where insulation is placed on the interior side of a foundation stem wall, it shall extend from the top of slab to the indicated depth below the exterior finish grade and the applicable tabulated F-factor shall be multiplied by 1.05.

h. The R-value of the vertical insulation located on the interior side of a stem wall shall be permitted to be reduced to R-2.5 at the slab edge, not exceeding 6 inches thick, provided the applicable F-factor is multiplied by 1.15 where R-5 vertical insulation is specified, 1.2

where R-10 vertical insulation is specified, or 1.25 where R-15 vertical insulation is specified.

Reason Statement:

The main purpose of this proposal is to coordinate with changes to R402.2.10.2 (slabs-on-grade) and R402.2.11.2 (crawlspace walls) which added a reference to Appendix RF in the legislative draft, but the appendix did not include solutions for these assemblies (only placeholders). This proposal provides the solutions and data in Appendix RF as anticipated as a follow-up to these changes made during the recently completed Draft 1 development. It also adds a consistent reference to Appendix RF for alternative assemblies used in the simulated performance compliance path (Section R405). The tabulated F-factors align with those used for R-value and F-factor requirements in Tables R402.1.2 and R402.1.3 of the code. The values are based on the same research used for the code and also referenced in ASHRAE 90.1 Appendix A (see bibliography).

More importantly, tabulated U-factors (and effective U-factors) for below-grade walls (enclosing conditioned basements or crawlspaces) are also provided based on the same research. The effective U-factors for below grade walls are derived in the same manner as F-factors where ground coupling effects are considered and then used to convert the U-factor (or C-factor as used in the commercial code) to an effective value based on air-to-air (instead of air-to-ground) heat exchange such that they have the same basis as U-factors used for above grade assemblies in terms of impacts on annual energy use. This also ensures that equivalent “apples-to-apples” trade-offs are made between above- and below-grade assemblies when using Section R402.1.5 (see revisions to R402.1.5 to coordinate). It also ensures consistent additional UA credits are achieved in accordance with Section R408 for above- and below-grade assemblies. Without these effective U-factors for basement and crawlspace walls, the trade-off value of adding insulation to a typical basement or crawlspace could be over-estimated by as much as 60%. This degree of non-conservative error or bias should not be tolerable.

Alternatively, one could use REScheck (which relies on actual building energy modeling and includes ground-coupling effects) instead of Section R402.1.5 and the proposed effective U-factors. Therefore, an exception is provided for alternative methods based on whole-building energy modeling principles (which is consistent with the REScheck software approach) as laid out in Appendix C of ASHRAE 90.1. With other changes made in this proposal, results should be similar and significant conflicting results avoided.

NOTE TO STAFF: I have attached a Word file of the submitted proposal should the formatting not come through cdpACCESS correctly. It looked correct when submitted, but I had issues inputting the proposal.

Bibliography:

Kennedy, M. (1991). Super Good Cents Heat Loss Reference, Volume IV, Earth Contact: Assumptions, Calculations, and Coefficient Tables. Prepared by Ecotope, Seattle, WA for Bonneville Power Administration (Contract No. DE-AP79-91BP15338).

Baylon, D. and Kennedy, M. (2007). Calculating the Impact of Ground Contact on Residential Heat Loss. Buildings X, ASHRAE.

Cleaveland, J.P. and Akridge, J.M. (198?). Slab-on-Grade Thermal Loss in Hot Climates. Georgia Institute of Technology for ASHRAE.

Bahnfleth, W.P. and Amber, J. (1990). Algorithms for Slab-on-Grade Heat Transfer Calculations. U.S. Army Corps of Engineers, USACERL Technical Report E-90/15, September 1990.

Cost Impact:

The code change proposal will neither increase nor decrease the cost of construction.

The added supporting information in Appendix RF should provide for greater flexibility in evaluating TC trade-offs per R402.2 and R402.1.5, and also TC credit options for additional efficiency credits in R408. This is presumed to provide potential reduced costs. In some cases, depending on conditions the technical improvements could cut both ways, but this would come with the benefit of having a more accurate design where cost vs. benefits are more realistically assessed when considering how much insulation to put where on a building and where to get the lowest-cost credits or trade-offs for a particular building envelope design.

REC2D-1-23