IECC COMMERCIAL COMMITTEE ACTION REPORT ON THE RESULTS ON THE 2022 PUBLIC COMMENTS/CODE CHANGES TO PUBLIC COMMENT DRAFT 1 TO THE INTERNATIONAL ENERGY CONSERVATION CODE-COMMERCIAL (4/28/23)

Introduction

On July 19, 2021, Energy.cdpACCESScom was opened for 2021 Public Input Proposed Code Change submittals for consideration in the update to the 2024 International Energy Conservation Code and Chapter 11 of the International Residential Code. The submittal deadline was October 12, 2021. A total of 450 proposals were received (256 Commercial; 194 Residential). In addition, 17 committee proposals were submitted (7 Commercial; 10 Residential).

On September 6, 2022, energy.cdpaccess.com was opened for public comment on the IECC Commercial Public Comment Draft #1. The submittal deadline was October 21, 2022. On October 24, 2022, energy.cdpaccess.com was opened for public comment on the IECC Residential and Chapter 11 of the IRC Public Comment Draft #2. The submittal deadline was December 15, 2023. A total of 246 Commercial and 434 Residential proposals were received. In addition, 40 committee proposals were submitted (28 Commercial; 12 Residential)
Proposals are identified as follows:

- Commercial Energy Public Comment Draft 1 proposed code changes (CED1)
- Commercial Energy Committee Public Comment Draft 1 (CECD1) (committee proposal)
- Commercial Energy Public Comment Draft 1 public comments (CEPCD1)
- Residential Energy Public Comment Draft 1 proposed code changes (RED1)
- Residential Energy Committee Public Comment Draft 1(RECD1) (committee proposal)
- Residential Energy Public Comment Draft 1 public comments (REPCD1)
- Residential Energy IRC Public Comment Draft 1 proposed code changes (IRCED1)
- The “Part” listed after the code change indicates the respective items of the code change that involve possible coordination issues between the Commercial and Residential provisions or between the IECC-RE and IRC Chapter 11.

The process for consideration of the proposals included:

- Posting of the proposals on November 7, 2022 for Commercial, and December 23, 2022 for Residential.
- An open process of review by one of the Subcommittees established by the Consensus Committee, including interested parties
- Subcommittee recommended action on the proposals to the Consensus Committee
- Consensus Committee action on the proposals with an open process including posting of documents and participation by interested parties. The required majority for approval was 2/3 majority in accordance with Section 9.4 of the ICC Consensus Procedures.

This **Committee Action Report (CAR)** includes the following:

- A summary of the actions taken by the respective IECC Consensus Committee from November/2022 – April/2023 on each proposal. The Consensus Committee action is noted by one of the following: Approve (as submitted); Approved as Modified; or Disapproved along with the vote count and percentages for a successful action. As noted previously, In accordance with Section 9.4(b) of the ICC Consensus Procedures (ICC CP), the disposition of an item during the public input process required a 2/3 majority . Those proposals that were withdrawn by the proponent are so noted.
- All approved proposals (approve and approved as modified) are included in the CAR in legislative format, including the reason(s) for the committee action. These proposals form the basis for the ballot process below.

The results of the balloting process by the Consensus Committee will be the basis for the development of Public Comment Draft #2.

In an effort to expedite the schedule, Public Comment Draft #2 will be posted for comment during the balloting process by the Consensus Committee. Public Comment Draft #2 (PCD #2) will incorporate all text revisions to the Public Comment Draft #1 IECC/Chapter 11 of the IRC based on those code changes which have achieved the voting majorities in Section 9.4 of the ICC CP (approval by at least a majority of the committee <u>and</u> at least two-thirds of those voting, excluding abstentions). In the event that the balloting process results in a change to PCD #2, an addendum will be posted with the change clearly indicated in order to facilitate comments.

Public Comment Draft #2 will be posted and open for code change submittals via Energy.cdpACCESS. IIn accordance with Section 9.7 of the procedures, public comments will be limited to only “substantive changes”. As such, the full PCD #2 is not open for comment. Further information will be posted on ICC’s Energy website.

Ballot Instructions

<u>Ballot format</u>

The ballot process will utilize a link to a single electronic ballot, structured below in accordance with Section 9.1 of the ICC CP. This ballot format will be used for subsequent ballots as well. On the signature page of the ballot, instructions will be included with direction for members to vote on the results of the approved code changes by selecting <u>one</u> of the following:

(*The annotation in italics will not be included in the ballot)*

- Affirmative (all code changes)
    - *An affirmative vote is a single vote to ratify approval of all the proposals approved by the committee.*

- Affirmative with comment (comments on separate file; send to Secretariat)
    - *An affirmative with comment vote is a single vote to ratify approval of all the proposals approved by the committee and allows the voting member to offer comments on specific proposals. Such comments must be identified by code change number on a separate file and sent to the Secretariat for reproduction as part of the recirculation ballot process for all committee members to view.*

Comments can be in favor, in opposition or neutral but in all cases such comments will *__not__* *affect the single ratification vote cast on all the proposals. Comments provided with an affirmative vote are for information only, no action is required by the committee.*

- Negative, with reasons (the reasons for a negative vote shall be given and, if possible, should include specific wording or actions that would resolve the objection)
    - *This single vote identifies that the voting member has an objection to one or more of the approved proposals. On a separate file, the proposals must be identified by code change number and a reason for the negative vote on the proposal. If there are text revisions for the committee to consider that would resolve the negative vote, such revisions should be included as well. This file is to be sent to the Secretariat for reproduction as part of the recirculation ballot process for all committee members to view.*
    - *Negative votes to code changes without a reason "shall not be factored into the numerical requirements for consensus" (Section 2.7 (3); 2022 ANSI Essential Requirements).*
    - *Proposals not identified as receiving a negative vote are considered as an affirmative vote.*

In some cases, committee members may wish to abstain on voting on a specific proposal(s). If this is the case, be sure to vote as directed above and in a separate file identify the code change number(s) for which you are abstaining and send to the Secretariat for reproduction as part of the recirculation ballot process for all committee members to view. This abstention can be combined in the same file as an "Affirmative with comment" or "Negative, with reasons". See Section 9.4 of ICC CP for abstentions - such abstentions are excluded from numerical requirements for required voting majorities.

<u>Ballot #1</u>
The initial ballot, Ballot #1, initiates the balloting process of the CAR.

- Ballot #1 will be open for 30 days. The 30-day deadline requires both the completion of the online ballot as well as the submittal of any comments/reasons.
- Comments received with "Affirmative with comment" ballots will be compiled per proposal as well as reasons for abstentions.
- For each proposal receiving a negative comment, the reasons for the negative and any proposed text revisions to resolve the negative will be compiled per proposal, along with the vote tally on that proposal from Ballot #1.

<u>Ballot #2</u>
The results from Ballot #1 will be recirculated to the committee for review to give committee members an opportunity to review comments provided and, if they choose, to change their vote. See Section 9.6 of the ICC CP for a discussion on recirculation ballots.

- Ballot #2 will be open for 14 days. The 14-day deadline requires both the completion of the online ballot as well as the submittal of any comments/reasons.

- Unless a committee member records a vote change on a given proposal, that committee member's Ballot #1 vote is presumed to be unchanged. If additional comments are included with their ballot, these comments will be compiled and recirculated as done with Ballot #1.
- If the requisite majorities of Section 9.4 of the ICC CP are achieved on Ballot #2 with affirmative or affirmative with comment, this is final approval of the text revisions to be incorporated into Public Comment Daft #1. Ballot #3 and the remaining steps below are not required.
- If the requisite majorities of Section 9.4 are <u>not</u> achieved on Ballot #2 with affirmative or affirmative with comment, the negative votes and reasons and all other comments will be compiled per proposal, along with the vote tallies per proposal.

<u>Consensus Committee Meeting</u>

The results of Ballots #1 and #2 for those code changes that did not achieve the requisite majorities of Section 9.4 will be compiled and distributed to the committee. These code changes will serve as the agenda for a meeting of the Consensus Committee. Any revisions to the code changes to be considered at the meeting must be developed and submitted at a time to be determined in advance of the meeting. The committee will discuss and vote on the code changes at this meeting. This meeting will be open to interested parties.

<u>Ballot #3</u>

The results of the Consensus Committee meeting will be compiled and sent to the committee. Ballot #3 will be a recirculation ballot sent to those not in attendance at the Consensus Committee meeting. This is the last step in the approval process of the CAR and the determination of the resulting text to be included in Public Comment Draft #2.

- The ballot will be open for 14 days. The 14-day deadline requires both the completion of the online ballot as well as the submittal of any comments/reasons.
- All code changes considered at the Consensus Committee meeting require the requisite majorities of Section 9.4 in order to be incorporated into Public Comment Draft #2.
- Code changes that do not meet these majorities will <u>not</u> be included in Public Comment Draft #2.

As per the instructions provided in the CAR your electronic ballot must submitted along with any comment/reason statement emailed to the Secretariat (kstenger@iccsafe.org) by **<u>Friday, May 26 at 11:59 pm Pacific</u>**. If you have further questions or issues with your ballot please contact the Secretariat.

Results of the Commercial Consensus Committee Public Comment Draft #1 Process November 2022-April 2023

Proposal Number	CC action	vote yes	vote no	abstain	%
CECD1-01-22	approve	34	0	0	100%
CECD1-02-22	approved as modified	31	2	0	94%
CECD1-03-22	approve	27	0	1	100%
CECD1-04-22	approve	30	1	2	97%
CECD1-05-22	approve	29	1	0	97%
CECD1-06-22	approve	35	0	1	100%
CECD1-07-22	approve	29	0	1	100%
CECD1-08-22	approve	32	2	0	94%
CECD1-09-22	approve	34	0	2	100%
CECD1-10-22	disapproved	19	11	1	63%
CECD1-11-22	approved as modified	31	0	2	100%
CECD1-12-22	approve	31	0	0	100%
CECD1-13-22	approve	33	0	0	100%
CECD1-14-22	approve	30	2	1	94%
CECD1-15-22	approved as modified	28	2	2	93%
CECD1-16-22	approve	24	4	7	86%
CECD1-17-22	approved as modified	21	6	4	78%
CECD1-18-22	approved as modified	22	10	2	69%
CECD1-19-22	approve	30	1	1	97%
CECD1-20-22	approve	31	1	1	97%
CECD1-21-22	approved as modified	35	0	0	100%
CECD1-22-22	approve	34	0	1	100%
CECD1-23-22	approve	34	0	2	100%
CECD1-24-22	approve	36	1	0	97%
CECD1-25-22	approved as modified	32	0	0	100%
CECD1-26-22	disapproved	17	13	0	57%
CECD1-27-22	approve	26	1	0	96%
CECD1-28-22	approve	20	10	0	67%
CED1-001-22	approve	32	0	0	100%
CED1-002-22	approve	31	0	0	100%
CED1-003-22	approve	30	0	0	100%
CED1-004-22	editorial				
CED1-005-22	approved as modified	30	0	0	100%
CED1-006-22	approved as modified	31	0	0	100%
CED1-007-22	disapproved	27	1	0	96%
CED1-008-22	disapproved	29	1	0	97%
CED1-009-22	approved as modified	35	0	0	100%
CED1-010-22	disapproved	28	1	1	97%
CED1-011-22	disapproved	35	0	1	100%
CED1-012-22	approve	32	0	0	100%
CED1-013-22	approve	32	0	0	100%
CED1-014-22	disapproved	15	14	4	52%
CED1-015-22	approved as modified	22	7	2	76%
CED1-016-22	disapproved	29	0	2	100%
CED1-017-22	disapproved	34	0	0	100%
CED1-018-22	disapproved	23	2	2	92%
CED1-019-22	disapproved	18	10	3	64%
CED1-020-22	disapproved	17	12	3	59%
CED1-022-22	disapproved	22	8	3	73%
CED1-023-22	disapproved	19	11	1	63%
CED1-024-22	disapproved	26	2	1	93%
CED1-025-22	disapproved	26	3	2	90%
CED1-026-22	withdrawn				
CED1-027-22	approved as modified	28	0	0	100%
CED1-028-22	disapproved	30	1	0	97%
CED1-029-22	approved as modified	30	1	0	97%
CED1-030-22	approved as modified	26	3	1	90%
CED1-031-22	approved as modified	28	3	0	90%
CED1-032-22	disapproved	21	11	1	66%
CED1-033-22	disapproved	27	2	2	93%
CED1-034-22	disapproved	31	0	1	100%
CED1-035-22	disapproved	32	0	0	100%
CED1-036-22	approve	28	3	1	90%
CED1-037-22	disapproved	26	6	1	81%
CED1-038-22	disapproved	26	7	0	79%
CED1-039-22	approve	29	2	3	94%
CED1-040-22	disapproved	27	5	0	84%
CED1-041-22	disapproved	32	2	0	94%
CED1-042-22	disapproved	26	3	3	90%
CED1-043-22	disapproved	30	2	0	94%
CED1-044-22	disapproved	28	2	3	93%

Proposal Number	CC action	vote yes	vote no	abstain	%
CED1-045-22	approve	30	3	2	91%
CED1-046-22	disapproved	32	1	1	97%
CED1-047-22	disapproved	30	1	1	97%
CED1-048-22	disapproved	33	1	0	97%
CED1-049-22	disapproved	25	7	3	78%
CED1-050-22	approved as modified	29	0	3	100%
CED1-051-22	disapproved	22	12	3	65%
CED1-052-22	disapproved	31	6	0	84%
CED1-053-22	disapproved	28	4	2	88%
CED1-054-22	disapproved	28	4	2	88%
CED1-055-22	approved as modified	20	9	5	69%
CED1-056-22	approved as modified	30	9	1	77%
CED1-057-22	approved as modified	31	0	0	100%
CED1-058-22	disapproved	18	14	1	56%
CED1-059-22	disapproved	22	12	1	65%
CED1-060-22	disapproved	23	7	3	77%
CED1-061-22	disapproved	30	0	1	100%
CED1-062-22	approved as modified	30	0	1	100%
CED1-063-22	disapproved	31	1	1	97%
CED1-064-22	disapproved	34	0	0	100%
CED1-065-22	approved as modified	25	4	2	86%
CED1-066-22	withdrawn				
CED1-067-22	withdrawn				
CED1-068-22	withdrawn				
CED1-069-22	disapproved	16	13	1	55%
CED1-070-22	disapproved	24	4	2	86%
CED1-071-22	disapproved	27	1	0	96%
CED1-072-22	withdrawn				
CED1-073-22	withdrawn				
CED1-074-22	disapproved	24	1	3	96%
CED1-075-22	approve	33	0	1	100%
CED1-076-22	approved as modified	29	0	0	100%
CED1-077-22	approved as modified	31	0	0	100%
CED1-078-22	approved as modified	36	0	1	100%
CED1-079-22	withdrawn				
CED1-080-22	withdrawn				
CED1-081-22	approve	28	0	1	100%

Proposal Number	CC action	vote yes	vote no	abstain	%
CED1-082-22	withdrawn				
CED1-083-22	disapproved	27	0	0	100%
CED1-084-22	approved as modified	27	0	2	100%
CED1-085-22	disapproved	30	6	0	83%
CED1-086-22	disapproved	17	15	1	53%
CED1-087-22	approve	29	0	0	100%
CED1-088-22	disapproved	35	0	1	100%
CED1-089-22	disapproved	26	0	0	100%
CED1-090-22	approved as modified	30	0	0	100%
CED1-091-22	approve	33	0	0	100%
CED1-092-22	approve	32	0	1	100%
CED1-093-22	disapproved	27	2	1	93%
CED1-094-22	approved as modified	34	0	1	100%
CED1-095-22	approved as modified	37	0	0	100%
CED1-096-22	disapproved	18	9	1	67%
CED1-097-22	disapproved	24	6	1	80%
CED1-098-22	withdrawn				
CED1-099-22	approved as modified	30	2	2	94%
CED1-100-22	approved as modified	34	0	0	100%
CED1-101-22	disapproved	22	5	6	81%
CED1-102-22	withdrawn				
CED1-103-22	approved as modified	27	0	0	100%
CED1-104-22	withdrawn				
CED1-105-22	disapproved	34	0	0	100%
CED1-106-22	approved as modified	27	1	1	96%
CED1-107-22	approved as modified	29	0	0	100%
CED1-108-22	approved as modified	35	0	0	100%
CED1-109-22	disapproved	20	7	4	74%
CED1-110-22	approve	37	0	0	100%
CED1-111-22	approved as modified	30	0	1	100%
CED1-112-22	approve	30	0	0	100%
CED1-113-22	disapproved	22	4	5	85%
CED1-114-22	disapproved	31	0	0	100%
CED1-115-22	approve	31	0	0	100%
CED1-116-22	disapproved	30	0	0	100%
CED1-117-22	disapproved	14	14	1	50%

Proposal Number	CC action	vote yes	vote no	abstain	%
CED1-118-22	approved as modified	26	1	0	96%
CED1-119-22	approved as modified	29	0	0	100%
CED1-120-22	withdrawn				
CED1-121-22	approved as modified	30	0	0	100%
CED1-122-22	disapproved	27	2	1	93%
CED1-123-22	withdrawn				
CED1-124-22	disapproved	22	8	0	73%
CED1-125-22	disapproved	27	2	1	93%
CED1-126-22	approve	31	0	0	100%
CED1-127-22	disapproved	19	13	2	59%
CED1-128-22	approved as modified	36	0	0	100%
CED1-129-22	withdrawn				
CED1-130-22	approve	25	1	1	96%
CED1-131-22	approve	27	1	0	96%
CED1-132-22	approve	30	0	0	100%
CED1-133-22	disapproved	34	0	1	100%
CED1-134-22	approve	33	0	1	100%
CED1-135-22	deny	20	10	1	67%
CED1-136-22	deny	24	6	1	80%
CED1-137-22	disapproved	27	0	0	100%
CED1-138-22	approved as modified	28	0	0	100%
CED1-139-22	approved as modified	28	0	1	100%
CED1-140-22	withdrawn				
CED1-141-22	approved as modified	26	1	0	96%
CED1-142-22	disapproved	19	9	0	68%
CED1-143-22	disapproved	21	7	6	75%
CED1-144-22	approve	27	0	0	100%
CED1-145-22	approved as modified	32	0	1	100%
CED1-146-22	approved as modified	35	0	0	100%
CED1-147-22	approved as modified	29	1	2	97%
CED1-148-22	approved as modified	28	2	0	93%
CED1-149-22	approve	35	0	0	100%
CED1-150-22	approve	30	0	0	100%
CED1-151-22	approve	36	0	0	100%
CED1-152-22	disapproved	26	3	3	90%
CED1-153-22	disapproved	31	1	1	97%
CED1-154-22	disapproved	30	1	1	97%
CED1-155-22	withdrawn				
CED1-156-22	approved as modified	33	1	1	97%
CED1-157-22	approved as modified	28	3	2	90%
CED1-158-22	approved as modified	29	2	0	94%
CED1-159-22	withdrawn				
CED1-160-22	approve	30	1	0	97%
CED1-161-22	approved as modified	33	0	1	100%
CED1-162-22	disapproved	33	0	2	100%
CED1-164-22	approved as modified	25	4	2	86%
CED1-165-22	approved as modified	32	1	1	97%
CED1-166-22	approved as modified	34	0	1	100%
CED1-167-22	approve	24	4	4	86%
CED1-168-22	approved as modified	31	0	0	100%
CED1-169-22	withdrawn				
CED1-170-22	disapproved	26	9	2	74%
CED1-171-22	disapproved	29	1	1	97%
CED1-172-22	approve	32	0	0	100%
CED1-173-22	approve	30	0	0	100%
CED1-174-22	approved as modified	30	0	1	100%
CED1-175-22	approve	34	0	1	100%
CED1-176-22	approved as modified	26	2	3	93%
CED1-177-22	approved as modified	25	0	3	100%
CED1-178-22	withdrawn				
CED1-179-22	disapproved	28	1	1	97%
CED1-180-22	disapproved	31	1	1	97%
CED1-181-22	disapproved	22	7	1	76%
CED1-182-22	approved as modified	32	1	0	97%
CED1-183-22	disapproved	23	6	0	79%
CED1-184-22	disapproved	17	15	3	53%
CED1-185-22	approved as modified	30	2	0	94%
CED1-186-22	disapproved	29	3	0	91%

Proposal Number	CC action	vote yes	vote no	abstain	%
CED1-187-22	approve	25	0	0	100%
CED1-188-22	disapproved	23	11	0	68%
CED1-189-22	disapproved	22	13	2	63%
CED1-190-22	approved as modified	25	10	1	71%
CED1-191-22	disapproved	15	14	4	52%
CED1-192-22	approved as modified	23	6	1	79%
CED1-193-22	disapproved	21	5	2	81%
CED1-194-22	approve	26	2	0	93%
CED1-195-22	approved as modified	31	0	0	100%
CED1-196-22	disapproved	23	7	1	77%
CED1-197-22	approve	30	0	0	100%
CED1-198-22	approve	32	0	1	100%
CED1-199-22	disapproved	22	3	0	88%
CED1-200-22	withdrawn				
CED1-201-22	withdrawn				
CED1-202-22	withdrawn				
CED1-203-22	approved as modified	27	3	2	90%
CED1-204-22	approved as modified	22	11	1	67%
CED1-205-22	disapproved	29	0	0	100%
CED1-206-22	disapproved	32	1	0	97%
CED1-207-22	disapproved	25	1	2	96%
CED1-208-22	approve	26	10	3	72%
CED1-209-22	approved as modified	33	0	0	100%
CEPC1-001-22	withdrawn				
CEPC1-002-22	heard by committee				
CEPC1-003-22	heard by committee				
CEPC1-004-22	heard by committee				
CEPC1-005-22	heard by committee				
CEPC1-006-22	heard by committee				
CEPC1-007-22	heard by committee				
CEPC1-008-22	heard by committee				
CEPC1-009-22	heard by committee				
CEPC1-010-22	heard by committee				

Proposal Number	CC action	vote yes	vote no	abstain	%
CEPC1-011-22	heard by committee				
CEPC1-012-22	heard by committee				
CEPC1-013-22	heard by committee				
CEPC1-014-22	heard by committee				
CEPC1-015-22	heard by committee				
CEPC1-016-22	heard by committee				
CEPC1-017-22	heard by committee				
CEPC1-018-22	heard by committee				
CEPC1-019-22	heard by committee				

CECD1-1-22

Proponents: Michael Jouaneh, representing IECC CE Electrical Power, Lighting, and Renewables Subcommittee

2024 International Energy Conservation Code [RE Project]

Revise as follows:

C405.1.1 Lighting for dwelling units. No less than 90 percent of the 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 ~~a kitchen~~ other appliances ~~appliance or exhaust hood~~.
2. Antimicrobial lighting used for the sole purpose of disinfecting.

C405.2.5 Specific application controls. Specific application controls shall be provided for the following:

1. The following lighting shall be controlled by an occupant sensor complying with Section C405.2.1.1 or a time-switch control complying with Section C405.2.2.1. In addition, a manual control shall be provided to control such lighting separately from the general lighting in the space:

    1.1. Luminaires for which additional lighting power is claimed in accordance with Section C405.3.2.2.1.

    1.2. Display and accent lighting, including lighting in display cases.

    1.3 Supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting.

    1.4 Lighting equipment that is for sale or demonstration in lighting education.

2. *Sleeping units* shall have control devices or systems that are configured to automatically switch off all installed luminaires and switched receptacles within 20 minutes after all occupants have left the unit.

    Exceptions:

    1. Lighting and switched receptacles controlled by card key controls in buildings containing fewer than 50 sleeping units.
    2. Spaces where patient care is directly provided.

3. Lighting for nonvisual applications, such as plant growth and food warming, shall be controlled by a time switch control complying with Section C405.2.2.1 that is independent of the controls for other lighting within the room or space.
4. Task lighting for medical and dental purposes that is in addition to *general lighting* shall be provided with a *manual control*.
5. Lighting integrated into range hoods and exhaust fans shall be controlled independently of fans.

Reason: A quick search of home improvement stores like Home Dept and Lowes makes clear that range hoods and exhaust fans are commonly provided with high efficacy LED lighting. There is no reason not to make this an enforceable requirement of the code similar to other lighting sources.
There is also energy to be saved in controlling ventilation fans separately from lighting in bathrooms. The uses are not coincident. In a bathroom with a window one may choose to use the fan and not the light during the day when bathing. In the evening, one may choose to use the light and not the fan when grooming.

Ceiling fans are subject to NAECA regulation, so efficacy of the lighting kits cannot be regulated under base code. However, these can be included in the lighting efficacy requirements of L06.

Cost Impact: The code change proposal will increase the cost of construction.
This code change will result in a modest increase in the cost of construction. The LED lamps will likely cost $5-$10 more per range hood. And in some instances an additional switch will be required to control the fan separately from the light. But this increase in construction costs will be more than offset by the long-term energy savings.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: Clarification which appliances are required; Range hoods and exhaust fans offer high efficacy options, and they should be included.

Proposal # 965

CECD1-2-22

Proponents: Michael Jouaneh, representing IECC CE Electrical Power, Lighting, and Renewables Subcommittee (ieccceelectrical@iccsafe.org)

2024 International Energy Conservation Code [RE Project]

Delete and substitute as follows:

~~**C503.5 Lighting systems.** New lighting systems that are part of the *alteration* shall comply with Sections C405 .~~

> ~~**Exception:** *Alterations* that replace less than 10 percent of the luminaires in a space, provided that such *alterations* do not increase the installed interior lighting power.~~

C503.5 Lighting systems. Lighting systems that are part of the alteration shall comply with Sections C503.5.1 and C503.5.2.

~~**C503.5.1 Lighting acceptance testing.** Where an *alteration* requires compliance with Section C405 or any of its subsections, lighting systems that serve the *alteration* shall comply with Section C408.3.~~

C503.5.1 Interior lighting and controls. Alterations to interior spaces, lighting, or controls shall comply with the following:

1. Where the area of interior spaces is altered, those spaces shall comply with the lighting power requirements of Section C405.3 and 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 C405.3 and 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 is not required for alterations.

Add new text 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 pass functional tests verifying that lights are automatically shut off where daylight is present.

3. Where 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: This proposal provides a set of comprehensive provisions for the alteration of lighting systems which addresses several long-standing problems with the existing code language:
1. It is not clear whether existing light fixtures can be altered without a requirement that existing lighting controls also be altered to comply with the current code, and vice-versa. This proposal clearly specifies when alterations to one trigger mandatory compliance upgrades for the other.

2. It is not clear how compliance should be determined for exterior lighting alterations. For interior spaces compliance can always be determined on a room by room basis, but compliance for exterior lighting can only be determined for the entire site.

3. The existing exception does not acknowledge the type of alterations that people actually make to existing lighting systems, as they only address one-for-one replacement of light fixtures within a room. This proposal would create more meaningful exceptions for smaller projects.

4. Exceptions based on altered and new luminaire wattage are easier to calculate and enforce than calculating both existing wattage and altered wattage and calculating a fraction (especially for large outdoor lighting systems).

5. The newly added demand responsive lighting control requirements in Section C405.2.9 are intended for lighting systems installed on a building

wide basis and not as an alteration.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal improves the clarity and enforceability of the lighting alterations requirements.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: This proposal improves the clarity and enforceability of the lighting alterations requirements.

Proposal # 977

CECD1-3-22

IECC: C405.2.1, C405.2.1.1, C405.2.1.2, C406.2.5.3.1, C406.2.5.3.2, C406.2.5.3.3

Proponents: Michael Jouaneh, representing IECC CE Electrical Power, Lighting, and Renewables Subcommittee (ieccceelectrical@iccsafe.org)

2024 International Energy Conservation Code [RE Project]

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. Computer room, data center.
3. Conference/meeting/multipurpose rooms.
4. Copy/print rooms.
5. Corridors
6. Enclosed offices.
7. Laundry/washing area.
8. Locker rooms.
9. Lounges/breakrooms.
10. Medical supply room in a healthcare facility.
11. Open plan office areas.
12. Restrooms
13. Storage rooms.
14. Telemedicine room in a healthcare facility.
15. Warehouse storage areas.
16. Other spaces 300 square feet (28 m^2) or less that are enclosed by floor-to-ceiling height partitions.

Exception: Luminaires tha t are required to have specific application controls in accordance with Section C405.2.5.

C405.2.1.1 Occupant sensor control function. Occupant sensor controls in warehouse~~s~~ storage areas shall comply with Section C405.2.1.2. Occupant sensor controls in open plan office areas shall comply with Section C405.2.1.3. Occupant sensor controls in corridors shall comply with Section C405.2.1.4. Occupant sensor controls for all other spaces specified in Section C405.2.1 shall comply with the following:

1. They shall automatically turn off lights within 20 minutes after all occupants have left the space.
2. They shall be manual on or controlled to automatically turn on the lighting to not more than 50-percent power.
3. They shall incorporate a manual control to allow occupants to turn off lights.

Exception: Full automatic-on controls with no manual control shall be permitted in ~~corridors,~~ interior parking areas, stairways, restrooms, locker rooms, lobbies, library stacks and areas where manual operation would endanger occupant safety or security.

C405.2.1.2 Occupant sensor control function in warehouse storage areas. Lighting in warehouse storage areas shall be controlled as follows:

1. Lighting in each aisleway shall be controlled independently of lighting in all other aisleways and open areas.
2. Occupant sensors shall automatically reduce lighting power within each controlled area to an unoccupied setpoint of not more than 50 percent of full power within 20 minutes after all occupants have left the controlled area.
3. Lights that are not turned off by occupant sensors shall be turned off by time-switch control complying with Section C405.2.2.1.
4. A manual control shall be provided to allow occupants to turn off lights in the space.

Revise as follows:

C406.2.5.3.1 Occupant sensor controls. Occupant sensor controls shall be installed to control lights in the following space types:

~~1. Courtroom~~

~~2. Electrical/mechanical room~~

~~3.~~ 1. Food preparation area

~~4.~~ 2. Laboratory

~~5.~~ 3. Elevator lobby

~~6.~~ 4. Pharmacy area

~~7.~~ 5. Vehicular maintenance area

~~8.~~ 6. Workshop.

~~9. Chapel in a facility for the visually impaired~~

~~10.~~ 7. Recreation room in a facility for the visually impaired

~~11.~~ 8. Exercise area in a fitness center

~~12.~~ 9. Playing area in a fitness center

~~13.~~ 10. Exam/treatment room in a healthcare facility

~~14.~~ 11. Imaging room in a healthcare facility

~~15.~~ 12. Physical therapy room in a healthcare facility

~~16.~~ 13. Library reading area

~~17.~~ 14. Library stacks

~~18.~~ 15. Detailed manufacturing area

~~19.~~ 16. Equipment room in a manufacturing facility

~~20.~~ 17. Low-bay area in a manufacturing facility

~~21.~~ 18. Post office sorting area

~~22.~~ 19. Religious fellowship hall

~~23. Religious worship/pulpit/choir area~~

~~24.~~ 20. Hair salon

~~25.~~ 21. Nail salon

~~26.~~ 22. Banking activity area

~~27. Computer room, data center~~

~~28. Laundry/washing area~~

~~29 Medical supply room in a healthcare facility~~

~~30. Telemedicine room in a healthcare facility~~

~~31.~~ 23. Museum restoration room

C406.2.5.3.2 Occupant sensor control function. ~~Occupant sensor controls shall automatically turn lights off within 10 minutes after all occupants have leftthe space. A manual control complying with C405.2.6 shall allow occupants to turn off lights.Time-switch controls are not required.~~ Occupant sensors in library stacks and laboratories shall comply with C405.2.1.2. Occupant sensors in elevator lobbies shall comply with C405.2.1.4. All other occupant sensors required by C406.2.5.3.1 shall comply with 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 ~~function~~. *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. ~~Where lighting power is reduced, the unoccupied setpoint shall be 20 percent of full power or in egress areas to the power level required to meet egress light levels.~~

Reason: Several space types that were originally proposed to be included in the Additional Efficiency Requirements of L03 are moved into “base code” so that they will be required on all projects. Several other space types are removed from L03 (Courtroom, Chapel, and Religious Worship) due to concerns about functional problems. Electrical / mechanical rooms are removed from L03 because this may prevent too many projects from selecting this credit (not many people put occupant sensors in switchgear rooms for safety reasons).
Occupant sensor function for laboratories and library stacks is grouped with warehouses in C405.2.1.2. This section best describes the function required of the occupant sensors in spaces which are continuously occupied but have aisles with shelving that extends close to the ceiling.

Occupant sensor function for elevator lobbies is grouped with corridors in C405.2.1.4 because they have essentially the same functional and life safety requirements.
The unoccupied setpoint is reduced to 20% in C405.2.1.2 (laboratories, library stacks, and warehouses) in L03.
The unoccupied setpoint in C405.2.1.3 (open office) is already 20% and does not need to be mentioned in L03.
The unoccupied setpoint in C405.2.1.4 needs to remain at 50% in L03 to allow for code-minimum egress illuminance levels to be maintained. Recall that occupant sensors may not work in smoke, so cannot be relied on to sense motion and turn lights on in corridors during a fire. Language about meeting egress lighting levels was removed assuming that occupants egress from aisles in warehouses not through them.

Cost Impact: The code change proposal will decrease the cost of construction.
For projects pursuing L03 this proposal would result in a reduction in construction costs because occupant sensors would be required in fewer space types. For projects not pursuing L03, this code change proposal will increase the cost of construction because occupant sensors will be required in more space types for base code compliance.

Workgroup Recommendation

Commercial Energy Committee Committee Action: Approved
Commercial Energy Committee Reason: This will allow hotel lobbies to match the requirements of other lobbies, as the lighting requirements are similar.

CECD1-4-22

Proponents: Kristopher Stenger, representing ICC (kstenger@iccsafe.org); Michael Jouaneh, representing IECC CE Electrical Power, Lighting, and Renewables Subcommittee (ieccceelectrical@iccsafe.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

C405.2.3.1 Dimming control function. Spaces required to havedimming 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 asturning 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 following: ~~lighting controls have a high-end trim setting and have undergone functional testing in accordance with Section C408.3.1.4.~~
>
> 1. The calibration adjustment equipment is located for *ready access* only by authorized personnel. Occupant sensors will be required in more space types for base code compliance.
> 2. Lighting controls with ready access for users cannot increase the lighting power above the maximum level established by the *high-end trim* controls.

C406.2.5.2 L02 ~~Enhanced digital lighting controls~~ *High-end trim* lighting controls. Measure credits shall be achieved where qualifying spaces are no less than 50 percent of the ~~gross~~ project interior floor area exclusive of *dwelling and sleeping units* ~~within the project shall comply with the requirements of this section.~~ 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.

~~1. Lighting controls function. Interior general lighting shall be located, scheduled and operated in accordance with Section C405.2 and shall be configured with the following enhanced control functions:~~

~~1.1. Luminaires shall be configured for continuous dimming.~~

~~1.2. Each luminaire shall be individually addressed.~~

~~**Exceptions:**~~

~~1. Multiple luminaires mounted on no more than 12 linear feet (3.66 m) of a single lighting track and addressed as a single luminaire.~~

~~2. Multiple linear luminaires that are ganged together to create the appearance of a single longer fixture and addressed as a single luminaire, where the total length of the combined luminaires is not more than 12 feet (3.66 m).~~

~~1.3. No more than eight luminaires within a daylight zone are permitted to be controlled by a *single daylight responsive control*.~~

~~2 Luminaires shall be controlled by a digital control system configured with the following capabilities:~~

~~2.1. Sheduling and illumination levels of individual luminaires and groups of luminaires are capable of being reconfigured through the system.~~

~~2.2. Load shedding.~~

~~2.3. Occupancy sensors and daylight responsive controls are capable of being reconfigured through the system.~~

~~3. Construction documents shall include submittal of a Sequence of Operations, including a specification outlining each of the functions required by this section.~~

~~4. High-end trim. Luminaires shall be initially configured with the following:~~

~~4.1. High-end trim, setting the maximum light output of individual luminaires or groups of luminaires to support visual needs of a space or area, shall be implemented and construction documents shall state that maximum light output or power of controlled lighting shall be initially reduced by atleast 15 percent from full output. The average maximum light output or power of the controlled lighting shall be documented without high-end trim and with high-end trim to verify reduction of light output or power by at least 15 percent when tuned.~~

~~4.2. Where lumen maintenance control is used, controls shall be configured to limit the initial maximum lumen output or maximum lighting power to 85 percent or less of full light output or full power draw and lumen maintenance controls shall be limited to increasing lighting power by 1 percent per year.~~

~~4.3. High-end trim and lumen maintenance controls shall be accessible only to authorized personnel.~~

~~Where general lighting in more than 50 percent of the gross lighted floor area receives high-end trim, the~~ The base credits from Tables C406.1.2(1) through C406.1.2(9) shall be prorated as follows:
~~*[Tuned lighted fl oor area,%]*~~ 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.

C408.3.1.4 *High-end trim* controls. Where lighting controls are configured for *high-end* *trim* ~~trims~~, verify the following:

1. ~~That high~~*High-end trim* maximum level has been set.
2. ~~That the~~ The calibration adjustment equipment is located for *ready access* only by authorized personnel.
3. ~~That lighting~~ Lighting controls with *ready access* for users cannot increase the lighting power above the maximum level established by the *high-end trim* controls.

Add new text as follows:

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 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 to not greater than 85 percent of full power or light output.

Reason: Additional efficiency credit L02 in Public Comment Draft #1 combines two different lighting control strategies: high-end trim, and digitally addressable luminaires.
High-end trim can be accomplished at a reasonable cost and is already recognized in C405.2.3.1 as an alternate for dimming controls. It also has clear and demonstrated energy savings.
Digitally addressable luminaires are extremely expensive, and do not have any demonstrated energy savings.
This proposal dramatically simplifies L02 by eliminating the requirement for digitally addressable luminaires and focusing the credit entirely on high-end trim.
This proposal also clarifies base code requirements for high-end trim lighting controls and adds new functional testing and documentation requirements for projects pursuing energy credit L02.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change proposal will neither increase nor decrease the cost of construction for projects which do not pursue L02. For projects which do pursue L02, the cost of construction will be dramatically reduced.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: This proposal reduces the cost of the measure while not reducing energy savings.

Proposal # 1500

CECD1-5-22

Proponents: Kristopher Stenger, representing ICC (kstenger@iccsafe.org); Michael Jouaneh, representing IECC CE Electrical Power, Lighting, and Renewables Subcommittee (ieccceelectrical@iccsafe.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

C405.2.9 Demand responsive lighting controls. ~~*Buildings* shall have controls that are capable of automatically reducing general lighting power not less than 15 percent in response to a demand response signal.~~ Interior *general lighting* in group B, E, M, and S occupancies shall have *demand responsive controls* complying with C405.2.9.1 in not less than 75 percent of the interior floor area.

Exceptions:

1. ~~Buildings with less than 4,000 watts of combined installed general lighting power in spaces that have more than 0.5 W/ft² (5.38 W/m²) of general lighting power.~~ Where the combined interior floor area of group B, E, M, and S occupancies is less than 10,000 square feet.
2. ~~*Buildings* where demand response programs are not available.~~ *Buildings* where a *demand response signal* is not available from a controlling entity other than the owner.
3. ~~I-2 and I-3 occupancies.~~ Parking garages.

Add new text as follows:

C405.2.9.1 Demand responsive lighting controls function. Demand responsive 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 lights gradually and continuously over a period of not longer than 15 minutes to get to their demand response setpoint.
4. Returning lights to their normal operational settings at the end of the demand response event.

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

Revise as follows:

C406.3.2 G01 Lighting Load Management. ~~Luminaires shall have dimming capability and automatic load management controls that shall gradually reduce *general lighting* power during peak periods. The load management controls shall reduce lighting power in 75 percent of the building area by at least 20 percent with *continuous dimming* over a period no longer than 15 minutes. Where less than 75 percent, but at least 50 percent of the project *general lighting* is controlled, the credits from Tables C406.3 shall be prorated as follows:~~ 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 4-29 with no more than 75 percent of the interior floor area being counted.

(Equation 4-29)

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

~~**Exception:** Warehouse or retail storage building areas shall be permitted to achieve this credit by switching off at least 25 percent of lighting power in 75 percent of the building area without dimming, or as adjusted by Equation 4-29.~~

Add new text 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 rooms with controls, each room shall be tested.
3. For projects with more than seven rooms with controls, testing shall be done for each unique space type. Where multiple rooms of each space type exist, not less than 10 percent and in no case fewer than one 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 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 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 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: This proposal makes a number of important improvements to the code requirements for demand responsive lighting controls:
1. It limits the scope in base code to those occupancies (B, E, M, and S) where this can reasonably be achieved without excessive complexity and/or negative impact on building operations.
2. Changes the 4,000W exception to 10,000 square feet to significantly simplify compliance determination.
3. Specifies the capabilities of the required controls, so that it is clear to designers and building code officials what control systems would comply.
4. Modifies C406.3.2 to refer to the technical requirements in C405.2.9.1 so that the code can have one clear and consistent standard for how these controls operate.
5. Revises language to be clear that compliance with both base code and energy credits is determined occupancy by occupancy for mixed-use buildings.
6. Adds functional testing requirements for demand responsive lighting controls.

To coordinate with C405.2.9 requirements, where a demand response signal is available and the building is not exempt, the credits are reduced by half.

Cost Impact: The code change proposal will decrease the cost of construction.
This code change proposal will decrease the cost of construction by limiting the requirement for demand responsive lighting controls in C405.2.9 to occupancy groups B, E, M, and S.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: This proposal makes a number of important improvements to the code requirements for demand responsive lighting controls.

CECD1-6-22

Proponents: Kristopher Stenger, representing ICC (kstenger@iccsafe.org); Michael Jouaneh, representing IECC CE Electrical Power, Lighting, and Renewables Subcommittee (ieccceelectrical@iccsafe.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

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

ID	Energy Credit Measure	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	8	13	7	11	6	8	9	6	1	24	8	9	30	15	5	32	28	31	36
E03	Envelope leak reduction	C406.2.1.3	15	10	12	8	6	16	13	5	1	7	7	9	65	16	1	73	43	52	26
E04	Add Roof Insulation	C406.2.1.4	1	1	1	1	1	1	4	3	1	5	3	4	6	5	1	7	7	6	8
E05	Add Wall Insulation	C406.2.1.5	10	10	6	8	5	6	8	4	1	8	3	4	11	7	1	14	12	13	13
E06	Improve Fenestration	C406.2.1.6	7	7	4	6	9	11	13	3	1	22	5	10	27	18	7	41	33	22	21
H01	HVAC Performance	C406.2.2.1	20	19	16	17	14	13	11	11	5	13	10	8	15	12	7	18	14	17	19
H02	Heating efficiency	C406.2.2.2	x	x	x	x	x	x	3	1	1	6	2	3	10	5	2	14	10	13	16
H03	Cooling efficiency	C406.2.2.3	7	6	4	4	3	3	1	1	1	1	1	1	1	1	x	x	x	x	x
H04	Residential HVAC control	C406.2.2.4	9	10	8	22	20	25	16	17	32	21	24	17	23	27	16	21	24	18	18
H05	DOAS/fan control	C406.2.2.5	32	31	27	28	23	23	28	21	12	42	24	24	56	36	19	73	54	70	79
W01	SHW preheat recovery	C406.2.3.1 a	61	63	74	74	85	88	101	100	121	103	109	122	102	111	130	93	106	99	96
W02	Heat pump water heater	C406.2.3.1 b	50	52	62	61	72	74	86	85	104	88	94	106	88	96	112	81	92	87	84
W03	Efficient gas water heater	C406.2.3.1 c	38	39	46	46	53	55	63	62	76	64	68	76	64	69	81	58	66	62	60
W04	SHW pipe insulation	C406.2.3.2	7	7	8	7	8	8	8	9	10	8	9	9	7	8	9	6	7	6	6
W05	Point of use water heaters	C406.2.3.3 a	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W06	Thermostatic bal. valves	C406.2.3.3 b	3	3	3	3	3	3	3	3	4	3	3	4	3	3	4	3	3	3	2
W07	SHW heat trace system	C406.2.3.3 c	12	12	13	13	14	15	15	15	18	14	15	16	13	14	16	11	13	11	10
W08	SHW submeters	C406.2.3.4	11	11	13	13	15	16	18	18	22	19	20	22	19	20	24	17	20	18	18
W09	SHW distribution sizing	C406.2.3.5	45	46	55	54	63	65	74	73	89	75	80	89	74	81	95	68	77	72	70
W10	Shower heat recovery	C406.2.3.6	15	16	19	19	22	23	26	26	32	27	29	32	27	29	34	25	28	27	26
P01	Energy monitoring	C406.2.4	3	3	2	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2	3
L01	Lighting Performance	C406.2.5.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	C406.2.5.2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
L03	Increase occp. sensor	C406.2.5.3	3	3	4	4	4	4	3	4	3	2	3	2	1	1	2	1	1	1	1
L04	Increase daylight area	C406.2.5.4	~~5~~ x	~~5~~ x	~~5~~ x	~~5~~ x	~~5~~ x	~~5~~ x	~~4~~ x	~~4~~ x	~~4~~ x	~~4~~ x	~~4~~ x	~~3~~ x	~~3~~ x	~~4~~ x	~~3~~ x	~~2~~ x	~~3~~ x	~~3~~ x	~~2~~ x
L05	Residential light control	C406.2.5.5	8	8	9	9	9	9	8	8	10	6	8	7	4	6	8	3	5	4	3
L06	Light power reduction	C406.2.5.7	2	2	2	2	2	2	2	2	2	1	2	1	1	1	1	1	1	1	1
Q01	Efficient elevator	C406.2.6.1	4	4	4	4	5	5	5	5	5	4	5	5	4	4	5	4	4	4	3
Q02	Commercial kitchen equip.	C406.2.6.2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q03	Residential kitchen equip.	C406.2.6.3	15	15	17	16	17	18	17	18	20	16	17	18	15	16	18	13	15	13	12
Q04	Fault detection	C406.2.6.4	3	3	2	3	2	2	2	2	1	2	2	1	1	2	1	3	2	3	3

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

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

ID	Energy Credit Measure	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	6	11	6	11	7	9	6	6	2	3	3	3	4	3	7	5	5	17	3
E03	Envelope leak reduction	C406.2.1.3	5	3	4	3	5	8	8	3	2	6	2	2	7	3	1	9	7	19	5
E04	Add Roof Insulation	C406.2.1.4	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	1	2	3
E05	Add Wall Insulation	C406.2.1.5	1	3	1	3	2	2	9	4	1	4	1	1	3	1	1	3	3	3	3
E06	Improve Fenestration	C406.2.1.6	1	1	1	1	1	1	1	1	1	4	3	5	5	1	1	5	5	2	2
H01	HVAC Performance	C406.2.2.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H02	Heating efficiency	C406.2.2.2	x	x	x	x	2	3	4	3	7	6	4	6	8	6	10	11	12	15	19
H03	Cooling efficiency	C406.2.2.3	6	6	4	4	3	3	2	2	1	1	1	1	1	1	1	x	x	x	x
H04	Residential HVAC control	C406.2.2.4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H05	DOAS/fan control	C406.2.2.5	41	41	40	40	42	36	42	37	39	49	40	46	56	46	61	65	68	82	93
W01	SHW preheat recovery	C406.2.3.1 a	4	4	4	4	5	5	5	5	6	6	6	6	6	6	6	6	5	5	5
W02	Heat pump water heater	C406.2.3.1 b	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3
W03	Efficient gas water heater	C406.2.3.1 c	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
W04	SHW pipe insulation	C406.2.3.2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
W05	Point of use water heaters	C406.2.3.3 a	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W06	Thermostatic bal. valves	C406.2.3.3 b	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
W07	SHW heat trace system	C406.2.3.3 c	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1
W08	SHW submeters	C406.2.3.4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W09	SHW flow reduction	C406.2.3.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W10	Shower heat recovery	C406.2.3.6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
P01	Energy monitoring	C406.2.4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
L01	Lighting Performance	C406.2.5.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	C406.2.5.2	5	5	5	5	5	6	5	6	6	5	6	6	5	5	5	4	4	3	2
L03	Increase occp. sensor	C406.2.5.3	5	5	5	5	5	5	5	5	6	5	5	6	5	5	5	4	4	3	2
L04	Increase daylight area	C406.2.5.4	~~7~~ x	~~7~~ x	~~7~~ x	~~7~~ x	~~7~~ x	~~7~~ x	~~7~~ x	~~7~~ x	~~8~~ x	~~6~~ x	~~6~~ x	~~6~~ x	~~6~~ x	~~6~~ x	~~5~~ x	~~5~~ x	~~5~~ x	~~5~~ x	~~4~~ x
L05	Residential light control	C406.2.5.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L06	Light power reduction	C406.2.5.7	7	7	7	7	7	7	7	7	9	7	7	8	6	7	7	5	5	4	3
Q01	Efficient elevator	C406.2.6.1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1
Q02	Commercial kitchen equip.	C406.2.6.2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q03	Residential kitchen equip.	C406.2.6.3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q04	Fault detection	C406.2.6.4	3	3	3	3	3	3	3	3	2	3	3	2	3	3	3	3	3	4	4

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

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

ID	Energy Credit Measure	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	4	7	4	7	3	4	7	2	1	7	2	3	10	6	4	12	9	19	11
E03	Envelope leakage reduction	C406.2.1.3	5	3	4	2	2	2	5	1	1	8	1	2	13	4	1	18	9	18	7
E04	Add Roof Insulation	C406.2.1.4	2	2	2	2	2	2	3	2	1	3	1	2	3	2	2	3	3	2	3
E05	Add Wall Insulation	C406.2.1.5	13	14	8	11	4	4	7	4	1	5	2	4	6	4	3	9	7	10	8
E06	Improve Fenestration	C406.2.1.6	5	5	4	5	7	7	8	2	1	8	2	4	10	5	1	21	17	10	9
H01	HVAC Performance	C406.2.2.1	21	20	17	18	16	13	12	12	11	11	11	8	11	11	8	13	11	14	16
H02	Heating efficiency	C406.2.2.2	x	x	x	x	x	x	1	1	6	2	1	1	3	2	2	6	4	8	11
H03	Cooling efficiency	C406.2.2.3	7	6	4	4	3	2	1	2	1	1	2	1	1	1	1	x	x	x	x
H04	Residential HVAC control	C406.2.2.4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H05	DOAS/fan control	C406.2.2.5	32	30	26	28	25	23	24	22	28	26	22	20	30	26	19	41	34	48	62
W01	SHW preheat recovery	C406.2.3.1 a	18	19	22	22	25	27	31	21	32	34	34	38	37	36	40	36	37	36	35
W02	Heat pump water heater	C406.2.3.1 b	14	15	18	17	20	22	25	25	27	29	29	32	31	31	34	30	32	31	30
W03	Efficient gas water heater	C406.2.3.1 c	11	12	14	14	16	17	19	19	20	21	21	24	23	23	25	22	23	23	22
W04	SHW pipe insulation	C406.2.3.2	3	3	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3
W05	Point of use water heaters	C406.2.3.3 a	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W06	Thermostatic bal. valves	C406.2.3.3 b	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	1	1
W07	SHW heat trace system	C406.2.3.3 c	5	6	6	6	6	7	7	7	7	7	7	8	7	7	8	7	7	6	6
W08	SHW submeters	C406.2.3.4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W09	SHW flow reduction	C406.2.3.5	13	14	16	16	18	20	22	22	23	25	25	28	27	26	29	26	27	26	25
W10	Shower heat recovery	C406.2.3.6	4	5	5	5	6	7	8	8	8	9	9	10	10	9	10	9	10	10	9
P01	Energy monitoring	C406.2.4	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
L01	Lighting Performance	C406.2.5.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	C406.2.5.2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
L03	Increase occp. sensor	C406.2.5.3	3	3	3	3	3	3	3	3	3	4	2	3	2	2	3	2	2	1	1
L04	Increase daylight area	C406.2.5.4	~~4~~ x	~~5~~ x	~~5~~ x	~~4~~ x	~~5~~ x	~~5~~ x	~~4~~ x	~~4~~ x	~~4~~ x	~~5~~ x	~~4~~ x	~~4~~ x	~~3~~ x	~~4~~ x	~~3~~ x	~~3~~ x	~~3~~ x	~~3~~ x	~~2~~ x
L05	Residential light control	C406.2.5.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L06	Light power reduction	C406.2.5.7	1	1	2	2	2	2	2	2	2	2	1	2	1	1	2	1	1	1	1
Q01	Efficient elevator	C406.2.6.1	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	2	2	2	2
Q02	Commercial kitchen equip.	C406.2.6.2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q03	Residential kitchen equip.	C406.2.6.3	9	9	10	10	10	11	11	11	11	11	11	12	11	11	12	10	11	10	9
Q04	Fault detection	C406.2.6.4	3	3	3	3	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2

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

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

ID	Energy Credit Measure	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	1	1	1	1	2	2	9	2	1	19	4	5	26	7	3	33	23	29	13
E03	Envelope leak reduction	C406.2.1.3	2	1	1	1	2	3	11	2	1	24	4	6	33	9	3	42	29	36	16
E04	Add Roof Insulation	C406.2.1.4	1	1	0	1	1	1	2	1	1	1	1	1	2	2	1	2	2	1	2
E05	Add Wall Insulation	C406.2.1.5	1	1	0	1	1	2	3	3	1	2	1	1	2	2	2	2	2	2	2
E06	Improve Fenestration	C406.2.1.6	1	1	1	1	1	1	2	2	1	1	2	2	3	2	1	4	4	1	1
H01	HVAC Performance	C406.2.2.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H02	Heating efficiency	C406.2.2.2	x	x	x	x	1	1	6	3	3	10	6	8	15	11	10	19	15	23	28
H03	Cooling efficiency	C406.2.2.3	6	5	3	4	3	2	1	1	1	1	1	1	1	1	1	x	x	x	x
H04	Residential HVAC control	C406.2.2.4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H05	DOAS/fan control	C406.2.2.5	29	27	20	25	24	21	36	27	15	51	35	38	67	53	45	84	70	97	115
W01	SHW preheat recovery	C406.2.3.1 a	24	26	31	29	33	35	37	38	45	38	41	44	37	40	44	34	38	33	30
W02	Heat pump water heater	C406.2.3.1 b	15	16	19	18	21	23	25	25	29	26	28	30	26	28	31	25	27	24	22
W03	Efficient gas water heater	C406.2.3.1 c	15	16	19	18	21	22	23	24	28	24	25	27	23	25	27	21	24	21	18
W04	SHW pipe insulation	C406.2.3.2	2	3	3	3	3	3	3	3	3	3	3	3	2	3	3	2	2	2	2
W05	Point of use water heaters	C406.2.3.3 a	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W06	Thermostatic bal. valves	C406.2.3.3 b	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
W07	SHW heat trace system	C406.2.3.3 c	3	4	4	4	4	4	4	4	4	4	4	4	3	4	4	3	3	3	3
W08	SHW submeters	C406.2.3.4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W09	SHW flow reduction	C406.2.3.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W10	Shower heat recovery	C406.2.3.6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
P01	Energy monitoring	C406.2.4	2	2	2	2	2	1	2	1	1	2	1	1	2	2	1	2	2	2	3
L01	Lighting Performance	C406.2.5.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	C406.2.5.2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	1	1	0
L03	Increase occp. sensor	C406.2.5.3	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	0
L04	Increase daylight area	C406.2.5.4	~~3~~ x	~~3~~ x	~~3~~ x	~~3~~ x	~~3~~ x	~~3~~ x	~~2~~ x	~~2~~ x	~~2~~ x	~~2~~ x	~~2~~ x	~~2~~ x	~~1~~ x	~~2~~ x	~~1~~ x	~~1~~ x	~~1~~ x	~~1~~ x	~~1~~ x
L05	Residential light control	C406.2.5.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L06	Light power reduction	C406.2.5.7	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	1	2	1	1
Q01	Efficient elevator	C406.2.6.1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Q02	Commercial kitchen equip.	C406.2.6.2	24	26	28	27	28	29	27	29	32	26	28	29	24	26	28	21	23	19	17
Q03	Residential kitchen equip.	C406.2.6.3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q04	Fault detection	C406.2.6.4	3	2	2	2	2	2	2	2	1	2	2	1	2	2	2	3	2	3	4

a. "x" indicates measure is not available for that measure.

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

ID	Energy Credit Measure	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	5	9	5	8	5	6	10	5	2	20	6	6	25	10	4	28	22	26	16
E03	Envelope leak reduction	C406.2.1.3	6	4	5	4	3	7	12	3	2	28	5	6	36	9	3	41	27	33	15
E04	Add Roof Insulation	C406.2.1.4	4	4	3	4	4	4	8	6	2	7	6	7	9	8	9	9	10	9	12
E05	Add Wall Insulation	C406.2.1.5	16	19	11	17	5	6	10	7	2	9	6	8	9	7	7	9	9	10	8
E06	Improve Fenestration	C406.2.1.6	4	4	3	4	5	6	6	4	1	9	4	7	11	7	6	16	14	8	8
H01	HVAC Performance	C406.2.2.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H02	Heating efficiency	C406.2.2.2	x	x	x	x	x	x	6	2	3	11	6	8	15	11	9	18	15	19	23
H03	Cooling efficiency	C406.2.2.3	7	7	5	5	4	3	1	2	1	x	x	x	x	x	x	x	x	x	x
H04	Residential HVAC control	C406.2.2.4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
H05	DOAS/fan control	C406.2.2.5	7	36	31	34	30	28	43	32	23	61	42	49	75	61	49	90	77	93	90
W01	SHW preheat recovery	C406.2.3.1 a	18	19	22	21	25	26	28	29	34	29	31	34	29	31	35	26	29	27	26
W02	Heat pump water heater	C406.2.3.1 b	12	12	15	14	17	17	20	20	24	21	22	25	21	23	26	20	22	21	20
W03	Efficient gas water heater	C406.2.3.1 c	11	11	13	13	15	16	17	17	21	18	19	21	18	19	22	16	18	17	16
W04	SHW pipe insulation	C406.2.3.2	3	3	4	4	4	4	4	4	5	4	4	5	4	4	5	3	4	3	3
W05	Point of use water heaters	C406.2.3.3 a	8	10	11	10	11	12	12	12	14	13	13	14	13	13	14	11	12	12	11
W06	Thermostatic bal. valves	C406.2.3.3 b	1	1	1	1	1	1	1	1	2	1	1	2	1	1	2	1	1	1	1
W07	SHW heat trace system	C406.2.3.3 c	5	5	5	5	6	6	6	6	7	6	6	7	5	6	7	5	5	5	5
W08	SHW submeters	C406.2.3.4	11	11	13	13	15	16	18	18	22	19	20	22	19	20	24	17	20	18	18
W09	SHW flow reduction	C406.2.3.5	29	30	36	35	41	43	48	48	56	50	53	59	51	54	62	47	52	49	48
W10	Shower heat recovery	C406.2.3.6	6	6	7	7	8	9	10	10	11	10	11	12	10	11	12	10	11	10	10
P01	Energy monitoring	C406.2.4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4
L01	Lighting Performance	C406.2.5.1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L02	Lighting dimming & tuning	C406.2.5.2	5	5	5	5	6	6	5	6	7	5	5	5	4	4	5	3	4	3	2
L03	Increase occp. sensor	C406.2.5.3	5	6	6	6	7	7	6	7	8	5	6	6	4	5	6	3	4	3	2
L04	Increase daylight area	C406.2.5.4	~~7~~ x	~~8~~ x	~~9~~ x	~~8~~ x	~~9~~ x	~~9~~ x	~~8~~ x	~~8~~ x	~~10~~ x	~~6~~ x	~~7~~ x	~~7~~ x	~~5~~ x	~~6~~ x	~~6~~ x	~~4~~ x	~~5~~ x	~~5~~ x	~~4~~ x
L05	Residential light control	C406.2.5.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
L06	Light power reduction	C406.2.5.7	7	7	8	7	8	8	7	8	9	5	7	6	4	5	6	4	4	3	2
Q01	Efficient elevator	C406.2.6.1	4	4	5	4	5	5	5	5	6	4	5	5	4	4	5	3	4	3	3
Q02	Commercial kitchen equip.	C406.2.6.2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q03	Residential kitchen equip.	C406.2.6.3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Q04	Fault detection	C406.2.6.4	3	3	3	3	3	2	3	2	2	3	3	2	3	3	2	4	3	4	4

a. "x" indicates measure is not available for that measure.

b. Other occupancy groups include all Groups except for Groups A-2, B, E, I, M, and R.

C406.2.5.4 L04 Increase daylight area. The total daylight area of the building ~~project~~ (DLA_{BLDG}) ~~with continuous daylight dimming meeting the requirements of C405.2.4~~ determined by Equation 4-23 shall be at least 5 percent greater than the typical ~~daylit~~ daylight area (DLA_{TYP}) from Table C406.2.5.4.

$$DLA_{BLDG} = DLZ / LFA$$ **(Equation 4-23)**

where:

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

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

Credits for measure L04 shall be determined by ~~based on~~ Equation 4-24 or Equation 4-25, whichever is less::

(Equation 4-24)

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

EC_{DL}= The lesser of actual area of *daylight zones* in the *building* with continuous daylight dimming, ft^2 or m^2 and (GLFA x DLA_{max}) see TableC406.2.5.4. *Daylight zones* shall meet the criteria in Sections C405.2.4.2 and C405.2.4.3 for primary sidelit *daylight zones*, secondary sidelit *daylight zones*,and toplit *daylight zones*.

~~GLFA = Project gross lighted fl oor area, ft² or m²~~

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

EC_{DL5}= C406.2.5.4 L04 base energy credits from Section C406.2

(Equation 4-25)

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

where:

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

Building use type	DLA_{TYP}	DLA_{MAX}
Group B; Office ≤ 5000 ft^2 (460 m^2)	10%	20%
Group B; Office > 5000 ft^2 (460 m^2)	21%	31%
Group M; Retail with ≤ 1000 ft^2 (900 m^2) roof area	0%	20%
Group M; Retail with > 1000 ft^2 (900 m^2) roof area	60%	80%
Group E; Education	42%	52%
Groups S-1 and S-2; Warehouse	~~5~~0%	~~7~~0%
~~Group I-2, R, and other; Medical, hotel, multifamily, dormitory, and other~~	~~NA~~	~~NA~~

Reason: There are several problems with this credit which are corrected by this proposal:

1. This credit can only be achieved for occupancies where there are values provided for DLATYP and DLAMAX in Table C406.2.5.4 - otherwise the credit cannot be calculated. The relevant tables in C406.2 are amended to indicate that L04 cannot be achieved for those occupancies where DLATYP and DLAMAX are not provided.
2. C406.2.5.4 says that the credit is achieved when “the daylight area of the building is at least 5% greater than a percentage”. Equation 4-23 is added to convert DLABLDG to a percentage so that this comparison can be made.
3. GLFA (gross lighted floor area) is not a readily understood term. It is not used anywhere else in the code, and the word “gross” is unclear. This is revised to LFA (lighted floor area) and given a clear meaning.
4. ECDL is very confusing as the description includes conditional logic. This is broken into two separate equations for clarity.
5. Table C406.2.5.4 is amended to indicate clearly that buildings in Group S-1 and S-2 which are not warehouse cannot obtain the credit.
6. Table C406.2.5.4 is amended to strike the occupancy groups which are currently indicated as “NA”. This does not need to be in C406.2.5.4 when the tables in C406.2 are amended to show that L04 is not available for these occupancies.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No changes in scope or applicability are proposed – revisions are editorial.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: Per reason statement of proposal

Proposal # 1502

CECD1-7-22

IECC: C406.2.5.6

Proponents: Kristopher Stenger, representing ICC (kstenger@iccsafe.org); Michael Jouaneh, representing IECC CE Electrical Power, Lighting, and Renewables Subcommittee (ieccceelectrical@iccsafe.org)

2024 International Energy Conservation Code [RE Project]

Revise as follows:

C406.2.5.6 L06 Reduced lighting power. Interior lighting within ~~the whole~~ all building areas shall comply with ~~all the requirements of~~ this section. ~~The net connected interior lighting power (LPn) shall be 95 percent or less than the net interior lighting power allowance (LPAn) determined in accordance with Section C405.3.2.2. In R-1 and R-2 occupancies the credit is calculated for all common areas other than dwelling units and sleeping units. No less than 95 percent of the permanently installed light fixtures in dwelling units and sleeping units, excluding kitchen appliance lighting, shall be provided by high efficacy lamps with aminimum efficacy of 90 lumens per watt or high efficacy luminaires that have a minimum efficacy of 55 lumens per watt. Energy credits shall not be greater than four times the L06 base credit from Section C406.2 and shall be determined using Equation 4-25:~~

1. 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 4-25.
2. 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:

    1. LIghting integral to other appliances.
    2. Antimicrobial lighting used for the sole purpose of disinfecting.

(Equation 4-25)

$$EC_{LPA} = EC_5 \times 20 \times (LPA_n - LP_n)/LPA_n$$

EC_{LPA}= additional energy credit for lighting power reduction
LP~~n~~= ~~net~~ connected interior lighting power calculated in accordance with Section C405.3.1, watts~~, excluding any additional lighting power allowed in Section C405.3.2.2.1~~
LPA~~n~~= interior lighting power allowance calculated in accordance with the requirements of Section C405.3.2~~.2~~, watts~~, less any additional interior lighting power allowed in Section C405.3.2.2.1~~
EC5 = L06 base credit from Section C406.2

Reason: This section required some editorial fixes to align with IECC 2024 PC#1. Additionally, some minor changes in stringency are proposed. The proponent of CEPI-193 (DoE) was involved in development of these proposed changes.

- The reference to the section that defines how lighting power is calculated was corrected (C405.3.2)
- The explanation that dwelling units and sleeping are excluded from the calculation is no longer needed due to the addition of C405.3.1 exception #1 in PC Draft #1
- The requirement that no less than 95% of lighting comply, was removed. This is appropriate for an additional efficiency option and simplifies the requirement significantly.
- The language regarding kitchen appliance/exhaust fans was revised to match a draft PLR SC proposal that makes this change.
- Wording was revised to match C405.1.1 in PC draft#1
- Luminaire efficacy threshold was increased to 65 LPW. This is appropriate for an additional efficiency option.
- The exclusion of additional lighting power from the calculation of credits was removed. This will align with the way that COMCheck calculates the percentage reduction in power below code allowed and simplifies the calculation. This change may slightly increase stringency for some projects but does not reduce stringency for any project.

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

Workgroup Recommendation

Commercial Energy Committee Committee Action: Approve
Commercial Energy Committee Reason: Mostly editorial changes to better align with base code, and increase in stringency in terms of luminaire efficacy.

CECD1-8-22

Proponents: Kristopher Stenger, representing ICC

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C407.5 Calculation software tools. Calculation procedures used to comply with ~~this section~~ Section C407 shall ~~be~~ apply an approved version of a performance analysis software tools capable of calculating the annual energy consumption of all building elements that differ between the *standard reference design* and the *proposed design*. The same approved version of the performance analysis tool shall be used to calculate the proposed design and standard reference design.~~and shall include the following capabilities:~~

1. ~~Building operation for a full calendar year (8,760 hours).~~
2. ~~Climate data for a full calendar year (8,760 hours) and shall reflect *approved* coincident hourly data for temperature, solar radiation, humidity and wind speed for the building location.~~
3. ~~Ten or more thermal zones.~~
4. ~~Thermal mass effects.~~
5. ~~Hourly variations in occupancy, illumination, receptacle loads, thermostat settings, mechanical ventilation, HVAC equipment availability, service hot water usage and any process loads.~~
6. ~~Part-load performance curves for mechanical equipment.~~
7. ~~Capacity and efficiency correction curves for mechanical heating and cooling equipment.~~
8. ~~Printed *code official* inspection checklist listing each of the *proposed design* component characteristics from Table C407.4.1(1) determined by the analysis to provide compliance, along with their respective performance ratings, including but not limited to *R*-value, *U*-factor, SHGC, HSPF, AFUE, SEER and EF.~~

C407.5.1 ~~Specific~~ Software tool approval. Any version of a performance ~~Performance~~ analysis ~~tools complying with the applicable subsections~~ tool meeting the requirements of Section ~~C407~~ C407.5.1.1 and C407.5.1.2 ~~tested according to ASHRAE Standard 140~~ shall be permitted to be *approved.* Tools are permitted to be *approved* based on meeting a specified threshold for a jurisdiction. The *code official* shall be permitted to approve tools for a specified application or limited scope.

Add new text as follows:

C407.5.1.1 Software tool capabilities. Approved software tools shall include the following capabilities:

1. Building operation for a full calendar year (8,760 hours).
2. Climate data for a full calendar year (8,760 hours) and shall reflect approved coincident hourly data for temperature, solar radiation, humidity, and wind speed for the building location.
3. Ten or more thermal zones.
4. Thermal mass effects.
5. Hourly variations in occupancy, illumination, receptacle loads, thermostat settings, mechanical ventilation, HVAC equipment availability, service hot water usage and any process loads.
6. Part-load performance curves for mechanical equipment.
7. Capacity and efficiency correction curves for mechanical heating and cooling equipment.
8. Printed code official inspection checklist listing each of the proposed design component characteristics from Table C407.4.1(1) determined by the analysis to provide compliance, along with their respective performance ratings, including but not limited to R-value, U-factor, SHGC, HSPF, AFUE, SEER and EF.

Revise as follows:

C407.5.~~2~~ 3 Input values. Where calculations require input values not specified by Sections C402, C403, C404 and C405, those input values shall be taken from an *approved* source.

C407.5.~~3~~ 4 Exceptional calculation methods. Where the simulation program does not model a design, material or device of the *proposed design*, an exceptional calculation method shall be used where approved by the *code official*. Where there are multiple designs, materials or devices that the simulation program does not model, each shall be calculated separately and exceptional savings determined for each. The total exceptional savings shall not constitute more than half of the difference between the baseline simulated building performance and the proposed simulated building performance. Applications for approval of an exceptional method shall include all of the following:

1. Step-by-step documentation of the exceptional calculation method performed, detailed enough to reproduce the results.
2. Copies of all spreadsheets used to perform the calculations.
3. A sensitivity analysis of energy consumption where each of the input parameters is varied from half to double the value assumed.
4. The calculations shall be performed on a time step basis consistent with the simulation program used.
5. The performance rating calculated with and without the exceptional calculation method.

ASHRAE

ASHRAE
180 Technology Parkway NW
Peachtree Corners, GA 30092

140—~~2014~~ 2020: Standard Method of Test for ~~the Evaluation of~~ Evaluating Building ~~Energy Analysis Computer Programs~~ Performance Simulation Software (with Addenda A and B)

Add new text as follows:

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 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.

C407.5.2 Algorithms not tested. Algorithms not tested in accordance with C407.5.1.2, including algorithms that are alternatives to those that were tested, and numerical settings not tested, such as timesteps and tolerances, shall be permitted to be used when modeling the proposed design and *standard reference design.*

Reason: Addendum b for ASHRAE Standard 140-2020 adds software acceptance criteria to Standard 140, allowing codes citing Standard 140, such as IECC, to require the results from software to provide results within the ranges included in the addendum. This provides the IECC with a measure of the acceptability of a building performance simulation software program based on the tests included in Standard 140. Before Addendum b, Standard 140 had test cases with example results to evaluate building performance software. But, it did not include any information on when a software’s results would be considered acceptable for the test cases. This meant that organizations that cited Standard 140 would only require that software ran the tests and not that their results had to be within a specific range of results. Historically, this caused confusion for jurisdictions adopting IECC when determining if software passed or failed 140 when simply running the tests was all that was required.
All major building energy modeling software developers were invited to participate in the process to determine the acceptance ranges that appear in 140-2020, Addendum b and many software developers participated. The acceptance ranges were set so that most commonly used software programs are within the ranges, and additional software is expected to be within the ranges as software developers address outlying results. Overall, this approach will encourage building performance simulation software to be more accurate and consistent. No comments were provided during the public review of Addendum b, which reflects the consensus reached within the software and modeling community.

This proposal adds the necessary referencing language to utilize Addendum b for ASHRAE Standard 140, including the acceptance ranges to be met, the reporting requirements, and the details necessary for testing to section C407 Simulated Building Performance.

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 construction. It impacts only an alternative path to compliance C407. The modeler needs to select to use software that complies, which is no different than previously. The additional burden of testing software using Standard 140 rests with the building performance software vendor, where for many software vendors much of this cost has already been borne when they submitted results during development of the acceptance criteria.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: This proposal incorporates ASHRAE Standard 140-2020 modeling software acceptance criteria into Section C407.5.

Proposal # 1505

CECD1-9-22

Proponents: Kristopher Stenger, representing ICC

2024 International Energy Conservation Code [CE Project]

Delete and substitute as follows:

~~AAMA~~

~~American Architectural Manufacturers Association~~
~~1827 Walden Office Square Suite 550~~
~~Schaumburg, IL 60173-4268~~

FGIA

Fenestration & Glazing Industry Alliance (formerly AAMA)
1900 E. Golf Road, Suite 1250
Schaumburg, IL 60173

Revise as follows:

AAMA

American Architectural Manufacturers Association
1827 Walden Office Square Suite 550
Schaumburg, IL 60173-4268

AAMA/WDMA/CSA 101/I.S.2/A440 ~~—17~~ 22:	North American Fenestration Standard/Specification for ~~Windows~~ windows, ~~Doors~~ doors, and ~~Skylights~~ skylights

CSA

CSA Group
8501 East Pleasant Valley Road
Cleveland, OH 44131-5516

AAMA/WDMA/CSA 101/I.S.2/A440 ~~—17~~ 22:	North American Fenestration Standard/Specification for ~~Windows~~ windows, ~~Doors~~ doors, and ~~Unit Skylights~~ skylights

WDMA

Window ~~and~~ & Door Manufacturers Association
~~2025 M Street NW, Suite 800~~ 2001 K Street NW, Suite 300
Washington, DC ~~20036-3309~~ 20006

WDMA

Window and Door Manufacturers Association
2025 M Street NW, Suite 800
Washington, DC 20036-3309

AAMA/WDMA/CSA 101/I.S.2/A440 ~~—17~~ 22:	North American Fenestration Standard/Specification for ~~Windows~~ windows, ~~Doors~~ doors, and ~~Skylights~~ skylights

Reason: This proposal provides corrections to the listing of the *North American Fenestration Standard/Specification for windows, doors, and skylights* which is a referenced standard in Chapter 4 the IECC. There have been recent changes to the names and/or locations of the promulgating organizations. In addition, the title was slightly incorrect and the standard has also been updated.
The American Architectural Manufacturers Association (AAMA) has changed its name to the Fenestration & Glazing Industry Alliance (FGIA) and also changed its office address.

The Window & Door Manufacturers Association relocated its office.

Also, the title of *AAMA/WDMA/CSA 101/I.S.2/A440: North American Fenestration Standard/Specification for windows, doors, and skylights* has been inconsistently referenced in the code.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
no change to cost of construction

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: Based on proponent's reason statement.

Proposal # 1507

CECD1-11-22

Proponents: Kristopher Stenger, representing ICC

2024 International Energy Conservation Code [CE Project]

Revise as follows:

LOW SLOPE~~LOW-SLOPED ROOF~~. A ~~roof having a~~ slope less than 2 units vertical in 12 units horizontal (17-percent slope) as applied to roofs.

C402.4 Roof solar reflectance and thermal emittance. ~~Low-sloped~~ *Low slope* roofs directly above cooled conditioned spaces in *Climate Zones* 0 through 3 shall comply with one or more of the options in Table C402.4.

Exceptions: The following roofs and portions of roofs are exempt from the requirements of Table C402.4:

1. Portions of the roof that include or are covered by the following:
   1.1. Photovoltaic systems or components.
   1.2. Solar air or water-heating systems or components.
   1.3. Vegetative roofs or landscaped roofs.
   1.4. Above-roof decks or walkways.
   1.5. Skylights.
   1.6. HVAC systems and components, and other opaque objects mounted above the roof.
2. 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.
3. 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.
4. Roofs where not less than 75 percent of the roof area complies with one or more of the exceptions to this section.

CB103.1 General. A solar-ready zone shall be located on the roof of buildings that are five stories or less in height above grade plane, and are oriented between 110 degrees and 270 degrees of true north or have ~~low-slope~~ *low slope* roofs. Solar-ready zones shall comply with Sections CB103.2 through CB103.8.

Exceptions:

1. A building with a permanently installed, on-site renewable energy system.
2. A building with a solar-ready zone that is shaded for more than 70 percent of daylight hours annually.
3. A building where the licensed design professional certifies that the incident solar radiation available to the building is not suitable for a solar-ready zone.
4. A building where the licensed design professional certifies that the solar zone area required by Section CB103.3 cannot be met because of extensive rooftop equipment, skylights, vegetative roof areas or other obstructions.

CD101.3 On-site renewable electricity systems. In addition to any renewable energy generation equipment provided to comply with Section C406.3, buildings shall install equipment for on-site renewable energy generation with a direct current (DC) nameplate capacity rating of not less than that computed using Equation CD-2.

$$\underline{AA = CA + SNA/3} \quad \textbf{CD-1}$$

AA = Adjusted area, in ft^2 (m^2)
CA = Conditioned area, in ft^2 (m^2)
SNA = Semi-heated and nonconditioned area, in ft^2 (m^2)

$$\underline{REQ = AA \times CF} \quad \textbf{CD-2}$$

REQ = Required on-site capacity, in DC watts
AA = Adjusted area from Equation CD-1, in ft^2 (m^2)
CF = Capacity factor from Table CD101.3, in watts/ft^2 (m^2)

Exceptions:

1. Any required renewable energy generation capacity in excess of 10 W/ft^2 (108 W/m^2) of net available roof area is permitted to be provided using an off-site renewable energy system in accordance with Section CD101.4. For the purposes of this section, net available roof area is the gross roof area minus the roof area occupied by any combination of skylights, mechanical equipment, vegetated areas, required access pathways, vehicle parking, and occupied roof terrace area.
2. The following buildings are permitted to provide off-site renewable energy generation in accordance with Section CD101.4 in lieu of all or part of the on-site renewable energy generation capacity required by Section CD101.3.

   2.1 Any *building* where more than 50 percent of roof area would be shaded from direct-beam sunlight by existing natural objects or by structures that are not part of the building for more than 2500 annual hours between 8:00 a.m. and 4:00 p.m.

   2.2 Any *building* with gross conditioned floor area less than 1,000 square feet (93 m^2).

   2.3 Any *building* whose primary roof slope is 2 units vertical in 12 units horizontal (17-percent slope) or greater ~~than 2 in 12~~.

3. Alternate forms of renewable energy generation capacity are permitted where the annual energy generation is not less than that produced by the required solar capacity, and where annual energy generation is calculated using an *approved* methodology.
4. All or part of the required renewable energy generation capacity is permitted to be replaced by other efficiency measures provided such measures will reduce the annual energy consumption of the *building* by an amount no less than that which would otherwise be produced annually by the required renewable energy capacity, as calculated using the total building performance compliance path in Section C407 and an approved calculation methodology for solar production.

Reason: This comment:

- Changes the IECC commercial provisions defined term from "low-sloped roof" to "low slope."
- Adjusts the definition to align with the term and coordinate with the existing IBC definition of "steep slope" [i.e., "A roof slope 2 units vertical in 12 units horizontal (17-percent slope) or greater."].
- Makes changes to use the defined term in C402.4.
- Makes changes to use the defined term in CB103.1.
- Changes the wording of CD101.3 to align the exception with the definition.

In combination, these modifications are intended to clarify provisions within the IECC and align complementary terminology between the IECC and IBC.

RED1-182-22 is a companion comment which changes the new terms "low-sloped roof" and "steep-sloped roof" in the residential 1st Public Comment Draft to "low slope" and "steep slope," respectively, and coordinates their use with the residential roof radiative property provisions. RED1-182-22 has been approved by the Residential Consensus Committee.

The term serves within the body of the commercial 1st Public Comment Draft solely as a trigger in C402.4 for roof radiative properties. As is shown via the proposed change to CB103.1, it may be appropriate as a trigger for solar-ready zones. However, if the intention in CB103.1 is to refer to a slope trigger different than 2 in 12, the defined term should not be used and the proposed change to CB103.1 should be removed from this comment.

The proposed modification to CD101.3 coordinates an exception to the onsite renewable electricity system provisions in the appendix by clarifying that a roof with a slope of exactly 2 in 12 falls within the exception, creating consistency between the defined term and this trigger.

Regarding potential concerns about defining the term "low slope" solely with respect to roofs, note that the words "slope" and "sloped" appear in the Commercial 1st Public Comment Draft in the following locations in addition to the ones included for revision in this comment:

- **Chapter 2, definition of fenestration**

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

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

· **Table C301.1**

o North Slope, Alaska

o Slope, North Dakota

· **Figure C405.2.4.2(3)**

o Daylight Zone Under a Sloped Rooftop Monitor

No confusion is created with the proposed term “low slope” with respect to these other uses of “slope.” Uses in the residential 1st Public Comment Draft are identical except there is no equivalent to Figure C405.2.4.3(3) and there is a use in the definition of “grade plane,” which is not defined in the commercial 1st Public Comment Draft.

Limiting the definition to roofs also serves to guide decisions about where to italicize “low slope.” In fact, this is not an issue in the 2021 IBC or 2021 IRC, which include no uses of the phrase “low slope” outside the roofing chapters (i.e., 15 and 9, respectively). There are no uses of “low slope” in the IEBC.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
this proposal neither increases or decreases the cost of construction. It is merely a terminology clarification.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: The definition of slopes, with regard to roofing, is clarified.

Proposal # 1511

CECD1-12-22

Proponents: Kristopher Stenger, representing ICC (kstenger@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

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

EQUIPMENT TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE[a]
Air cooled (dehumidification mode)	—	~~4.0~~ 3.8 ISMRE 2	AHRI 920
Air-source heat pumps (dehumidification mode)	—	~~4.0~~ 3.8 ISMRE 2	AHRI 920
Water cooled (dehumidification mode)	Cooling tower condenser water	~~4.9~~ 4.7 ISMRE 2	AHRI 920
	~~Chilled water~~	~~6.0 ISMRE~~	
Air-source heat pump (heating mode)	—	~~2.7~~ 2.05 ISCOP 2	AHRI 920
Water-source heat pump (dehumidification mode)	Ground source, closed and open loop[b]	~~4.8~~ 4.6 ISMRE 2	AHRI 920
	~~Ground-water source~~	~~5.0 ISMRE~~	
	Water source	~~4.0~~ 3.8 ISMRE 2	
Water-source heat pump (heating mode)	Ground source, closed and open loop[b]	~~2.0~~ 2.13 ISCOP 2	AHRI 920
	~~Ground-water source~~	~~3.2 ISCOP~~	
	Water source	~~3.5~~ 2.13 ISCOP 2	

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. ~~This table is a replica of ASHRAE 90.1 Table 6.8.1-13 Electrically Operated DX-DOAS Units, Single-Package and Remote Condenser, without Energy Recovery—Minimum Efficiency Requirements.~~ For minimum efficiency compliance purposes, open loop systems shall be rated using closed-loop test conditions.

TABLE C403.3.2(13) ELECTRICALLY OPERATED DX-DOAS UNITS, SINGLE-PACKAGE AND REMOTE CONDENSER, WITH ENERGY RECOVERY—MINIMUM EFFICIENCY REQUIREMENTS~~[b]~~

EQUIPMENT TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE[a]
Air cooled (dehumidification mode)	—	~~5.2~~ 5.0 ISMRE 2	AHRI 920
Air-source heat pumps (dehumidification mode)	—	~~5.2~~ 5.0 ISMRE 2	AHRI 920
Water cooled (dehumidification mode)	Cooling tower condenser water	~~5.3~~ 5.1 ISMRE 2	AHRI 920
	~~Chilled water~~	~~6.6 ISMRE~~	
Air-source heat pump (heating mode)	—	~~3.3~~ 3.2 ISCOP 2	AHRI 920
Water-source heat pump (dehumidification mode)	Ground source, closed and open loop[b]	~~5.2~~ 5.0 ISMRE 2	AHRI 920
	~~Ground-water source~~	~~5.8 ISMRE~~	
	Water source	~~4.8~~ 4.6 ISMRE 2	
Water-source heat pump (heating mode)	Ground source, closed and open loop[b]	~~3.8~~ 3.5 ISCOP 2	AHRI 920
	~~Ground-water source~~	~~4.0 ISCOP~~	
	Water source	~~4.8~~ 4.04 ISCOP 2	

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. ~~This table is a replica of ASHRAE 90.1 Table 6.8.1-14 Electrically Operated DX-DOAS Units, Single-Package and Remote Condenser, with Energy Recovery—Minimum Efficiency Requirements.~~ For minimum efficiency compliance purposes, open loop systems shall be rated using closed-loop test conditions.

AHRI

Air-Conditioning, Heating, & Refrigeration Institute
~~2111~~ 2311 Wilson Blvd, Suite ~~500~~ 400
Arlington, VA 22201

AHRI

Air-Conditioning, Heating, & Refrigeration Institute
2111 Wilson Blvd, Suite 500
Arlington, VA 22201

~~920—2015:~~ANSI/AHRI 920-2020 with Addendum 1: Performance Rating of DX-Dedicated Outdoor Air System Units

Reason: To ensure marketplace consistency with DOE's adoption of ISMRE2 and ISCOP2 levels based on AHRI 920-2020, this committee drafted proposal includes the following changes:
1. Updates existing IECC 2021 ISMRE and ISCOP standards to ISMRE2 and ISCOP2 standards consistent with the Department of Energy final rule, published in the Federal Register on November 1, 2022. (87 FR 65651)
a. Note: The effective date of this rule was January 3, 2023. Compliance with the standards established for DX-DOASes in this final rule is required on and after May 1, 2024, so no date was proposed herein as standards will already be federally effective upon publication of UECC 2025.
2. For the four equipment classes covered by 90.1, but not considered by DOE, this proposal harmonizes with Addendum cv of ASHRAE Standard 90.1-2019, changing ISMRE and ISCOP standards to ISMRE2 and ISCOP2 standards based on an industry analysis. Four of these equipment classes were be combined into two.
3. Adds AHRI Standard 920-2020 to Normative References in Section 6

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change is not expected to change the cost of construction.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: To ensure marketplace consistency with DOE's adoption of ISMRE2 and ISCOP2 levels based on AHRI 920-2020, this committee drafted proposal includes the following changes:
1. Updates existing IECC 2021 ISMRE and ISCOP standards to ISMRE2 and ISCOP2 standards consistent with the Department of Energy final rule, published in the Federal Register on November 1, 2022. (87 FR 65651)

a. Note: The effective date of this rule was January 3, 2023. Compliance with the standards established for DX-DOASes in this final rule is required on and after May 1, 2024, so no date was proposed herein as standards will already be federally effective upon publication of UECC 2025.
2. For the four equipment classes covered by 90.1, but not considered by DOE, this proposal harmonizes with Addendum cv of ASHRAE Standard 90.1-2019, changing ISMRE and ISCOP standards to ISMRE2 and ISCOP2 standards based on an industry analysis. Four of these equipment classes were be combined into two.
3. Adds AHRI Standard 920-2020 to Normative References in Section 6

Proposal # 1513

CECD1-13-22

Proponents: Kristopher Stenger, representing ICC (kstenger@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C403.11.6 Heat recovery for space conditioning in healthcare facilities. Where heating water is used for space heating, a ~~condenser~~ heat pump chiller meeting the requirements of Table C403.3.2(15) for heat recovery ~~system~~ and uses the cooling *system* return water as the heat source shall be installed where ~~provided that all of~~ the following are true:

1. The building is a Group I-2, Condition 2 occupancy.
2. The total design chilled water capacity for the Group I-2,Condition 2 occupancy, either air cooled or water cooled, required at cooling design conditions exceeds 3,600,000 Btu/h (1100 kw) of cooling.
3. Simultaneous heating, including *reheat*, and cooling occurs above 60°F (16°C) outdoor air temperature.

The ~~required~~ heat recovery system shall have a cooling capacity ~~that is~~ of not less than 7 percent of the total design chilled water capacity of the Group I-2, Condition 2 occupancy at peak design conditions.

Exceptions:

1. Buildings that provide 60 percent or more of their reheat energy from on-site renewable energy or other site-recovered energy. *On-site renewable energy* used to meet Sections C405.15.1 or C406.3.1 shall not be used to meet this exception.
2. Buildings in Climate Zones 5C, 6B, 7, and 8.

Reason: Section C403.11.6, “Heat Recovery for Space Conditioning in Healthcare Facilities,” requires heat recovery in most acute inpatient hospitals. The existing language refers to “condenser heat recovery.” The heat source was intended to be the chilled water return, and the economic justification was built on that. The diagram shows a parallel and in-series system. Both are acceptable ways to meet the requirement.

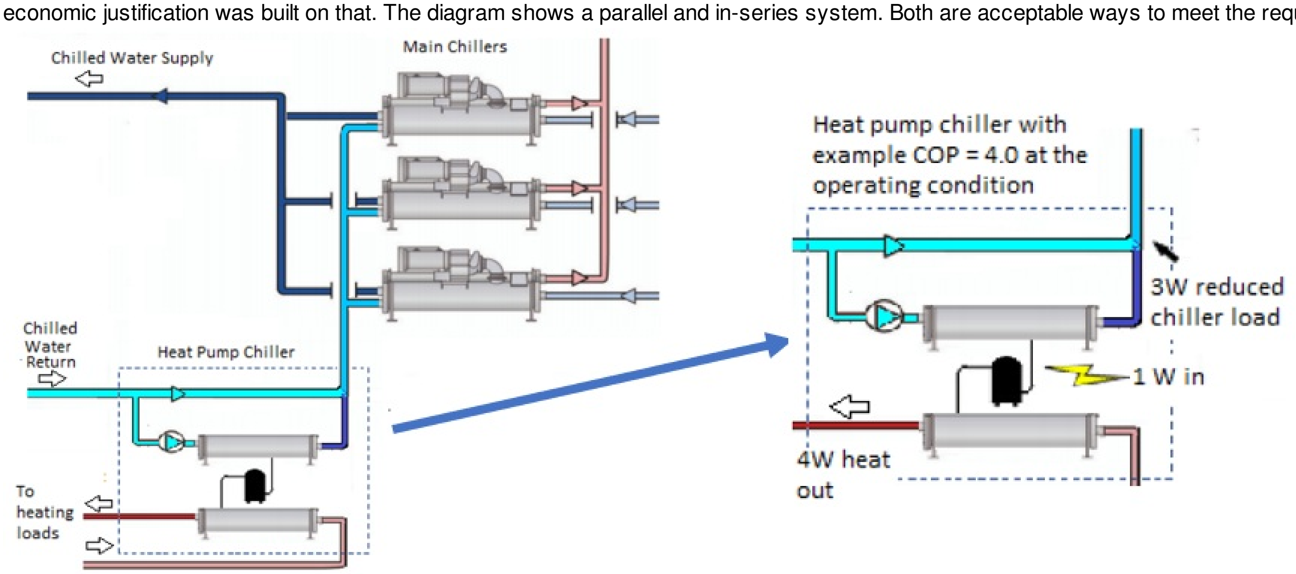


Figure 1. Heat pump chiller piped in series

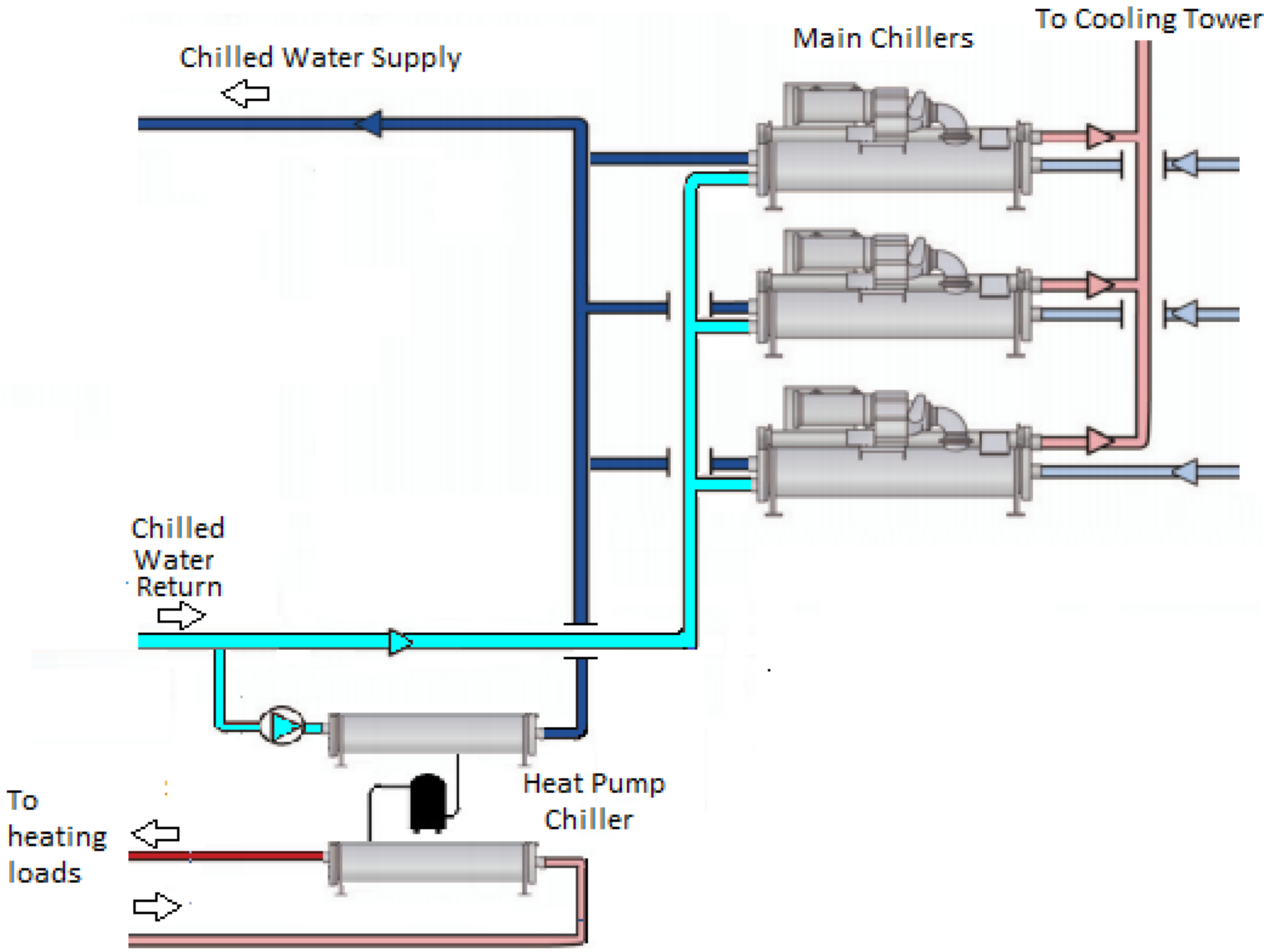


Figure 2. Heat pump chiller piped in parallel

The term “condenser heat recovery” has led some users to believe that the heat source can be water leaving the main chiller condenser. While this method does recover heat, it does not reduce the load on the chillers. Using the chilled return water as the heat source saves much more energy.

Reviewers should know that the misunderstanding extends to the ASHRAE 90.1-2019 User’s Manual. The intent of the language is not correctly described. This discrepancy will be addressed.

ASHRAE SSPC 90.1 passed addendum cu, which is nearly identical to this proposal. It was included in the 2022 version of the standard. The addendum can be found at this link:

https://www.ashrae.org/file%20library/technical%20resources/standards%20and%20guidelines/standards%20addenda/90_1_2019_cu_20220630.pdf

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Economic justification:

This addendum clarifies existing requirements. The economic justification was completed when Section 6.5.6.3 was created for the 2019 version of ASHRAE 90.1, and the same rationale was used for IECC 2021. The justification was based on recovering heat from the chilled water return.

Cost of construction:

This proposal neither increases nor decreases the cost of construction. The exception for site recovered energy was removed because there is no first cost increase to use the chilled water return system as the heat source rather than the chiller condenser water. The exception for on-site renewable energy was removed because there are now separate requirements for on-site renewable energy elsewhere in the standard.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: Standing on the reason statement with the proposal but with clearer language.

Proposal # 1520

CECD1-14-22

Proponents: Kristopher Stenger, representing ICC (kstenger@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

Add new definition as follows:

HIGH-CAPACITY GAS-FIRED WATER HEATER. Gas-fired instantaneous water heaters 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.

Revise as follows:

C404.2.1 High input service water-heating systems. Gas-fired ~~service water-heating equipment~~ *water heaters* installed in new buildings where the total input capacity provided by *high-capacity gas-fired water heaters* ~~high-capacity service water heating equipment~~ is 1,000,000 Btu/h (293 kW) or greater shall ~~be in compliance~~ comply with either or both of the following requirements.

1. Where a singular piece of *high-capacity gas-fired water heater* ~~high-capacity gas-fired service water-heating equipment~~ is installed, ~~such equipment~~ the *water heater* shall have a thermal efficiency, Et, of not less than 92 percent.
2. Where multiple pieces of *high-capacity gas-fired water heaters* ~~high-capacity gas-fired service water-heating equipment~~ 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* ~~gas-fired equipment~~ in the service water-heating system shall have a thermal efficiency of not less than 92 percent.

~~High-capacity gas-fired service water-heating equipment is comprised of gas-fired instantaneous water heaters with a rated input both 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.~~

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 requireements 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.

C404.8.3 Covers. Outdoor heated pools and outdoor permanent spas shall be provided with a vapor-retardant cover or other *approved* vapor-retardant means.

Exception: Where more than 75 percent of the energy for heating, computed over an operating season of not fewer than 3 calendar months, is from a heat pump or an on-site renewable energy system, covers or other vapor-retardant means shall not be required. On-site renewable energy used to meet Sections C405.15.1 or C406.3.1 shall not be used to meet this exception.

Reason: The exceptions to efficiency requirements in Sections C404.2.1 and C404.8.3 were created long before the IECC included provisions for employing on-site renewable energy. The exceptions were created because the underlying requirements were not cost-effective if a portion of the energy was free. In addition, there was the added benefit of encouraging the use of renewable energy.
The addition of on-site renewable energy requirements in Section C405.15.1 and optional credits in Section C406.3.1 creates a risk that the renewable energy used to meet those sections could be applied to the exceptions. Therefore, this proposal requires that on-site renewable energy used to meet the exception is not the same energy used to meet other requirements.

The changes in the body of C404.2.1 High-input service water-heating systems are editorial and do not change the requirement.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Changes are editorial and do not change the requirement.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: this proposal requires that on-site renewable energy used to meet the exception is not the same energy used to meet other requirements.
The changes in the body of C404.2.1 High-input service water-heating systems are editorial and do not change the requirement.

Proposal # 1514

CECD1-15-22

Proponents: Kristopher Stenger, representing ICC (kstenger@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

CD101.1 Prescriptive compliance. Where compliance is demonstrated using the prescriptive compliance option in Section C401.2.1, the number of additional efficiency credits required by Section C406.1 shall be ~~50 percent higher than~~ 1.4 times the number that required by ~~Table~~ Section C406.1.1.

CD101.2 Total building performance compliance . Where compliance is demonstrated using the total building performance option of Section C401.2.1, the percentage of annual energy cost (PAEC), applied to the standard reference design referenced in Equation ~~4-23~~ 4-32, shall be multiplied by ~~0.98~~ 0.97.

Reason: The Glide Path appendix was originally approved with "placeholder" values, pending evaluation of the overall code progress. Attached please find the proposed revisions to those values, based on input from PNNL and Mike Waite.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
this modifications do not increase or decrease the cost of construction

---

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: This proposal updates “placeholder values” for the prescriptive pathway additional energy credit requirement and the performance path PAEC multiplier based on input from PNNL and others. It also incorporates two editorial changes.

Proposal # 1516

CECD1-16-22

Proponents: Kristopher Stenger, representing ICC (kstenger@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

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 ~~Common~~ ~~area~~ area, the following space types ~~Restrooms, laundry rooms, storage rooms, and utility rooms~~ shall have ~~automatic full OFF occupancy~~ occupant sensor controls that comply with the requirements of C405.2.1.1 :Laundry/washing areas, dining areas, food preparation areas, seating areas, exercise areas, playing areas, and massage spaces. . ~~Each additional control device shall control no more than 5,000 sq.ft (464 m~~~~^{2}~~~~).~~
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.

~~2.~~ 3. Each dwelling unit shall have a switch ~~main control~~ by the main entrance that turns off all the ~~lights~~ lighting and all switched receptacles in the dwelling unit. The switch shall be clearly labeled. ~~Two switched receptacles shall be provided in living and sleeping rooms or areas and clearly identified. All switched receptacles shall be located within 12 inches (30 cm) of an unswitched receptacle. The main control shall be permitted to have two controls, one for permanently wired lighting and one for switched receptacles. The main controls should be clearly identified as “lights master off” and “switched outlets master off.”~~

Reason: This is primarily, but not entirely, an editorial cleanup. The following issues are addressed by this proposal:
1. Some of the listed common area space types are already required to have occupant sensor controls in base code (restrooms, storage rooms).
2. Space types are revised to conform to the list of spaces in C405.3.2(2) for consistency with other sections of the code, and to improve enforceability.
3. Occupant sensor is a defined term in the code, but occupancy sensor is not.
4. No common areas in residential building would have individual rooms greater than 5,000 sf.
5. The proposal was not clear on the quantity of switched receptacles required – two per apartment unit, or two per living and sleeping room. We revised to one per living and sleeping room.
6. Usually in residential construction switched receptacles are counted as meeting NEC receptacle requirements. We were not clear on why these are required to be in addition to NEC receptacle requirements (which is the effect of requiring a non-dim receptacle within 12 inches).
7. Having two controls at the main entry makes it more likely that the receptacle switch control will just be left “on”.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Will not change the cost of construction

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: Adds space types for occupant sensor control and removes spaces that already would have been required to install occupant sensors. Also, provide clarifications and makes the language more enforceable.

Proposal # 1519

CECD1-17-22

Proponents: Kristopher Stenger, representing ICC (kstenger@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C403.8.1 **~~Fan power~~** **Allowable fan horsepower.** ~~For each fan system serving an occupied space or other enclosed space that includes one or more fans or fan arrays with fan electrical input power greater than 1 kW, fan system electrical input power determined per Section C403.8.1.2 at the fan system design airflow shall not be greater than the limit is calculated in accordance with Section C403.8.1.1. This section does not apply to fans service heat rejection equipment.~~ Where the summed fan system motor nameplate horsepower of an HVAC fan system is greater than 5 hp (3.7 kW) at fan system design conditions, it shall not be greater than the allowable total fan system motor nameplate hp (Option 1) or fan system bhp (Option 2) specified in Table C403.8.1(1). Such summed HVAC fan system motor nameplate horsepower shall include supply fans, exhaust fans, return or relief fans, and fan-powered terminal units associated with systems providing heating or cooling capability. Single-zone variable air volume systems shall comply with the constant volume fan power limitation.

Exceptions:

1. Hospital, vivarium and laboratory systems that utilize flow control devices on exhaust or return to maintain space pressure relationships necessary for occupant health and safety or environmental control shall be permitted to use variable volume fan power limitation.
2. Individual exhaust fans with motor nameplate horsepower of 1 hp (0.746 kW) or less are exempt from the allowable fan horsepower requirement.

Add new text as follows:

C403.8.2 **Motor nameplate horsepower.** For each fan, the fan brake horsepower (bhp) shall be indicated on the construction documents and the selected motor shall be not larger than the first available motor size greater than the following: 1. For fans less than 6 bhp (4476 W), 1.5 times the fan brake horsepower.

TABLE C403.8.1(1) FAN POWER LIMITATION

-	LIMIT	CONSTANT VOLUME	VARIABLE VOLUME
Option 1: Fan system motor nameplate hp	Allowable nameplate motor hp	hp<=CFMs x 0.0011	hp<=CFMs x 0.0015
Option 2: Fan system bhp	Allowable fan system bhp	bhp<=CFMs x 0.00094 + *A*	bhp<=CFMs x 0.0013 + *A*

For SI: 1 bhp = 735.5 W, 1 hp = 745.5 W, 1 cfm = 0.4719 L/s.
where:
CFM_S =The maximum design supply airflow rate to conditioned spaces served by the system in cubic feet per minute.
hp = The maximum combined motor nameplate horsepower.
bhp = The maximum combined fan brake horsepower.
A = Sum of [PD × CFM_D / 4131].
where:
PD = Each applicable pressure drop adjustment from Table C403.8.1(2) in. w.c.
CFM_D = The design airflow through each applicable device from Table C403.8.1(2) in cubic feet per minute.

TABLE C403.8.1(2) FAN POWER LIMITATION PRESSURE DROP ADJUSTMENT

DEVICE	ADJUSTMENT
CREDITS	-
Return air or exhaust systems required by code or accreditation standards to be fully ducted, or systems required to maintain air pressure differentials between adjacent rooms	0.5 inch w.c. (2.15 inches w.c. for laboratory and vivarium systems)
Return and exhaust airflow control devices	0.5 inch w.c.
Exhaust filters, scrubbers or other exhaust treatment	The pressure drop of device calculated at fan system design condition
Particulate filtration credit: MERV 9 thru 12	0.5 inch w.c.
Particulate filtration credit: MERV 13 thru 15	0.9 inch w.c.
Particulate filtration credit: MERV 16 and greater and electronically enhanced filters	Pressure drop calculated at 2 times the clean filter pressure drop at fan system design condition.
Carbon and other gas-phase air cleaners	Clean filter pressure drop at fan system design condition.
Biosafety cabinet	Pressure drop of device at fan system design condition.
Energy recovery device, other than coil runaround loop	For each airstream, (2.2 x energy recovery effectiveness - 0.5) inch w.c.
Coil runaround loop	0.6 inch w.c. for each airstream.
Evaporative humidifier/cooler in series with another cooling coil	Pressure drop of device at fan system design conditions.
Sound attenuation section (fans serving spaces with design background noise goals below NC35)	0.15 inch w.c.
Exhaust system serving fume hoods	0.35 inch w.c.
Laboratory and vivarium exhaust systems in high-rise buildings	0.25 inch w.c./100 feet of vertical duct exceeding 75 feet.
Deductions	-
Systems without central cooling device	-0.6 inch w.c.
Systems without central heating device	-0.3 inch w.c.
Systems with central electric resistance heat	-0.2 inch w.c.

For SI: 1 inch w.c. = 249 Pa, 1 inch = 25.4 mm, 1 foot = 304.8 mm.
w.c. = Water Column, NC = Noise Criterion

Delete without substitution:

~~TABLE C403.8.1(1) SUPPLY FAN POWER ALLOWANCES (W/CFM)~~

~~a. See section C408.3.1.1 for requirements for a Multi-Zone VAV system.~~

~~b. Power allowances require further calculation. Multiply the actual pressure drop of the device or component by the fan power allowance in Table C403.8.1(2).~~

~~c. The 100 percent outdoor air system must serve 3 or more HVAC zones.~~

~~d. A low-turndown single-zone VAV fan system must be capable of and configured to reduce airflow to 50 percent of design airflow and use no more than 30 percent of the design wattage at that airflow. No more than 10 percent of the design load served by the equipment shall have fixed loads.~~

~~e. The deduction of 0.500 W/cfm is a default value for multizone VAV fan systems. If the terminal unit or fan coil manufacturer can demonstrate that the share of the unit's fan power required to move the fan system's air is less than 0.500 W/cfm, that value may be used. The W/cfm shall be calculated by dividing the power required to operate the terminal unit's fan at fan system design conditions by the airflow of the terminal unit at those conditions.~~

~~TABLE C403.8.1(2) EXHAUST, RETURN, RELIEF, TRANSFER FAN SYSTEM POWER ALLOWANCES (W/CFM)~~

~~a. See Section C408.3.1.1 for requirements for a Multi-Zone VAV System.~~

~~b. Particle filter pressure loss can only be counted once per fan system.~~

~~c. Power allowances require further calculation. Multiply the actual pressure drop of the device or component by the fan power allowance in Table C403.8.1(2).~~

~~TABLE C403.8.1(3) FAN POWER LIMIT ALTITUDE CORRECTION FACTOR~~

~~TABLE C403.8.1(4) DEFAULT VALUES FOR FAN ELECTRICAL INPUT POWER BASED ON MOTOR NAMEPLATE HP[a,b]~~

a. ~~This table cannot be used for Motor Nameplate Horsepower values greater than 100.~~

b. ~~This table is to be used only with motors with a service factor ≤1.15. If the service factor is not provided, this table may not be used.~~

~~**C403.8.1.1 Determining Fan Power Limit.** The maximum allowed fan system electrical input power, shall be determined in accordance with the following steps 1 through 5:~~

1. ~~The fan system's classification shall be determined. A fan system is considered to be multizone VAV where it meets the following requirements; fan systems that do not meet the following requirements shall be classified as other fans:~~

   1.1 ~~The fan system shall serve three or more HVAC zones and airflow to each shall be individually controlled based on heating, cooling and/or ventilation requirements.~~

   1.2 ~~The sum of the minimum airflows for each HVAC zone shall be not greater than 40 percent of the fan system design conditions.~~

   ~~**Exception:** Hospital, vivarium, and laboratory systems that use flow control devices on exhaust or return to maintain space pressure relationships necessary for occupant health and safety or environmental control shall use the multizone VAV fan power allowances.~~

2. ~~Determine the fan system airflow and choose the applicable table(s) for fan power allowance.~~

   2.1 ~~For single-cabinet fan systems, use the fan system airflow and the power allowances in both Table C403.8.1(1) and Table C403.8.1(2).~~

   2.2 ~~For supply-only fan systems, use the fan system airflow and power allowances in Table C403.8.1(1).~~

   2.3 ~~For relief fan systems, use the design relief airflow and the power allowances in Table C403.8.1(2).~~

   2.4 ~~For exhaust, return and transfer fan systems, use the fan system airflow and the power allowances in Table C403.8.1(2).~~

   2.5 ~~For complex fan systems and DOAS with energy recovery fan systems, separately calculate the fan power allowance for the supply and return/exhaust systems and sum them. For the supply airflow at the fan system design conditions, and the power allowances in Table C403.8.1(1). For the return/exhaust airflow, use return or exhaust airflow at the fan system design conditions, and the power allowances in Table C403.8.1(2).~~

3. ~~For each fan system determine the components included in the fan system and sum the fan power allowances of those components. All fan systems shall include the System Base Allowance. If, for a given component, only a portion of the fan system airflow passes through the component, calculate the fan power allowance for the com-ponent per equation 4-7:~~

~~**(Equation 4-7)**~~

$$FPA_{adj} = (Q_{comp} / Q_{sys}) * FPA_{comp}$$

~~FPA_{adj} = The corrected fan power allowance for the component in w/cfm~~
~~Q_{comp} = The airflow through component in cfm~~
~~Qsys = The fan system airflow in cfm~~
~~FPA_{comp} = The fan power allowance of the component from Table C403.8.1(1) or Table C403.8.1(2)~~

4. ~~Multiply the fan system airflow by the sum of the fan power allowances for the fan system, then divide by 1000 to convert to KW.~~

~~**(Equation 4-8)**~~

$$FPL = (Q_{sys} * FPA_{sum})/1000$$

~~FPL = The fan power limit in KW~~
~~Q_{sys} = The fan system airflow in cflm (L/s)~~
~~FPA_{sum} = The sum of the fan power allowance for the system in W/cfm~~
~~1000 = The conversion from W to kW~~

5. ~~For building sites at elevations greater than 3,000 feet (900 m), multiply the fan power limit by the correction factor from Table C408.3.1(3).~~

~~**(Equation 4-9)**~~

$$FPL_{alt} = FPL * C_{alt}$$

~~FPL_{alt} = The adjusted fan power limit in KW.~~
~~FPL = The fan power limit in KW calculated in step 4.~~
~~C_{alt} = The altitude correction factor from Table C408.3.1(3)~~

~~**C403.8.1.2 Determining Fan System Electrical Input Power.** The fan system electrical input power is the sum of the fan electrical input power of each fan or fan array in-cluded in the fan system other than fans with fan electrical input power ≤ 1 kW. If variable speed drives are used their efficiency losses shall be included. Fan system input power shall be calculated with mid-life filter pressure drop, which is the mean of the clean filter pressure drop and design final filter pressure drop. The fan electrical input power for each fan or fan array shall be determined using one of the following methods. There is no requirement to use the same method for all fans in a fan system:~~

1. ~~Use the default fan electrical input power in Table C408.3.1(4) for one or more of the fans. This method cannot be used for complex fan systems.~~
2. ~~Use the fan electrical input power at fan system design conditions provided by the manufacturer of the fan, fan array, or equipment that includes the fan or fan array, calculated per a test procedure included in 10 CFR Part 430, 10 CFR Part 431, ANSI/AMCA Standard 210, ASHRAE 51 AHRI Standard 430, AHRI Standard 440, or ISO 5801.~~
3. ~~Use the fan electrical input power provided by the manufacturer, calculated at fan system design conditions per one of the methods listed in section 5.3 of ANSI/AMCA 208.~~
4. ~~Use the fan nameplate electrical input power.~~

~~**C403.8.2 Motor nameplate horsepower.** For each fan, the fan brake horsepower (bhp) shall be indicated on the construction documents and the selected motor shall be not larger than the first available motor size greater than the following:~~

1. ~~For fans less than 6 bhp (4476 W), 1.5 times the fan brake horsepower.~~
2. ~~For fans 6 bhp (4476 W) and larger, 1.3 times the fan brake horsepower.~~

~~**Exceptions:**~~

1. ~~Fans equipped with electronic speed control devices to vary the fan airflow as a function of load.~~
2. ~~Fans with a fan nameplate electrical input power of less than 0.89 kW.~~
3. ~~Systems complying with Section C403.8.1 fan system motor nameplate hp (Option 1).~~
4. ~~Fans with motor nameplate horsepower less than 1 hp (746 W).~~

Reason: This harmonizes the code with ASHRAE 90.1-2022

Cost Impact: The code change proposal will decrease the cost of construction.
The code change proposal will decrease the cost of construction.
Changes to Section C403.8.1 as included in the Public Draft 1 would increase the cost of construction. Reverting to the language in the 2021 IECC would reduce the cost, by comparison.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: The same language was approved by ASHRAE SSPC 90.1, but not in time for the 2022 version. To keep the codes in alignment, IECC 2024 should keep the language that is in IECC 2021.

Proposal # 1522

CECD1-18-22

Proponents: Kristopher Stenger, representing ICC (kstenger@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

Add new definition as follows:

PURCHASED ENERGY. energy or power purchased for consumption and delivered to the building site.

Add new text 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 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% 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.

Revise as follows:

~~**C406.1.1.1**~~ **C406.1.1.2 Building Core/Shell and Initial 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 ~~in Table C406.1.1~~ 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 in ~~Table C406.1.1~~ 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:
   - 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 ~~in Table C406.1.1~~ by Sections 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 ~~in Table C406.1.1~~ by Sections 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.

Add new text as follows:

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.

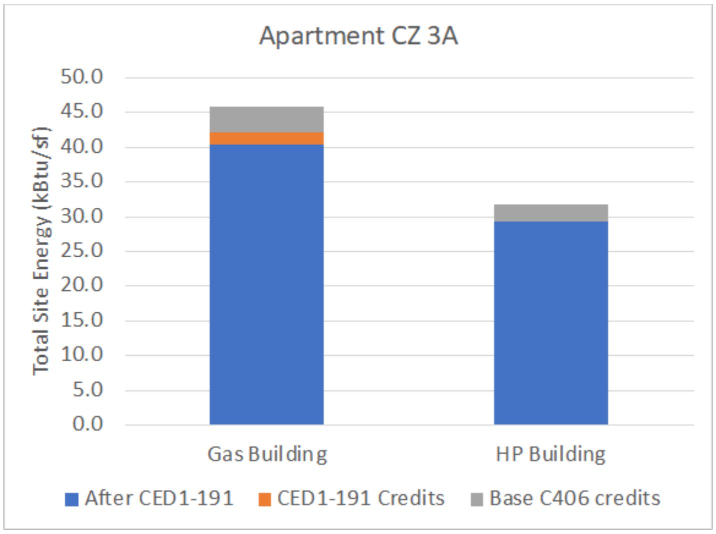
   6.2 The *addition's* total heat pump space heating capacity serving the *addition* is not less than 50% of the *addition's* space heating load at heating design conditions calculated in accordance with Section C403.1.1.

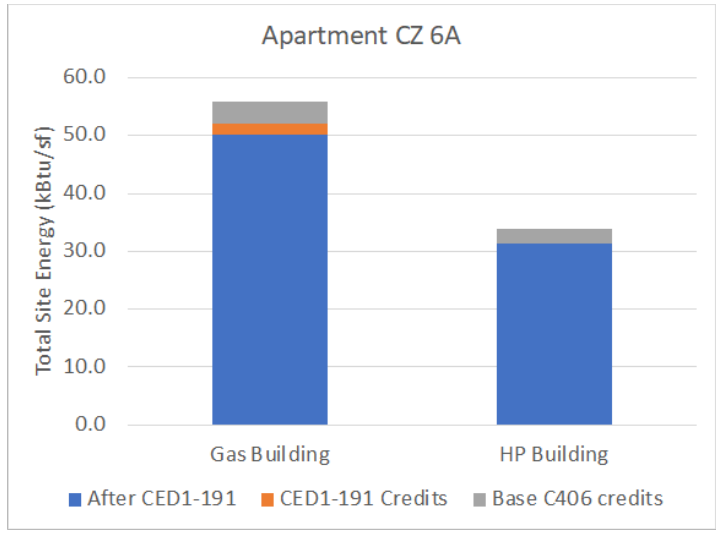
   6.3 Any energy source other than electricity or *on-site renewable energy* is used for space heating serving the *addition* only when a heat pump cannot provide the necessary heating energy to satisfy the thermostat setting.

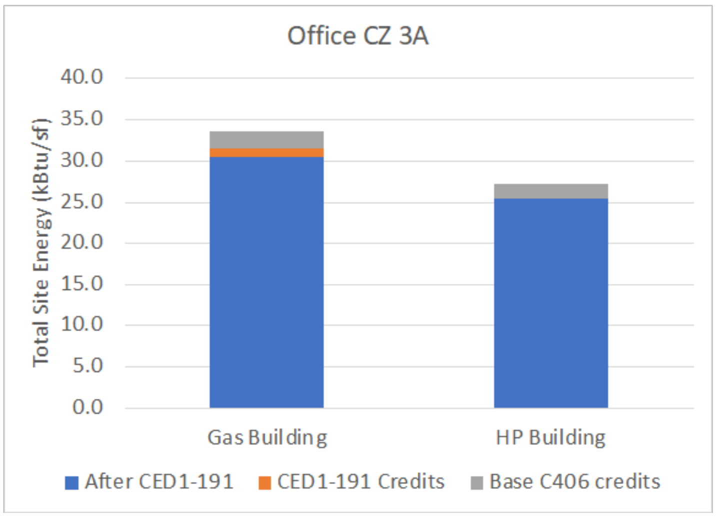
   6.4 Electric resistance heat serving the *addition* is used only in accordance with Section C403.4.1.1.

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

Reason: The additional energy efficiency credit flexibility is of great value, and the increased requirement for energy savings in this proposal are important. However, the public review draft does not recognize the differences among buildings primarily relying on efficient electric technologies and buildings that continue to rely on fossil fuels for their space heating, water heating and cooking end uses in either their site energy usage or in the imperative to decarbonize buildings. Electric alternatives to fossil fuel systems require less site energy usage, generally considerably less with heat pump coefficients of performance for space and water heating (see Figure 1). In general, efficient electric technologies are also already the lowest emission option across end uses. However, in some locations, the use of fossil fuels for peak heating requirements at very low outside air temperatures may represent a comparable site energy option and the lowest emission option when compared to electric resistance supplemental heat in the near- or medium-term. Therefore, 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. The proposed changes set 50% higher energy efficiency requirements for buildings that use fossil fuels for anything other than peak space heating needs or that primarily rely on electric resistance for space or water heating. This same 50% higher level is included in proposed Section C502.3 text for Additions, which require 50% of those for new buildings.


Apartment CZ 3A
Total Site Energy (kBtu/sf)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Gas Building
HP Building
After CED1-191
CED1-191 Credits
Base C406 credits


Apartment CZ 6A
Total Site Energy (kBtu/sf)
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Gas Building
HP Building
After CED1-191
CED1-191 Credits
Base C406 credits


Office CZ 3A
Total Site Energy (kBtu/sf)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Gas Building
HP Building
After CED1-191
CED1-191 Credits
Base C406 credits

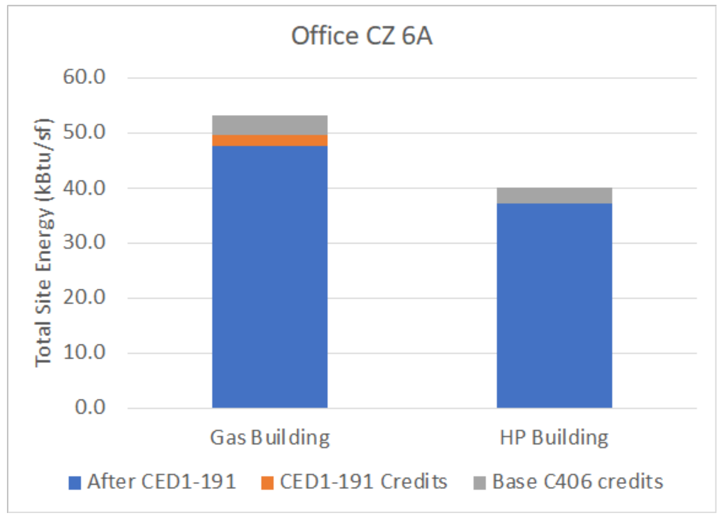

Office CZ 6A
Total Site Energy (kBtu/sf)
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Gas Building
HP Building
After CED1-191
CED1-191 Credits
Base C406 credits

Fig. 1: Comparing site EUI of fossil fuel and electric heat pump buildings using DOE prototype models

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The number of credits that the original proponent of these changes (PNNL) set for Section C406 were determined based on a cost-effectiveness test using an unreasonably high 9.3% nominal discount rate. The Commercial Consensus Committee approved cost-effectiveness criteria of both a 5.3% nominal discount rate and a 9.3% nominal discount rate. The 5.3% discount rate is much more appropriate for this analysis. For PNNL's original submission, they used an 8% nominal discount rate and proposed a set of credit requirements more than 14% higher (area-weighted average by building type and climate zone) than those in the public review draft. A straight line extrapolation would yield 43% higher credit requirements; because the discount rate effect is non-linear, it is reasonable to expect the level of cost-effective credits required to comfortably exceed 50% above those in the public review draft. Although detailed data is not available from PNNL, further analysis using the outputs of PNNL's cost-effectiveness analysis and the DOE prototype models indicates that an additional 25% higher energy efficiency credits would have to cost an average of 12.2 times the upfront cost of the base credits to violate the cost-effectiveness criteria with a 9.3% nominal discount rate (16.6 times the base credits' upfront cost with a 5.3% nominal discount rate, as shown in Fig. 2). A similar analysis was presented to the Commercial Consensus Committee for an additional 50% credit requirement; here it's even stronger at 25% and excluding Storage spaces. The public review draft's Appendix CF includes an "Advanced Energy Credits Package" double that of the Section C406 requirements, which PNNL determined to be the maximum credits a jurisdiction could reasonably require. Taken together, this indicates that 50% higher energy efficiency credits would be rather easily cost justified regardless of the heating and hot water systems.

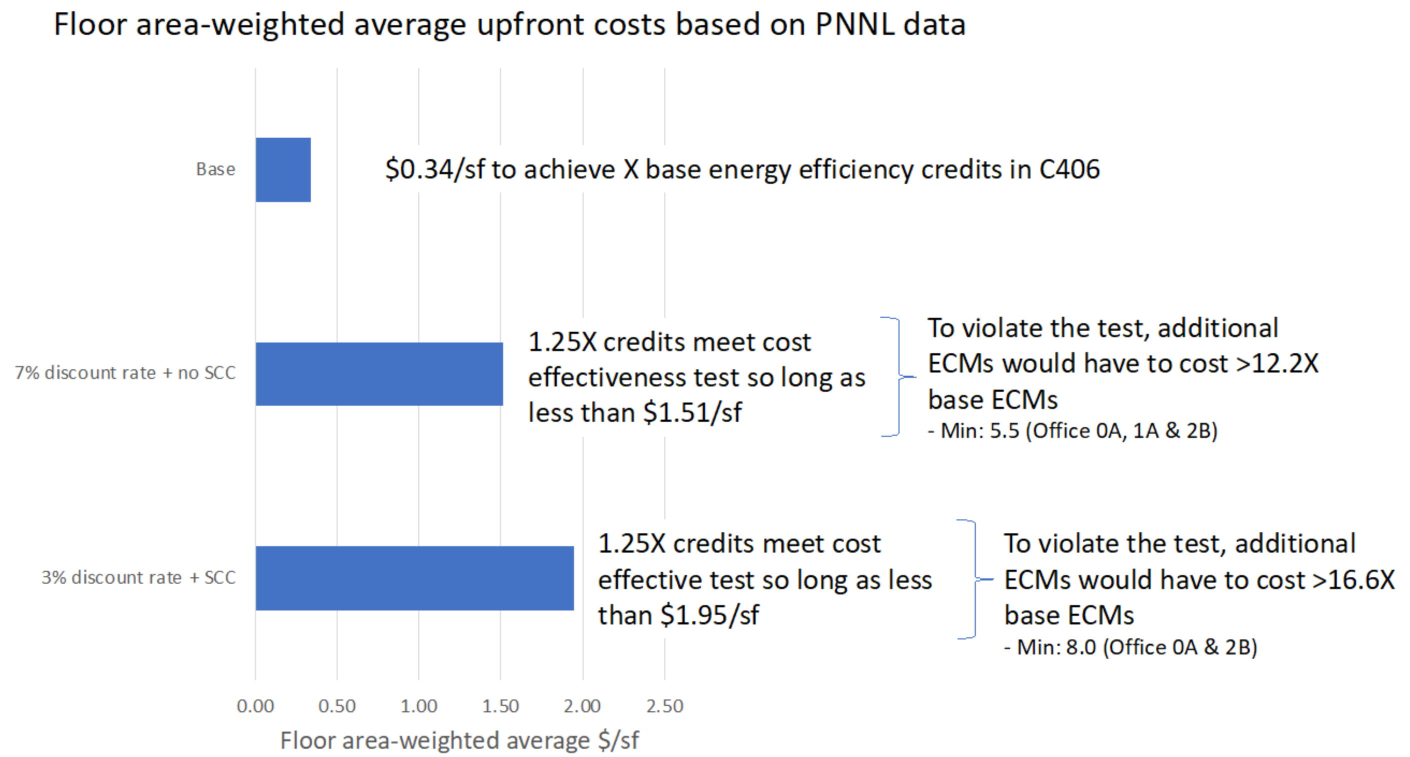


Fig. 2: Cost-effectiveness analysis using PNNL data

In addition to the base cost-effectiveness analysis support, the Commercial Consensus Committee provided the option of including a social cost of carbon in cost-effectiveness calculations. PNNL also did not do calculations showing what that high-efficiency cost-effective credit package level would be with a SCC. Further, there is mounting evidence supporting a SCC more than 3X higher than that recommended by the Committee, which warrants further consideration.

This background is somewhat inconsequential as there were indeed cost-effective credit levels with the high discount rate used by PNNL. Under this proposal, anyone can submit a design that meets those low credit levels for a building with electric heat pumps as the primary space heating and water heating equipment. If they choose to use fossil fuel or electric resistance equipment, they would have to meet a higher number of energy efficiency credits. The entire code has separate energy efficiency requirements depending on the fuel and equipment type chosen, so this proposal is consistent with the current code.

The IECC will often allow less efficiency depending on design decisions without consideration of cost-effectiveness (e.g. where a designer chooses to have a window instead of an opaque wall or in relaxing lighting power density requirements to allow for non-essential services such as advertising lighting). The Committee is certainly not precluded from considering higher efficiency requirements following particular design decisions. The Committee is also not precluded from considering the societal benefits of reducing greenhouse gas emissions, such as they did explicitly in the justification for on-site renewable energy requirements in this public review draft.

In summary: (1) this proposal is cost-effective and (2) the Committee does not have to base its decisions on cost-effectiveness alone.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: The proposed change align the requirements in C409 with changes in C402.

CECD1-19-22

Proponents: Kristopher Stenger, representing ICC (kstenger@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

TABLE C404.2 MINIMUM PERFORMANCE OF WATER-HEATING EQUIPMENT

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	DRAW PATTERN	PERFORMANCE REQUIRED[a]	TEST PROCEDURE[b]
Electric Table-top water heaters[c]	≤12 kW	≥ 20 gal ≤ 120 gal[d]	Very small Low Medium High	UEF ≥ 0.6323 – (0.0058 × Vr) UEF ≥ 0.9188 – (0.0031 × Vr) UEF ≥ 0.9577 – (0.0023 × Vr) UEF ≥ 0.9884 – (0.0016 × Vr)	DOE 10 CFR Part 430 App. E
Electric Storage water heaters[e,f]: resistance and heat pump	≤12 kW	≥ 20 gal ≤ 55 gal[f]	Very small Low Medium High	UEF ≥ 0.8808 – (0.0008 × Vr) UEF ≥ 0.9254 – (0.0003 × Vr) UEF ≥ 0.9307 – (0.0002 × Vr) UEF ≥ 0.9349 – (0.0001 × Vr)	DOE 10 CFR Part 430 App. E
	≤12 kW	> 55 gal ≤120 gal[f]	Very small Low Medium High	UEF ≥ 1.9236 – (0.0011 × Vr) UEF ≥ 2.0440 – (0.0011 × Vr) UEF ≥ 2.1171 – (0.0011 × Vr) UEF ≥ 2.2418 – (0.0011 × Vr)	DOE 10 CFR Part 430 App. E
Electric Storage water heaters[e,f,l]	> 12 kW	-	-	(0.3 + 27/Vm), %h	DOE 10 CFR 431.106 App B
Grid-enabled water heaters[g]	-	>75 gal d	Very small Low Medium High	UEF ≥ 1.0136 – (0.0028 × Vr) UEF ≥ 0.9984 – (0.0014 × Vr) UEF ≥ 0.9853 – (0.0010 × Vr) UEF ≥ 0.9720 – (0.0007 × Vr)	10 CFR 430 Appendix E
Electric Instantaneous water heaters[h]	≤12 kW	< 2 gal[d]	Very small Low Medium High	UEF ≥ 0.91 UEF ≥ 0.91 UEF ≥ 0.91 UEF ≥ 0.92	DOE 10 CFR Part 430
	>12 kW & ≤ 58.6 kW[i]	≤ 2 gal & ≤180ºF	All	UEF ≥ 0.80	DOE 10 CFR Part 430
Gas Storage water heaters[e,l]	≤ 75,000 Btu/h	≥20 gal & ≤ 55 gal[d]	Very small Low Medium High	UEF ≥ 0.3456 – (0.0020 × Vr) UEF ≥ 0.5982 – (0.0019 × Vr) UEF ≥ 0.6483 – (0.0017 × Vr) UEF ≥ 0.6920 – (0.0013 × Vr)	DOE 10 CFR Part 430 App. E
	≤ 75,000 Btu/h	> 55 gal & ≤ 100 gal[d]	Very small Low Medium High	UEF ≥ 0.6470 – (0.0006 × Vr) UEF ≥ 0.7689 – (0.0005 × Vr) UEF ≥ 0.7897 – (0.0004 × Vr) UEF ≥ 0.8072 – (0.0003 × Vr)	DOE 10 CFR Part 430 App. E
	> 75,000 Btu/h and ≤ 105,000 Btu/h [j,k]	≤ 120 gal & ≤180ºF	Very small Low Medium High	UEF ≥ 0.2674-0.0009 x Vr UEF ≥ 0.5362-0.0012 x Vr UEF ≥ 0.6002-0.0011 x Vr UEF ≥ 0.6597-0.0009 x Vr	DOE 10 CFR Part 430 App. E
	> 105,000 Btu/h[k]	-	-	80% Et SL ≤ (Q/800 +110√V), Btu/h	DOE 10 CFR 431.106
Gas Instantaneous water heaters[i]	> 50,000 Btu/h and < 200,000 Btu/h[k]	< 2 gal[d]	Very small Low Medium High	UEF ≥ 0.80 UEF ≥ 0.81 UEF ≥ 0.81 UEF ≥ 0.81	DOE 10 CFR Part 430 App. E
	≥ 200,000 Btu/h[k]	< 10 gal	-	80% Et	DOE 10 CFR 431.106
	≥ 200,000 Btu/h[k]	≥10 gal	-	80% Et SL ≤ (Q/800 +110√V), Btu/h	
Oil Storage water heaters[e,l]	≤ 105,000 Btu/h	≤ 50 gal[d]	Very small Low Medium High	UEF = 0.2509 – (0.0012 × Vr) UEF = 0.5330 – (0.0016 × Vr) UEF = 0.6078 – (0.0016 × Vr) UEF = 0.6815 – (0.0014 × Vr)	DOE 10 CFR Part 430
	> 105,000 Btu/h and ≤ 140,000 Btu/h[l]	≤ 120 gal & ≤180ºF	Very small Low Medium High	UEF ≥ 0.2932-0.0015 x Vr UEF ≥ 0.5596-0.0018 x Vr UEF ≥ 0.6194-0.0016 x Vr UEF ≥ 0.6740-0.0013 x Vr	DOE 10 CFR Part 430 App. E

	>140,000 Btu/h	All	-	80% Et $SL \le (Q/800 + 110\sqrt{V})$, Btu/h	DOE 10 CFR 431.106
Oil Instantaneous water heaters[h,l]	≤ 210,000 Btu/h	< 2 gal	-	80% Et $EF \ge 0.59 - 0.0005 \times V$	DOE 10 CFR Part 430 App. E
	> 210,000 Btu/h	< 10 gal	-	80% Et	DOE 10 CFR 431.106
	> 210,000 Btu/h	≥ 10 gal	-	78% Et $SL \le (Q/800 + 110\sqrt{V})$, Btu/h	DOE 10 CFR 431.106
Hot water supply boilers, gas and oil[h]	≥300,000 Btu/h and < 12,500,000 Btu/h	< 10 gal	-	80% Et	DOE 10 CFR 431.106
Hot water supply boilers, gas[i,l]	≥300,000 Btu/h and < 12,500,000 Btu/h	≥ 10 gal	-	80% Et $SL \le (Q/800 + 110\sqrt{V})$, Btu/h	DOE 10 CFR 431.106
Hot water supply boilers, oil[h,l]	≥300,000 Btu/h and < 12,500,000 Btu/h	≥ 10 gal	-	78% Et $SL \le (Q/800 + 110\sqrt{V})$, Btu/h	DOE 10 CFR 431.106
Pool heaters, gas[d]	All	_[f]	-	82% Et	DOE 10 CFR Part 430 App. P
Heat pump pool heaters	All	50°F db 44.2°F wb outdoor air 80.0°F entering water	-	4.0 COP	DOE 10 CFR Part 430 App. P
Unfired storage tanks	All	-	-	Minimum insulation requirement R-12.5 (h-ft2-°F)/Btu	(none)

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 more than 140 gallons of storage capacity need not meet the standby loss requirement if: (1)

The tank surface area is thermally insulated to R-12.5 or more; (2) a standing pilot light is not used; and (3) for gas or oil-fired storage water heaers, they have a fire damper or fan-assisted combustion.

Reason: This proposal updates Table C404.2 to reflect energy conservation standards per Department of Energy (DOE) 10 CFR 431.110 which were missing from Table C404.2.

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 construction.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: This proposal updates Table C404.2 to reflect energy conservation standards per Department of Energy (DOE) 10 CFR 431.110 which were missing from Table C404.2.

Proposal # 1527

CECD1-20-22

Proponents: Kristopher Stenger, representing ICC (kstenger@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C405.3.1 Total connected interior lighting power. The total connected interior lighting power shall be determined in accordance with Equation 4-12.

$$TCLP = [LVL + BLL + LED + TRK + \text{Other}]$$ **(Equation 4-12)**

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. Casino gaming areas.
4. Mirror lighting in makeup or dressing areas used for video broadcasting, video or film recording, or live theatrical and music performance.
5. Task lighting for medical and dental purposes that is in addition to general lighting.
6. Display lighting for exhibits in galleries, museums and monuments that is in addition to general lighting.
7. Lighting in any location that is specifically used for video broadcasting, video or film recording, or live theatrical and music performance.
8. Lighting for photographic processes.
9. Lighting integral to equipment or instrumentation and installed by the manufacturer.
10. Task lighting for plant growth or maintenance.
11. Advertising signage or directional signage.
12. Lighting for food warming.
13. Lighting equipment that is for sale.
14. Lighting demonstration equipment in lighting education facilities.
15. Lighting approved because of safety considerations.
16. Lighting in retail display windows, provided that the display area is enclosed by ceiling-height partitions.
17. Furniture-mounted supplemental task lighting that is controlled by automatic shutoff.
18. Exit signs.
19. Antimicrobial lighting used for the sole purpose of disinfecting a space.

20. Lighting in sleeping units and dwelling units.
21. For exit access stairways, exit stairways and their landings, where the applicable building code or life safety code requires a minimum illuminance of 10 footcandles on the walking surface, the power in excess of the allowed power calculated according to C405.3.2.2, is not included.

Reason: IBC 2021 requires that: “along exit access stairways, exit stairways and their required landings, the illumination level shall not to be less than 10 fc (108 lux) at the walking surface when the stairway is in use.”
This is an exceptionally high light level for an exit stair, and 10 times greater than required by the IBC 2018. The current lighting power allowance for stairways is insufficient. In the limited case of the stairway itself, it would be impossible to meet the requirements of both the IBC and the IECC. This exception eliminates that conflict by permitting any **power in excess of the allowed power** associated with the lighting of the stair to be excluded from the lighting power density calculations.

This is similar to C405.5.1 exception #15 for exterior lighting, which was approved and is in PCD1.

Another solution was considered and studied but is not ready for inclusion in the code and is much more complex. It was concluded that the exclusion approach is the best at this time, and arguably could lead to better energy efficiency.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Will not increase the cost of construction

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: This addresses changes to Section 1008.2.1 of the IBC which requires higher illuminances exit access stairways, exit stairways and at their required landings.

Proposal # 1528

CECD1-21-22

IECC: C405.1, C405.2, C405.2.5, C405.3, C405.3.2.1, C405.3.2.2, C405.1.1

Proponents: Kristopher Stenger, representing ICC (kstenger@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C405.1 General. Electrical power and lighting systems and generation shall comply with this section. ~~*Sleeping units* and dwelling units in hotels, motels, congregate living, and vacaction timeshare propoerties shall comply with Section C405.2.5 and with Section C405.1.1~~ . *General lighting* shall consist of all lighting included when calculating the total connected interior lighting power in accordance with Section C405.3.1 and which does not require specific application controls in accordance with Section C405.2.5.

Exception: *Dwelling units* and *sleeping units* that comply with Section C405.2.10 Section C405.3.3 and Section C405.6.

C405.2 Lighting controls. Lighting systems powered through the energy service for the building shall be provided with controls that comply with Sections C405.2.1 through ~~C405.2.9~~ C405.2.10.

Exceptions: Lighting controls are not required for the following:

1. Spaces where an automatic shutoff could endanger occupant safety or security.
2. Interior exit stairways, interior exit ramps and exit passageways.
3. Emergency lighting that is automatically off during normal operations.
4. Emergency lighting required by the *International Building Code* in exit access components which are not provided with fire alarm systems.
5. Up to 0.02 watts per square foot (0.06 W/m^2) of lighting in exit access components which are provided with fire alarm systems.

C405.2.5 Specific application controls. Specific application controls shall be provided for the following:

1. The following lighting shall be controlled by an occupant sensor complying with Section C405.2.1.1 or a time-switch control complying with Section C405.2.2.1. In addition, a manual control shall be provided to control such lighting separately from the general lighting in the space:

   1.1. Luminaires for which additional lighting power is claimed in accordance with Section C405.3.2.2.1.
   1.2. Display and accent lighting, including lighting in display cases.
   1.3. Lighting in display cases.
   1.3 Supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting.
   1.4 Lighting equipment that is for sale or demonstration in lighting education.

2. *Sleeping units* shall have control devices or systems that are configured to automatically switch off all installed luminaires and switched receptacles within 20 minutes after all occupants have left the unit.

   Exceptions:

   1. Lighting and switched receptacles controlled by card key controls in buildings containing fewer than 50 sleeping units.
   2. Spaces where patient care is directly provided.

3. Lighting for nonvisual applications, such as plant growth and food warming, shall be controlled by a time switch control complying with Section C405.2.2.1 that is independent of the controls for other lighting within the room or space.
4. Task lighting for medical and dental purposes that is in addition to *general lighting* shall be provided with a *manual control*.

Revise as follows:

C405.3 Interior lighting power requirements. A building complies with this section where its total connected interior lighting power calculated under Section C405.3.1 is not greater than the interior lighting power allowance calculated under Section C405.3.2. *Sleeping units* and *dwelling units* shall comply with C405.3.3.

C405.3.2.1 Building Area Method. For the Building Area Method, the interior lighting power allowance is calculated as follows:

1. For each building area type inside the building, determine the applicable building area type and the allowed lighting power density for that type from Table C405.3.2(1). For building area types not listed, select the building area type that most closely represents the use of that area. For the purposes of this method, an "area" shall be defined as all contiguous spaces that accommodate or are associated with a single building area type.
2. Determine the floor area for each building area type listed in Table C405.3.2(1) and multiply this area by the applicable value from Table C405.3.2(1) to determine the allowed lighting power (watts) for each building area type. Sleeping units and dwelling units are excluded from lighting power allowance calculations by application of Section ~~C405.1.1~~ C405.3.3. The area of sleeping units and dwelling units is not included in the calculation.
3. The total interior lighting power allowance (watts) for the entire building is the sum of the lighting power from each building area type.

C405.3.2.2 Space-by-Space Method. Where a building has unfinished spaces, the lighting power allowance for the unfinished spaces shall be the total connected lighting power for those spaces, or 0.1 watts per square foot (1.08 w/m^2), whichever is less. For the Space-by-Space Method, the interior lighting power allowance is calculated as follows:

1. For each space enclosed by partitions that are not less than 80 percent of the ceiling height, determine the applicable space type from Table C405.3.2(2). For space types not listed, select the space type that most closely represents the proposed use of the space. Where a space has multiple functions, that space may be divided into separate spaces.
2. Determine the total floor area of all the spaces of each space type and multiply by the value for the space type in Table C405.3.2(2) to determine the allowed lighting power (watts) for each space type. Sleeping units and dwelling units are excluded from lighting power allowance calculations by application of Section ~~C405.1.1~~ C405.3.3. The area of sleeping units and dwelling units is not included in the calculation.
3. The total interior lighting power allowance (watts) shall be the sum of the lighting power allowances for all space types.

~~C405.1.1~~ C405.3.3 Lighting power for sleeping units and dwelling units. ~~No less than 90 percent of the~~ *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 a kitchen appliance ~~or exhaust hood~~.
2. Antimicrobial lighting used for the sole purpose of disinfecting.

Reason: This proposal is based on CED1-26 as modified by the PLR (not yet heard by the E4C). CED1-26 is a reorganization for clarity of the specific requirements for sleeping units and dwelling units.

· C405.1 currently says that all "lighting systems" must comply with C405 and then goes on to list requirements specific to sleeping units and dwelling units. Read literally, sleeping units and dwelling units still must comply with everything else in C405. Obviously, that is not the intent – but that is what the code says.

· C405.1 currently says that sleeping units have to comply with C405.2.5 Specific application controls. Taken literally, this would mean if you had accent lighting or task lighting in a hotel room it would have to be controlled by an occupancy sensor or time-switch. Obviously, that is not the intent – but that is what the code says.

· An exemption to C405.1 has been added to make it clear that sleeping units and dwelling units must only comply with C405.2.10, C405.3.3, C405.6 and nothing else.

· Currently, there are two types of requirements that apply to sleeping units and dwelling units – lighting controls and lighting power. This proposal rearranges these requirements and puts them where they belong – in new sections C405.2.10 (lighting controls) and C405.3.3 (lighting power)

· An additional sentence is added to C405.3 to improve clarity. This is not a change in the requirements.

Text is added to C405.3.3 with different lighting power requirements for sleeping units in Group I-2 that are patient rooms. This is to accommodate CED1-9 which proposes to restore the patient room lighting power allowance to Table C405.3.2 (2)

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 construction. These minor revisions will have no significant effect on the

cost of lighting equipment required.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified
Commercial Energy Committee Reason: The proposal restructures the code for clarity of requirements for dwelling units and sleeping units..

CECD1-22-22

Proponents: Kristopher Stenger, representing ICC (kstenger@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C405.2.2.1 Time-switch control function. Time-switch *controls* shall comply with all of the following:

1. ~~Automatically~~ Programmed to automatically turn off lights when the space is scheduled to be unoccupied.
2. Have a minimum 7-day clock.
3. Be capable of being set for seven different day types per week.
4. Incorporate an automatic holiday “shutoff” feature, which turns off all controlled lighting loads for not fewer than 24 hours and then resumes normally scheduled operations.
5. Have program backup capabilities, which prevent the loss of program and time settings for not fewer than 10 hours, if power is interrupted.
6. Include an override switch that complies with the following:

    6.1. The override switch shall be a manual control.

    6.2. The override switch, when initiated, shall permit the controlled lighting to remain on for not more than 2 hours.

    6.3. Any individual override switch shall control the lighting for an area not larger than 5,000 square feet (465 m^2).

7. For spaces where schedules are not available, time switch controls are programmed to a schedule that turns lights off not less than 12 hours per day.

Exception: Within mall concourses, auditoriums, sales areas, manufacturing facilities and sports arenas:

1. The time limit shall be permitted to be greater than 2 hours, provided that the switch is a captive key device.
2. The area controlled by the override switch shall not be limited to 5,000 square feet (465 m^2) provided that such area is less than 20,000 square feet (1860 m^2).

Reason: PNNL study on main non-compliance was time switches not programmed so this proposal attempts to correct that issue.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Will not increase

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: This proposal will address the issue of programming time clock controls when a schedule is not known.

Proposal # 1531

CECD1-23-22

Proponents: Kristopher Stenger, representing ICC (kstenger@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

Add new definition as follows:

PARKING AREA, INTERIOR. Parking spaces, drive aisles, and ramps located within a building.

PARKING AREA, EXTERIOR. Parking spaces, drive aisles and ramps which are not located within a building, or which are located on a roof.

Revise as follows:

C405.2 Lighting controls. ~~Lighting systems powered through the energy service for the building shall be provided with controls that comply with Sections C405.2.1 through C405.2.9 .~~ Lighting systems in *interior parking areas* shall be provided with controls that comply with C405.2.9. All other lighting systems powered through the energy service for the building and *building site* lighting for which the building owner is responsible shall be provided with controls that comply with Sections C405.2.1 through C405.2.8.

Exceptions: Lighting controls are not required for the following:

1. Spaces where an automatic shutoff could endanger occupant safety or security.
2. Interior exit stairways, interior exit ramps and exit passageways.
3. Emergency lighting that is automatically off during normal operations.
4. Emergency lighting required by the *International Building Code* in exit access components which are not provided with fire alarm systems.
5. Up to 0.02 watts per square foot (0.06 W/m^2) of lighting in exit access components which are provided with fire alarm systems.

C405.2.7 Exterior lighting controls. Exterior lighting systems shall be provided with controls that comply with Sections C405.2.7.1 through C405.2.7.4.

Exceptions:

1. Lighting for ~~covered~~ vehicle entrances to ~~and exits from~~ buildings ~~and parking structures~~ where required for eye adaptation.
2. Lighting controlled from within dwelling units.

C405.2.7.3 Lighting setback. Lighting that is not controlled in accordance with Section C405.2.7.2 shall comply with the following:

1. Be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent by selectively switching off or dimming luminaires at one of the following times:

   1.1. From not later than midnight to not earlier than 6 a.m.

   1.2. From not later than one hour after building or business closing to not earlier than one hour before building or business opening.

   1.3. During any time where activity has not been detected for 15 minutes or more.

2. Luminaires serving ~~outdoor~~ exterior parking areas and having a rated input wattage of greater than 40 watts and a mounting height of 24 feet (7315 mm) or less above the ground shall be controlled so that the total wattage of such lighting is automatically reduced by not less than 50 percent during any time where activity has not been detected for 15 minutes or more. Not more than 1,500 watts of lighting power shall be controlled together.

~~C405.2.8~~ C405.2.9 Interior parking area ~~Parking garage~~ lighting control. ~~Parking garage~~ Interior parking area lighting shall be controlled by an *occupant sensor* complying with Section C405.2.1.1 or a *time-switch control* complying with Section C405.2.2.1. Additional lighting controls shall be provided as follows:

1. Lighting power of each luminaire shall be automatically reduced by not less than 30 percent when there is no activity detected within a lighting zone for 20 minutes. Lighting zones for this requirement shall be not larger than 3,600 square feet (334.5 m^2).

   Exception: Lighting zones provided with less than 1.5 footcandles of illumination on the floor at the darkest point with all lights on are not required to have automatic light-reduction controls.

2. Where lighting for eye adaptation is provided at ~~covered~~ vehicle entrances to ~~and exits from~~ buildings ~~and parking structures~~, such lighting shall be separately controlled by a device that automatically reduces lighting power by at least 50 percent from sunset to sunrise.

3. The power to luminaires within 20 feet (6096 mm) of perimeter wall openings shall automatically reduce in response to daylight by at least 50 percent.

   Exceptions:

   1. Where the opening-to-wall ratio is less than 40 percent as viewed from the interior and encompassing the vertical distance from the driving surface to the lowest structural element.
   2. Where the distance from the opening to any exterior daylight blocking obstruction is less than one-half the height from the bottom of the opening or fenestration to the top of the obstruction.
   3. Where openings are obstructed by permanent screens or architectural elements restricting daylight entering the interior space.

~~C405.2.9~~ C405.2.8 Demand responsive lighting controls. *Buildings* shall have controls that are capable of automatically reducing general lighting power not less than 15 percent in response to a demand response signal.

Exceptions:

1. Buildings with less than 4,000 watts of combined installed general lighting power in spaces that have more than 0.5 W/ft^2 (5.38 W/m^2) of general lighting power.
2. *Buildings* where demand response programs are not available.
3. I-2 and I-3 occupancies.

TABLE C405.5.2(2) LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS

LIGHTING ZONES				
Zone 1	**Zone 2**	**Zone 3**	**Zone 4**	
Base Site Allowance	160 W	280 W	400 W	560 W
~~Uncovered Parking Areas~~				
Parking area , exterior ~~areas and drives~~	0.015 W/ft^2	0.026 W/ft^2	0.037 W/ft^2	0.052 W/ft^2
Building Grounds				
Walkways and ramps less	0.50 W/linear foot	0.50 W/linear foot	0.55 W/linear foot	0.60 W/linear foot
Plaza areas	0.028 W/ft^2	0.049 W/ft^2	0.070 W/ft^2	0.098 W/ft^2
Dining areas	0.156 W/ft^2	0.273 W/ft^2	0.390 W/ft^2	0.546 W/ft^2
Stairways	Exempt	Exempt	Exempt	Exempt
Pedestrian tunnels	0.063 W/ft^2	0.110 W/ft^2	0.157 W/ft^2	0.220 W/ft^2
Landscaping	0.014 W/ft^2	0.025 W/ft^2	0.036 W/ft^2	0.050 W/ft^2
Building Entrances and Exits				
Pedestrian and vehicular entrances and exits	5.6 W/linear foot of opening	9.8 W/linear foot of opening	14 W/linear foot of opening	19.6 W/linear foot of opening
Entry canopies	0.072 W/ft^2	0.126 W/ft^2	0.180 W/ft^2	0.252W/ft^2
Loading docks	0.104 W/ft^2	0.182 W/ft^2	0.260 W/ft^2	0.364 W/ft^2
Sales Canopies				
Free-standing and attached	0.20 W/ft^2	0.35 W/ft^2	0.50 W/ft^2	0.70 W/ft^2
Outdoor Sales				
Open areas (including vehicle sales lots)	0.072 W/ft^2	0.126 W/ft^2	0.180 W/ft^2	0.252 W/ft^2
Street frontage for vehicle sales lots in addition to “open area” allowance	No allowance	7.2 W/linear foot	10.3 W/linear foot	14.4 W/linear foot

1 foot = 304.8 mm, 1 watt per square foot = 10.76 watts per square meter. W = watts.

TABLE C405.5.2(3) INDIVIDUAL LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS

LIGHTING ZONES				
Zone 1	**Zone 2**	**Zone 3**	**Zone 4**	
Building facades	No allowance	0.075 W/ft^2 of gross above-grade wall area	0.113 W/ft^2 of gross above-grade wall area	0.15 W/ft^2 of gross above-grade wall area
Automated teller machines (ATM) and night depositories	90 W per location plus 35W per additional ATM per location			
Uncovered entrances and gatehouse inspection stations at guarded facilities	0.144 W/ft^2 of area	0.252 W/ft^2 of area	0.360 W/ft^2 of area	0.504 W/ft^2 of area
Uncovered loading areas for law enforcement, fire, ambulance and other emergency service vehicles	0.104 W/ft^2 of area	0.182 W/ft^2 of area	0.260 W/ft^2 of area	0.364 W/ft^2 of area
Drive-up windows and doors	53 W per drive through	92 W per drive through	132 W per drive through	185 W per drive through
Parking area near 24-hour retail entrances.	80 W per main entry	140 W per main entry	200 W per main entry	280 W per main entry

For SI: For SI: 1 watt per square foot = 10.76 watts per square meter.

W = watts.

Reason: Inconsistent language is used throughout the lighting section to refer to parking areas. For example:

- C405.2.8 Parking garage lighting controls. These requirements have never been intended to apply to all lighting in a parking garage. They are intended to apply only to the lighting within parking areas, with separate controls requirements for stairs, elevator lobbies, electrical closets, etc.
- Table C405.5.2(2) uses the phrase “Uncovered Parking Areas” but there is no corresponding requirement for “Covered Parking Areas”, which raises the question of what LPD requirement would apply to an exterior parking lot on grade with shade structure above. This is resolved by deleting the reference to uncovered parking areas.
- C405.2.7 Exception 1 refers to a “parking structure” as something different than a building. This section also provides an exemption for daylight transition lighting at exits from a building, when this is not needed (daylight transition lighting for safety is important, but only at building entrances).
- The code has never stated that lighting on the roof of an unconditioned parking garage is considered “exterior”, while lighting within the garage is considered “interior”.

These issues are all addressed by the introduction of the defined terms “interior parking area” and “exterior parking area”, and several minor corrections to terminology throughout the body of the code.
Approval of this proposal will lead to more consistent implementation and enforcement of the lighting efficiency requirements in the code.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal is editorial in nature and will neither increase not decrease the cost of construction.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: This proposal would clarify what areas are covered by parking garage lighting versus exterior lighting for controls and lighting power requirements.

Proposal # 1532

CECD1-24-22

Proponents: Kristopher Stenger, representing ICC (kstenger@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C405.3.1 Total connected interior lighting power. The total connected interior lighting power shall be determined in accordance with Equation 4-12.

$$TCLP = [LVL + BLL + LED + TRK + \text{Other}] \qquad \textbf{(Equation 4-12)}$$

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. Casino gaming areas.~~
~~4.~~ 3. Mirror lighting in makeup or dressing areas used for video broadcasting, video or film recording, or live theatrical and music performance.
~~5.~~ 4. Task lighting for medical and dental purposes that is in addition to general lighting.
~~6.~~ 5. Display lighting for exhibits in galleries, museums and monuments that is in addition to general lighting.
~~7.~~ 6. Lighting in any location that is specifically used for video broadcasting, video or film recording, or live theatrical and music performance.
~~8.~~ 7. Lighting for photographic processes.
~~9.~~ 8. Lighting integral to equipment or instrumentation and installed by the manufacturer.
~~10.~~ 9. Task lighting for plant growth or maintenance.
~~11.~~ 10. Advertising signage or directional signage.
~~12.~~ 11. Lighting for food warming.
~~13.~~ 12. Lighting equipment that is for sale.
~~14.~~ 13. Lighting demonstration equipment in lighting education facilities.
~~15.~~ 14. Lighting approved because of safety considerations.
~~16.~~ 15. Lighting in retail display windows, provided that the display area is enclosed by ceiling-height partitions.
~~17.~~ 16. Furniture-mounted supplemental task lighting that is controlled by automatic shutoff.
~~18.~~ 17. Exit signs.
~~19.~~ 18. Antimicrobial lighting used for the sole purpose of disinfecting a space.

~~20.~~ 19. Lighting in sleeping units and dwelling units.

Reason: In PCD#1 the space-by-space lighting power allowance table C405.3.2(2) now includes space types and allowances for 4 types of casino gaming areas. When these were added, the existing exemption in IECC 2021 for "casino gaming areas" should have been removed because these are areas now have power allowances and are no longer exempt from the lighting power requirements. The proposal deletes that exemption.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
No increase

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: This proposal removes an exception for a space category that has been added to the lighting power allowance table.

Proposal # 1529

CECD1-25-22

Proponents: Kristopher Stenger, representing ICC (kstenger@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C403.7.4.1 Nontransient dwelling units. Nontransient dwelling units shall be provided with outdoor air energy recovery ventilation systems complying with not less than one of the following:

1. The system shall have an *enthalpy recovery ratio* of not less than 50 percent at cooling design condition and not less than 60 percent at heating design condition.
2. The system shall have a sensible recovery efficiency (SRE) that is not less than 65 percent at 32 °F (0 °C) and, in climate zones 0A, 1A, 2A, and 3A, having a net moisture transfer (NMT) that is not less than 40 percent at 95 °F (35 °C). SRE and NMT shall be determined from a listed value or from interpolation of listed values, at an airflow not less than the design airflow, based on testing in accordance with CAN/CSA C439.

Exceptions:

1. Nontransient dwelling units in Climate Zone 3C.
2. Nontransient dwelling units with not more than 500 square feet (46 m^2) of *conditioned floor area* in Climate Zones 0, 1, 2, 3, 4C and 5C ~~and either adjoin an open-ended corridor or do not adjoin a corridor~~.
3. ~~Nontransient dwelling units with not more than 500 square feet (46 m²) of conditioned floor area that are located in Climate Zones 1A, 2B, 3B, and 3C.~~
4. ~~4.~~ 3. *Enthalpy recovery ratio* requirements at heating design condition in Climate Zones 0, 1 and 2.
5. ~~5.~~ 4. *Enthalpy recovery ratio* requirements at cooling design condition in Climate Zones 4, 5, 6, 7 and 8.

Reason: Large, central H/ERVs serving multiple dwelling units are typically certified for performance based on testing conducted in accordance with AHRI 1060, "Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment." The “enthalpy recovery ratio” of AHRI 1060 encompasses both sensible and latent performance and this proposal retains it as the first of two optional compliance paths for this section. Smaller (and often in-suite) H/ERVs typically serving individual dwelling units are generally certified for performance (e.g., SRE for sensible energy transfer, NMT for latent energy transfer, etc.) based on testing conducted in accordance with test standard CAN/CSA C439. In practice, the test results are listed in a publicly accessible directory by a certification body (e.g., The Home Ventilating Institute). This proposal adds a second compliance option, C403.7.4.1.2, to recognize H/ERVs that are tested in accordance with CAN/CSA C439, that are expected to achieve comparable in-situ performance to units tested in accordance with AHRI 1060. The target SRE aligns with that currently required in IECC-R Section N1103.6.1 (R403.6.1) for certain dwelling units. The target net moisture transfer would only be required for hot/humid climate zones to support IAQ, where moderation of outdoor moisture levels is especially important for managing indoor humidity. The value of 40% is achievable by most models while providing a significant reduction in latent loads associated with introducing outdoor air.

Cost Impact: The code change proposal will decrease the cost of construction.
The code change proposal could potentially decrease the cost of construction by facilitating the permitting of smaller, in-suite H/ERVs. This will provide builders and specifiers with more options for specifying compliant systems.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: Adding the test method provides a path for smaller H/ERVs to comply.

Proposal # 1535

CECD1-27-22

IECC: C405.14.4, C405.14.5

Proponents: **Bryan Holland**, representing **NEMA**

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C405.14.4 EVSE Spaces. An installed EVSE with multiple output connections shall be permitted to serve multiple EVSE spaces. Each EVSE installed to meet the requirements of Section C405.14.1, serving either a single EVSE space or multiple EVSE spaces, shall comply with all of the following:

1. Have a minimum circuit capacity in accordance with C405.14.5.
2. ~~Have a minimum charging rate in accordance with C405.14.4.1.~~ Have a nameplate rating not less than 6.2kW
3. Be located within 3 feet (914 mm) of each EVSE space it serves.
4. Be installed in accordance with Section C405.14.6.

C405.14.5.1 Circuit Capacity. The electrical distribution equipment supplying the branch circuit(s) serving each EV capable space, EV ready space, and EVSE space shall comply with one of the following:

1. Have a calculated load of 7.2kVA or the nameplate rating of the equipment, whichever is larger, for each EV capable space, EV ready space, and EVSE space.
2. Meets the requirements of C405.14.5.3.1.

Reason: further clarification and to align with the definitions shown in CED1-39

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
will not increase the cost of construction

Workgroup Recommendation

Commercial Energy Committee Committee Action: Approve
Commercial Energy Committee Reason: further clarification and to align with the definitions shown in CED1-39

CECD1-28-22

IECC: APPENDIX CH (New), SECTION CH101 (New), CH101.1 (New), CH101.2 (New), SECTION CH102 (New), SECTION CH103 (New), CH103.1 (New), CH103.1.1 (New), CH103.1.1.1 (New), CH103.1.1.2 (New), CH103.1.1.3 (New), Table CH103.1.1 (New), CH103.1.2 (New), CH103.1.2.1 (New), CH103.1.2.2 (New), CH103.1.2.3 (New), CH103.1.2.4 (New), TABLE CH103.1.2 (New), CH103.1.3 (New), CH103.1.3.1 (New), TABLE CH103.1.3.1 (New), CH103.1.3.2 (New), CH103.1.4 (New), CH103.1.4.1 (New), CH103.1.4.2 (New), CH103.1.5 (New), CH103.2 (New), CH103.3 (New)

Proponents: Kristopher Stenger, representing ICC (kstenger@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

Add new text as follows:

APPENDIX CH
ELECTRIC-READY COMMERCIAL BUILDING PROVISIONS

SECTION 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.

SECTION 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.

SECTION 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 heatingshall comply with Sections CH103.1.1.1, CH103.1.1.2 and CH103.1.1.3.

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 circuitshall terminate within 6 feet (1829 mm) ofthe 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 ElectricSpace 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 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 50°F (10°C)

CH103.1.1.3 Additional space heating electric infrastructure sizing.. Electric infrastructure forfutureelectricspace heatingequipment shall be sized to
accommodate not less than one of the following:

1. An electrical capacity not less than the nameplate space heating combustion equipment heating capacity multiplied by the value in Table CH103.1.1

   (Equation #)

   $$VA_s = Q_{com} \text{ x } P_s$$

   where:

   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 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 per the equation below, or

   (Equation #)

   $$VA_s = Q_{design} \text{ x } P_s$$

   where:

   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 in VA/kBtu/h
3. An approved alternate design that uses no energy source other than electricity or on-site renewable energy.

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

CH103.1.2 Combustion service water heating. Spaces containing combustion equipment for service water heatingshall comply with Sections CH103.1.2.1, CH103.1.2.2 and CH103.1.2.3.

CH103.1.2.1 New Code Section. 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 ft3 (20 m3).

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 (203 mm) 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 capacity
of 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 3
feet (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 heatingequipment 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.

(Equation #)

$$VA_w = (Q_{capacity} \text{ x } P_w) + (Q_{recirc} \text{ x } 293 \text{ (VA/(Btu/h))}$$

where:

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
Pw = 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*

TABLE CH103.1.2 ALTERNATE ELECTRIC WATER HEATING EQUIPMENT CONVERSION FACTORS (VA/kBtu/h)

99.6% Heating Design Temperature -		Pw
Greater than (ºF)	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 ºF (-17.8°C)		293

CH103.1.3 Combustion cooking. Spaces containing combustion equipment for cookingshall comply with either CH103.1.3.1 orCH103.1.3.2

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 othercooking.. Spaces containing all other cookingequipmentnot designated ascommercial cooking appliances shall be provided with a dedicated branch circuitin compliance with NFPA 70 Section422.10. The branch circuitshall terminate within 6 feet (1829 mm) offossil fuelranges, 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 ElectricCookingEquipment" and be electrically isolated.

CH103.1.4 Combustion clothes drying.. Spaces containing combustion equipment for clothes dryingshall comply with either CH103.1.4.1 or CH103.1.4.2

CH103.1.4.1 Commercial drying.. Spaces c ontaining clothesdryingequipment, and end-usesfor commercial laundry applicationsshall be provided with conduit that is continuous between a junction box located within 3 feet (914 mm) of theequipment 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 electricequipmentwith an equivalent equipment capacity. The electrical junction box and electrical panel shall have labels stating, "For Future ElectricClothes DryingEquipment."

CH103.1.4.2 Residential drying.. Spaces containing clothes dryingequipment, appliances, and end-uses serving multipledwelling unitsor sleeping areaswith a capacity less thanor equal to9.2 cubicfeetshall be provided withadedicated 240-volt branch circuit with a minimum capacity of 30A and shallterminate within 6 feet (1829 mm) offossil fuelclothes 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 DryingEquipment" and be electrically isolated.

CH103.1.5 Onsite 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: 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 coproponents. 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 metaanalysis 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 allelectric 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.

Cost Impact: 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.

Workgroup Recommendation

Commercial Energy Committee Committee Action: Approve
Commercial Energy Committee Reason: The proposal provides an optional Appendix for jurisdictions interested in requiring the installation of electrical infrastructure so that building owner's would be able to cost effectively replace fossil fuel equipment with electric equipment at a future date.

CED1-1-22

Proponents: Mike Nugent, representing Building Code Action Committee (bcac@iccsafe.org); David Collins, representing Chair of SEHPCAC (sehpcac@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

SECTION C101
SCOPE AND GENERAL REQUIREMENTS

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

C101.2 Scope. This code applies to *commercial buildings* and the buildings' sites and associated systems and equipment.

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

Revise as follows:

~~C101.5~~ C101.4 Compliance. *Residential buildings* shall meet the provisions of IECC—Residential Provisions. *Commercial buildings* shall meet the provisions of IECC—Commercial Provisions.

~~C101.5.1~~ C101.4.1 Compliance materials. The *code official* shall be permitted to approve specific computer software, worksheets, compliance manuals and other similar materials that meet the intent of this code.

Add new text as follows:

SECTION C102
APPLICABILITY

Revise as follows:

~~C101.4~~ C102.1 Applicability. Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall govern.

~~C101.4.1~~ C102.1.1 Mixed residential and commercial buildings. Where a building includes both *residential building* and *commercial building* portions, each portion shall be separately considered and meet the applicable provisions of IECC—Commercial Provisions or IECC—Residential Provisions.

~~C108.3~~ C102.2 Other laws. The provisions of this code shall not be deemed to nullify any provisions of local, state or federal law.

~~C108.2~~ C102.3 Applications of references. References to chapter or section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of this code.

~~C108.1~~ C102.4 Referenced codes and standards. The codes and standards referenced in this code shall be those listed in Chapter 6, and such codes and standards shall be considered as part of the requirements of this code to the prescribed extent of each such reference and as further regulated in Sections ~~C108.1.1~~ C102.4.1 and ~~C108.1.2~~ C102.4.2.

~~C108.1.1~~ C102.4.1 Conflicts. Where conflicts occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply.

~~C108.1.2~~ C102.4.2 Provisions in referenced codes and standards. Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this code, the provisions of this code, as applicable, shall take precedence over the provisions in the referenced code or standard.

~~C107.1~~ C102.5 ~~General~~ Partial invalidity. If a portion of this code is held to be illegal or void, such a decision shall not affect the validity of the remainder of this code.

Delete without substitution:

~~SECTION C107~~
~~VALIDITY~~

~~SECTION C108~~

~~REFERENCED STANDARDS~~

Reason: Right now many jurisdictions delete Chapter 1 of the codes and write their own unified Administrative provisions. Part of the reason for this is that it is not easy to see where the administrative provisions are similar or different. Chapter 1 of the I-codes should be different where applicable. However, if the administrative provisions are the same, it is important for the authority having jurisdiction to be able to identify that quickly. As we work on this throughout the codes, it is hoped that jurisdictions will use the Chapter 1's in the relative code.
The intent of this change is to have the provision in Section 101, Scope and General Requirements, and Section 102, Applicability, to contain the same basic points for all the codes. This will make compliance easier. For the IECC, this would involve some reorganization, including movement of the sections dealing with references standards (C108) and validity (C107). There are no changes to requirements. A similar proposal will be submitted for IECC Residential.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is a reorganization of administrative provisions with no change to technical requirements.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: To correlate Chapter 1 of the IECC-C with the other family of I-Codes.

Proposal # 644

CED1-2-22

Proponents: Mike Nugent, representing Building Code Action Committee (bcac@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

SECTION C101
SCOPE AND GENERAL REQUIREMENTS

C101.2 Scope. This code applies to *commercial buildings* and the buildings' sites and associated systems and equipment.

Add new text as follows:

101.2.1 Appendices. Provisions in the appendices shall not apply unless specifically adopted.

Reason: Appendices are in all of the codes except for IZC. The intent is to put information about their adoption for inclusion in the same location in all of the codes immediately following the section on scope. This is already the case in the IBC, IFC, IMC, IPSDC and IWUIC. ADM7-22 has added this section to ICCPC, IGCC, IPMC, and ISPSC. This section was relocated in the IEBC, IFGC, IPC and IRC.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is an editorial coordination item.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: To correlate Chapter 1 of the IECC-C with the other family of I-Codes

Proposal # 641

CED1-3-22

Proponents: Mike Nugent, representing Building Code Action Committee (bcac@iccsafe.org); David Collins, representing Chair of SEHPCAC (sehpcac@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

Add new text as follows:

SECTION 103
CODE COMPLIANCE AGENCY

103.1 Creation of enforcement agency. The [INSERT NAME OF DEPARTMENT] is hereby created and the official in charge thereof shall be known as the authority having jurisdiction (AHJ). The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

103.2 Appointment. The authority having jurisdiction (AHJ) shall be appointed by the chief appointing authority of the jurisdiction.

103.3 Deputies. In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the authority having jurisdiction (AHJ) shall have the authority to appoint a deputy authority having jurisdiction (AHJ) , other related technical officers, inspectors and other employees. Such employees shall have powers as delegated by the authority having jurisdiction (AHJ).

Reason: This section include provisions for the creation of the code compliance agency. Similar language is in the IBC, IFC, IPC, IMC, IFGC, IEBC, IPMC, IPSDC, IWUIC, IRC and IGCC.
The department's responsibilities are more than just 'enforcement' of the code. The fill in the blank for the name allows for the agency to develop a name appropriate to their jurisdiction and responsibilities. This also allows for the code official to appoint staff where needed.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is an editorial change with no change to construction requirements.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: To correlate Chapter 1 of the IECC-C with the other family of I-Codes

Proposal # 643

CED1-5-22

Proponents: Greg Johnson, representing Johnson & Associates Consulting Services (gjohnsonconsulting@gmail.com)

2024 International Energy Conservation Code [CE Project]

Delete and substitute as follows:

~~**C105.2.2 Thermal envelope.** Inspections shall verify the correct type of insulation, *R*-values, location of insulation, fenestration, *U*-factor, SHGC and VT, and that air leakage controls are properly installed, as required by the code, *approved* plans and specifications.~~

<u>**C105.2.2 Building thermal envelope.** Inspections shall verify the type of insulation, *R*-values, location of insulation, fenestration, *U*-factor, SHGC and VT, and that air leakage controls are installed, as required by the code, *approved* plans and specifications.</u>

~~**C105.2.4 Mechanical system.** Inspections shall verify the installed HVAC equipment for the correct type and size, controls, insulation, *R*-values, system and damper air leakage, minimum fan efficiency, energy recovery and economizer as required by the code, *approved* plans and specifications.~~

<u>**C105.2.4 Mechanical system.** Inspections shall verify the installed HVAC equipment for the type and size, controls, insulation, *R*-values, system and damper air leakage, minimum fan efficiency, energy recovery and economizer as required by the code, *approved* plans and specifications.</u>

Reason: The stricken terms are subjective - always problematic - and unneeded. Inspections according to the approved plans addresses 'correct' and 'proper' installations.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is an administrative issue. There is no impact on construction.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: To remove subjective and unenforceable terms I the two inspection requirements.

Proposal # 855

CED1-6-22

Proponents: Mike Nugent, representing Building Code Action Committee (bcac@iccsafe.org); David Collins, representing Chair of SEHPCAC (sehpcac@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

SECTION C110
~~BOARD~~ MEANS OF APPEALS

C110.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the *code official* relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. ~~The *code official* shall be an ex officio member of said board but shall not have a vote on any matter before the board.~~ The board of appeals shall be appointed by the ~~applicable~~ governing ~~body~~ authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business, and shall render all decisions and findings in writing to the appellant with a duplicate copy to the *code official*.

C110.2 Limitations on authority. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an ~~equally good~~ equivalent or better form of construction is proposed. The board shall not have authority to waive requirements of this code.

C110.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training on matters pertaining to the provisions of this code and are not employees of the jurisdiction.

Add new text as follows:

110.4 Administration. The code official shall take action in accordance with the decisions of the board.

Reason: ADM40-19 was approved for IBC, IEBC, IFC, IWUIC, IPC, IMC, IFGC, ISPSC, IPMC, IPSDC, IECC-R and IGCC for revisions to the section on Means of Appeals. This item was disapproved for IECC Commercial and IRC. The result is an inconsistency with IECC Commercial and IRC.
The intent of this proposal is coordination for the means of appeals within the family of codes. Most of this was accomplished through ADM40-19 during the last cycle. Comments during the testimony, from the code development committees and subsequent discussions have suggested some minor improvements that were accomplished in ADM48-22 As Modified by Public Comments 1 and 2.

The change to the title is because the Administrative Chapter sets up the process and right to appeal. IECC-Commercial (and all the I-Codes) have an appendix for the Board of Appeals that can be use for guidance for forming that board.

General: The sentence about the code official not being a voting member of the board of appeals is proposed to be deleted. The fact about city employees not being a voting member of the board is already included in the section on qualifications. The code official is an important advisor for the Board of Appeals and this is addressed in the Appendix. The deletion of this sentence will not change that.

Limitation on authority. This is an editorial change for better English and code language.

Qualifications: The phrase for experience and training is slightly different in each code. Adding this idea to all codes would provide consistency.

Administration: The board, or jurisdiction can set a reasonable timeframe for the code official to act on the boards decision.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
These are administration requirements, so there will be no change in construction requirements.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: To remove subjective and unenforceable language and to correlate Chapter 1 of the IECC-C with the other family of I-Codes.

CED1-9-22

Proponents: Michael Myer, representing Pacific Northwest National Laboratory (michael.myer@pnnl.gov)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

TABLE C405.3.2(2) INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD

COMMON SPACE TYPES[a]	LPD (watts/ft²)
Atrium	
Less than 40 feet in height	0.41
Greater than 40 feet in height	0.51
Audience seating area	
In an auditorium	0.57
In a gymnasium	0.23
In a motion picture theater	0.27
In a penitentiary	0.56
In a performing arts theater	1.09
In a religious building	0.72
In a sports arena	0.27
Otherwise	0.33
Banking activity area	0.56
Breakroom (See Lounge/breakroom)	
Classroom/lecture hall/training room	
In a penitentiary	0.74
Otherwise	0.72
Computer room, data center	0.75
Conference/meeting/multipurpose room	0.88
Copy/print room	0.56
Corridor	
In a facility for the visually impaired (and not used primarily by the staff)[b]	0.71
In a hospital	0.61
Otherwise	0.44
Courtroom	1.08
Dining area	
In bar/lounge or leisure dining	0.76
In cafeteria or fast food dining	0.36
In a facility for the visually impaired (and not used primarily by the staff)[b]	1.22
In family dining	0.52
In a penitentiary	0.35
Otherwise	0.42
Electrical/mechanical room	0.71
Emergency vehicle garage	0.51
Food preparation area	1.19
Laboratory	
In or as a classroom	1.05
Otherwise	1.21
Laundry/washing area	0.51
Loading dock, interior	0.88
Lobby	
For an elevator	0.64
In a facility for the visually impaired (and not used primarily by the staff)[b]	1.44
In a hotel	0.48
In a motion picture theater	0.20

In a performing arts theater	1.21
Otherwise	0.80
Locker room	0.43
Lounge/breakroom	
In a healthcare facility	0.77
Mother's Wellness Room	0.68
Otherwise	0.55
Office	
Enclosed	0.73
Open plan	0.56
Parking area daylight transition zone	1.06
Parking area, interior	0.11
Pharmacy area	1.59
Restroom	
In a facility for the visually impaired (and not used primarily by the staff[b]	0.96
Otherwise	0.74
Sales area	0.85
Seating area, general	0.21
Security screening general areas	0.64
Security screening in transportation facilities	0.93
Security screening transportation waiting area	0.56
Stairwell	0.47
Storage room	0.35
Vehicular maintenance area	0.59
Workshop	1.17
BUILDING TYPE SPECIFIC SPACE TYPES[a]	**LPD (watts/ft²)**
Automotive (see Vehicular maintenance area)	
Convention Center—exhibit space	0.50
Dormitory - Living Quarters	0.48
Facility for the visually impaired[b]	
In a chapel (and not used primarily by the staff)	0.58
In a recreation room (and not used primarily by the staff)	1.20
Fire Station - Sleeping Quarters	0.23
Gaming establishments	
High limits game	1.68
Slots	0.54
Sportsbook	0.82
Table games	1.09
Gymnasium/fitness center	
In an exercise area	0.82
In a playing area	0.82
Healthcare facility	
In an exam/treatment room	1.33
In an imaging room	0.94
In a medical supply room	0.56
In a nursery	0.87
In a nurse's station	1.07

In an operating room	2.26
Patient Room	0.78
In a physical therapy room	0.82
In a recovery room	1.18
In a telemedicine room	1.44
Library	
In a reading area	0.86
In the stacks	1.18
Manufacturing facility	
In a detailed manufacturing area	0.75
In an equipment room	0.73
In an extra-high-bay area (greater than 50 feet floor-to-ceiling height)	1.36
In a high-bay area (25–50 feet floor-to-ceiling height)	1.24
In a low-bay area (less than 25 feet floor-to-ceiling height)	0.86
Museum	
In a general exhibition area	0.31
In a restoration room	1.24
Performing arts theater—dressing room	0.39
Post office—sorting area	0.71
Religious buildings	
In a fellowship hall	0.50
In a worship/pulpit/choir area	0.75
Retail facilities	
In a dressing/fitting room	0.45
Hair salon	0.65
Nail salon	0.75
In a mall concourse	0.57
Massage space	0.81
Sports arena—playing area	
For a Class I facility [c]	2.86
For a Class II facility[d]	1.98
For a Class III facility[e]	1.29
For a Class IV facility[f]	0.86
Sports arena-Pools	
For a Class I facility	2.20
For a Class II facility	1.47
For a Class III facility	0.99
For a Class IV facility	0.59
Transportation facility	
Airport hanger	1.36
At a terminal ticket counter	0.40
In a baggage/carousel area	0.28
Passenger loading area	0.71
In an airport concourse	0.49
Warehouse—storage area	
For medium to bulky, palletized items	0.33
For smaller, hand-carried items	0.69

For SI: 1 foot = 304.8 mm, 1 watt per square foot = 10.76 watts per square meter.

a. In cases where both a common space type and a building area specific space type are listed, the building area specific space type shall apply.
b. A ‘Facility for the Visually Impaired’ is a facility that is licensed or will be licensed by local or state authorities for senior long-term care, adult daycare, senior support or people with special visual needs.
c. Class I facilities consist of professional facilities; and semiprofessional, collegiate, or club facilities with seating for 5,000 or more spectators.
d. Class II facilities consist of collegiate and semiprofessional facilities with seating for fewer than 5,000 spectators; club facilities with seating for between 2,000 and 5,000 spectators; and amateur league and high school facilities with seating for more than 2,000 spectators.
e. Class III facilities consist of club, amateur league and high school facilities with seating for 2,000 or fewer spectators.
f. Class IV facilities consist of elementary school and recreational facilities; and amateur league and high school facilities without provision for spectators.

Reason: The 2021 version had a provision that allowed lighting power density to not be determined for sleeping unit spaces; however there was no clear efficacy requirement. A 2024 proposal removed the lighting power density values for dormitory, fire quarters - sleeping units, and patient rooms. This 2024 proposal required sleeping unit spaces to have luminaires with an efficacy of not less than 45 lm/W.
45 lm/W is very low - linear fluorescent, CFL, HID, and LED luminaires all can meet this requirement. The models used to develop the LPD for those spaces used luminaires ranging from 80 - 120 lm/W. Removing the LPD requirement and establishing a luminaire efficacy minimum is expected to result in a decrease in energy efficiency in two different ways.

Reduction in energy efficiency #1: Luminaires providing the same amount of light would could use 1.9x more power. For example, a 3,000 lumen fixture at 83 lm/W would draw 36 W. The 2024 proposal would allow a fixture with a 45 lm/W minimum. Thus, the new 3,000 lumen fixture could draw 66 W. This represents a 1.8x increase in power assuming the 2021 and 2024 project were providing the same amount of light and similar type of fixtures.

Reduction in energy efficiency #2: Removes the LPD altogether. Spaces are allowed to trade power between the different spaces and do not need to meet each LPD value per space. However, the overall lighting power allowance limits the total amount of power. Removing the LPD requirement for these sleeping units no longer sets a limit on the total amount of power that could be installed in a space. If a designed space exceeds the LPD value in the table, the exceeded power must be offset elsewhere in the building. Removing the LPD requirement eliminates the offset elsewhere in the building. Therefore, those spaces could use more power regardless of the luminaires installed.

Beyond the reduction in energy efficiency considerations, there is a secondary issue. The Building Area Method values (Table C405.3.2(1)) are developed by applying a weighted average of the space LPD values (Table C405.3.2(2)). Eliminating the specific space LPD values would require the Building Area Method LPD values for Dormitory, Fire Station, Hospital, and Hotel all to be changed.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Proposed code change restores text omitted - no cost impact.

Bibliography: No bibliography

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: The proposal accommodates the specific lighting needs of patient rooms.

CED1-12-22

Proponents: Daniel Carroll, representing Department of State DBSC (daniel.carroll@dos.ny.gov); Emma Gonzalez-Laders, representing Dept. of State/DBSC (emma.gonzalez-laders@dos.ny.gov)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C505.1 General. Spaces undergoing a change in occupancy from F, H, S or U occupancy classification shall comply with Section C503. Buildings or portions of buildings undergoing a change of occupancy without alterations shall comply with Section ~~C502.2~~ C505.2.

> **Exception:** Where the total building performance option in Section C407 is used to comply with this section, the annual energy cost of the proposed design shall not be greater than 110 percent of the annual energy cost otherwise permitted by Section C407.3.

C505.2 Energy use intensities. Building envelope, space heating, cooling, ventilation, lighting and service water heating shall comply with Sections C505.2.1 through C505.2.4.
Exceptions:

1. Where it is demonstrated by analysis approved by the *code official* that the change will not increase energy use intensity.
2. Where the occupancy or use change is less than 5,000 square feet (464 m^2) in area.

Reason: Section C505.1 currently references Section C502.1, which addresses nonconditioned and low-energy space altered to become conditioned space, an addition. The correct reference should be Section C505.2, which addresses energy use intensities.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change is editorial.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: To correct pointer to the applicable section required for compliance.

Proposal # 806

CED1-13-22

Proponents: Emily Toto, representing ASHRAE (etoto@ashrae.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

ASHRAE

ASHRAE
180 Technology Parkway NW
Peachtree Corners, GA 30092

140—~~2014~~ 2020:	~~Standard~~ Method of Test for Evaluating~~the Evaluation of~~ Building Performance Simulation Software~~Energy Analysis Computer Programs~~

Reason: Since publication of ANSI/ASHRAE 140-2014 (the most recently referenced version by IECC 2021), the following major revisions have occurred:

- Air-Side HVAC Equipment Analytical Verification Tests (140-2020 Section 5.5) are added
- Building Thermal Envelope and Fabric Load Tests (140-2020, Sections 5.2.1, 5.2.2, and 5.2.3) are updated with new test cases included.

Cost Impact: The code change proposal will increase the cost of construction.
The expected additional cost impact on the software development industry is minimal for updating the reference in IECC 2024 to Standard 140-2020. The primary cost of applying the Standard 140 test suites is for software developers to create input files for the new test cases, analyze the results, and then report their output. However, most major software developers have already run the new and updated test suites, either during simulation trials of the new and updated test suites or as part of other software qualification requirements (e.g., forthcoming updates to Standard 140 acceptance criteria).

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: To ensure compliance with the most current requirements of the referenced standard.

Proposal # 792

CED1-15-22

IECC: APPENDIX CG (New), SECTION CG101 (New), CG101.1 (New), CG101.2 (New), SECTION CG102 (New), CG102 (New), SECTION CG103 (New), CG103.1 (New), CG103.2 (New), CG103.2.1 (New), CG103.2.2 (New), CG103.2.3 (New), CG103.2.4 (New), CG103.2.5 (New), CG103.2.5.1 (New), CG103.2.5.2 (New), CG103.2.6 (New), CG103.2.7 (New), CG103.2.8 (New), CG103.3 (New), CG103.4 (New), CG103.5 (New), CG103.6 (New), SECTION CG104 (New), CG104.1 (New), CG104.2 (New), CG104.3 (New), CG104.4 (New), CG104.5 (New), CG104.6 (New), ASHRAE Chapter 06 (New)

Proponents: Diana Burk, representing New Buildings Institute (diana@newbuildings.org); Michael Waite, representing American Council for an Energy-Efficient Economy (mwaite@aceee.org); John Bade, representing California Investor Owned Utilities (johnbade@2050partners.com); Rachael Dorothy, representing self (dorothy.2@osu.edu); Erin Sherman, representing RMI (esherman@rmi.org); Melissa Kops, representing CT Green Building Council (melissa@ctgbc.org); Andy Woommavovah, representing Healthcare (andy.woommavovah@trinity-health.org); Jenny Hernandez, representing Las Cruces Sustainability (jehernandez@las-cruces.org); Khaled Mansy, representing self (khaled.mansy@okstate.edu); Brad Smith, representing City of Fort Collins (brsmith@fcgov.com); Brad Hill, representing Honeywell International Inc. (brad.hill@honeywell.com); David Goldstein, representing Natural Resources Defense Council (dgoldstein.nrdc@gmail.com)

2024 International Energy Conservation Code [CE Project]

Add new text as follows:

APPENDIX CG
ALL-ELECTRIC COMMERCIAL BUILDING PROVISIONS

SECTION 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.

SECTION CG102
DEFINITIONS

CG102 ALL-ELECTRIC BUILDING. A building using no purchased energy other than electricity when utility power is available.

CG102 APPLIANCE. A device or apparatus that is manufactured and designed to utilize energy and for which this code provides specific requirements.

CG102 COMBUSTION EQUIPMENT. Anyequipment or *appliance* used for space heating, *service water heating*, cooking, clothes drying, humidification, or lighting that uses *fuel gas* or *fuel oil*.
CG102 PURCHASED ENERGY. Energy or power purchased for consumption and delivered to the building site.

CG102 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 *building official, or*
2. A*lteration* of a *historic building* where the *alteration* will not affect the building's designation as a *historic building.*

SECTION 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 equipment comprise 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 systems. 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 m^2) 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 system*s 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.

SECTION 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.

Add new standard(s) as follows:

ASHRAE

ASHRAE
180 Technology Parkway NW
Peachtree Corners, GA 30092

100-2018 Energy Efficiency in Existing Buildings

Reason: 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 runs 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 purpose of a model code is to provide cities and states with a starting point on which each jurisdiction can base their energy code. Growing interest in establishing all-electric building requirements is evidenced by several cities and states passing ordinances banning fossil fuel combustion equipment in buildings including Washington DC, New York City, Ithaca, New York; Brookline, Massachusetts; Berkeley, Los Angeles, Sacramento, San Francisco, Oakland and San Jose, California; and Washington State. Including an appendix in the 2024 IECC that specifies requirements for all-electric commercial construction will streamline adoption and implementation of all-electric construction for policy makers and the building industry. We strongly encourage that the code language in this appendix minimizes the use of inefficient electric resistance heat for space heating in new buildings to avoid an unintended consequence of higher operational costs and carbon emissions for the life of the building. 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.
All-electric buildings not only reduce carbon emissions but are also healthier for building occupants. Gas appliances release harmful pollutants like nitrogen dioxide (NO_2) 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 being diagnosed with asthma. [3]Therefore, ensuring all-electric appliances are installed 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 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. Ensuring that jurisdictions encourage efficient electrification by only allowing the use of electric resistance heat for space and water heating in certain applications.

3. Additional requirements on appropriately sizing heat pumps for space heating and water heating are included so that electric resistance heat for supplementary heat is reduced. 2050 partners is conducting additional modeling to for a variety of building types in multiple climate zones to determine if additional requirements are needed. This modeling is not yet complete but will be complete before the commercial consensus committee considers this proposal.

4. A new section addressing the use of combustion equipment in existing buildings. This new section:

   a. Does not permit new combustion equipment in additions

   b. Requires buildings undergoing a substantial improvement, defined as work that exceeds 50% of the market value of the structure to both be all-electric and meet EUI targets outlined in ASHRAE Standard 100.

   c. Incentivizes heat pumps in new buildings by requiring buildings undergoing a substantial energy alteration to achieve additional energy efficiency credits.

   d. Requires new and replacement cooling equipment to be electric heat pump equipment configured to provide both space cooling and space heating and requires existing space heating systems that are not heat pump systems are required to provide supplementary heat.

   e. Requires new or replacement service hot water equipment to be electric.

   f. Requires new furnaces provided for space heating to only be permitted to be used as supplementary heat.

   g. Reduces the use of electric resistance and combustion equipment for supplementary heat through the use of improved controls.

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]"U.S. Energy Information Administration - EIA - Independent Statistics and Analysis." *Commercial Buildings Energy Consumption Survey (CBECS)*, Energy Information Administration (EIA), 2018, https://www.eia.gov/consumption/commercial/data/2018/pdf/CBECS_2018_Building_Characteristics_Flipbook.pdf.

[6] Slanger, Dan. *Reality Check: The Myth of Stable and Affordable Natural Gas Prices*, RMI, 5 May 2022, https://rmi.org/the-myth-of-stable-and-affordable-natural-gas-prices/.

Cost Impact: The code change proposal will decrease the cost of construction.
All-electric commercial buildings are less expensive to build than mixed fuel buildings because electric appliances and equipment are typically less expensive than combustion equipment and appliances. In additional developers avoid the cost of installing natural-gas lines and meters. Recent analysis by NBI and partners utilizing data from RS Means indicates that an all-electric 53,000 s.f. office building with a central heat pump water heater and minimum code compliant air source heat pump costs $0.07/s.f. to $0.24/s.f. less to build than a mixed-fuel office building of the same size. [4] Additional analyses from a recent CASE study indicate that all-electric high-rise multifamily buildings are also less expensive to build and operate than mixed-fuel buildings. HVAC costs, for example, are on the order of $2,504 to $7,131 lower per dwelling unit depending on the HVAC system installed. Installing electric space heating and water heating equipment instead of natural gas equipment in the majority of California's climate zones also yielded a positive benefit to cost ratio over the 15- year analysis period despite California's high electricity rates. This is perhaps why close to half of commercial buildings currently do not use natural gas. [5] Moving to all-electric construction also results in more stable utility bills because electricity prices are not as volatile as natural gas prices. [6]

Attached Files

- **Commercial Electrification Sign On Letter 2024 IECC.pdf**
  https://energy.cdpaccess.com/proposal/810/3084/files/download/384/

October 21, 2022

Commercial Consensus Committee Members
International Code Council
500 New Jersey Avenue, NW
6th Floor,
Washington, DC 20001

Re: Public Comment Draft #1 for IECC-C

Dear Commercial Consensus Committee Members,

As environmental and climate advocates, we applaud the Commercial Consensus Committee for approving a strong draft of the commercial 2024 International Energy Conservation Code (IECC). Building decarbonization is key to keeping global average temperature rise below 2 degrees Celsius to avoid the worst impacts of climate change. The provisions adopted into the 2024 IECC represent a significant step forward in positioning our nation for an equitable transition to a carbon free economy and for meeting our climate goals. However, we see an opportunity for the 2024 IECC to go further, specifically by amending the 2024 IECC to promote efficient electrification in a cost-effective manner that minimally impacts customer utility bills.

The energy code can contribute to a more climate-resilient economy in three ways, summarized here and detailed below. First, the transition away from on-site fossil fuel combustion in buildings in cities and states through building electrification and decarbonization policies will be expedited and less costly if the 2024 IECC requires that new construction is able to receive electric equipment in the future without having to install and/or upgrade electric infrastructure. Second, we recommend basing the energy efficiency credits for new commercial buildings on analysis that includes the nominal discount rate agreed to by the Commercial Consensus Committee, the social cost of carbon currently being used by federal agencies, and the impact of system selection on energy usage. Doing so will provide a more accurate signal to the building industry of the full costs of their choices. Finally, including an appendix in the energy code that cities and states can refer to as they specify requirements for all-electric commercial construction will streamline adoption and implementation of all-electric construction for policy makers and the building industry.

Include Electric Ready Requirements: We strongly recommend including electric-ready requirements for new construction mixed-fuel buildings where converting to all-electric operations will have minimal impact on the energy bills of building occupants. 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.[1] Having electric-ready infrastructure in place gives building owners or occupants the

[1] 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

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 California Building Energy Efficiency Standards 2022 update (Title 24, Part 6) has already 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.

Incorporate the Energy Usage and Social Cost Impacts of System Selection in Setting Energy Efficiency Credit Requirements: We recommend basing the energy efficiency credits for different building system options on analysis that includes the nominal discount rate agreed to by the Commercial Consensus Committee and the social cost of carbon currently being used by federal agencies[2], as well as the differences in energy usage among space and water heating systems. Buildings that burn fossil fuels have higher carbon emissions, and site energy usage than buildings that use electric heat pumps for space and water heating. Electrification alone can be insufficient to address these issues if it relies on electric resistance space and water heating that only marginally reduces site energy usage and requires a very low-carbon electricity supply to be environmentally beneficial; this low-upfront-cost approach also often burdens lower income households and renters with high utility bills. A simple way of accounting for the differences between the energy usage of electric heat pumps and other systems, as well as proper consideration of discount rates and social costs, would be to apply a multiplier on the base energy efficiency credit requirements for buildings that use fossil fuels or electric resistance for anything other than peak space heating needs.

Provide All-Electric Code as Appendix: The purpose of a model code is to provide cities and states with a starting point on which each jurisdiction can base their energy code. Growing interest in establishing all-electric building requirements is evidenced by several cities and states passing ordinances banning fossil fuel combustion equipment in buildings including Washington DC, New York City, Ithaca, New York; Brookline, Massachusetts; Berkeley, Los Angeles, Sacramento, San Francisco, Oakland and San Jose, California; and Washington State. Including an appendix in the 2024 IECC that specifies requirements for all-electric commercial construction will streamline adoption and implementation of all-electric construction for policy makers and the building industry. We strongly encourage that the code language in this appendix minimizes the use of inefficient electric resistance heat for space heating in new buildings to avoid an unintended consequence of higher operational costs and carbon emissions for the life of the building.

We sincerely applaud the Commercial Consensus Committee for approving a strong draft 2024 IECC and encourage the Commercial Consensus Committee to take additional actions to promote commercial building electrification. Doing so will help our country meet its climate goals equitably. Thank you for your leadership and for the opportunity to comment.

---

vary building to building. Labor costs for new construction were estimated by Western Allied Mechanical, a San Francisco Bay Area mechanical contractor for HVAC and water heating systems.

[2] The IECC's Cost Effectiveness Committee recommended analyzing measures under two discount rates: 9.3% nominal discount rate (7% real) and 5.3% discount rate (3% real). The analysis used to analyze the credits in Section C406 was based on 8% nominal discount rate and did not take into account the social cost of carbon. In February 2021, the Interagency Working Group on Social Cost of Greenhouse Gases of the United States Government published interim findings and provided interim estimates of the SC-CO2, SC-CH4, and SC-N2O that should be used by agencies until a comprehensive review and update is developed in line with the requirements in Executive Order 13990 (Technical Support Document: Social Cost of Carbon, Methane, (whitehouse.gov))

Signed,

Carlos Augusto Garcia, Senior Architect, Brooks + Scarpa Architects

Amy Rider, Director of Policy Acceleration, Building Decarbonization Coalition

California Statewide Utility Code and Standards Team

Christopher Chwedyk, Director, Burnham / The Code Group

Bill Eger, Energy Manager, City of Alexandria

Zach Waas Smith, Community Engagement Specialist, City of Ann Arbor

Brad Smith, Building Energy Code Project Manager , City of Fort Collins

Steve Stelzer, Program Director Green Building Resource Center, City of Houston

Jenny Hernandez, Sustainability Specialist , City of Las Cruces

Flore Marion, Energy planner, City of Pittsburgh

Brad Saint-Laurent, Architectural Sales - NYC & Philadelphia, Cladding Concepts

Ben Schwartz, Policy Manager, Clean Coalition

Melissa Kops, Board Advisor, Connecticut Green Building Council

Peter Dahl, Strategic Sustainability Specialist, define sustainability LLC

Ai Alaswadi, Green Plan Reviewer, Department of Buildings (DOB)

Bryan Bomer, Sustainability Manager, Department of Permitting Services Montgomery County

Maya Krasker, Planner III, DNREC, State of Delaware

Bill Kosik, Senior Energy Engineer, DNV

Rick Meinking, Senior Program Manager , Efficiency Maine Trust

Eric Reinhard, Designer, Eric Reinhard

Laurel Schandelmier, Associate, Glumac

Scott Greenbaum PE, CPHC, CEM, CBCP, GBE, Principal, Greene Energy Consultants, LLC

Ted Halsey, Architect / Planner, HA+P / Haley Architecture + Planning

Tom Phillips, Principal, Healthy Building Research

Frank Heitzman, architect, Heitzman Architects

Anica Landreneau, Global Sustainable Design Director, HOK

Herminigildo Marcos, Founding Principal, HRM Engineering Services PC

Jessica Bristow, Senior Manager, Energy and Carbon, International Living Futures Institute

Ryan Ben Sabilala, Sustainability Specialist , Majid Al Futtaim

Michael Hedrick, Engineering Manager, McKinstry

Caroline Traube, Engineering Manager, McKinstry

Brian Goldcrump, Sr Mechanical Engineer, McKinstry

Julie Curti, Director of Clean Energy, Metropolitan Area Planning Council

David B. Goldstein, Energy Co-Director Climate and Clean Energy Program, Natural Resources Defense Council

Darren Port, Sr Manager Codes and Standards, NEEP

Diana Burk, Project Manager, NBI

Mazen Yassine, Principal Engineer, OBO

Khaled Mansy, Professor, Oklahoma State University

Rachael Dorothy, engineer, OSU Facility Operations and Development

Larry Eisenberg, Principal, Ovus Partners 360

Peter Schwartz, President, PSA

Mike Waite, Senior Manager, Buildings, ACEEE

Ty Gorman, Campaign, Sierra Club

Jeannette LeZaks, Director of Research and Innovation , Slipstream

Kai Starn, Senior Sustainability Consultant, Steven Winter Associates

Erin Gallagher, Sustainability Consultant, Thornton Tomasetti

Andy Woommavovah, System Director, Trinity Heath

Chris Halfnight, Senior Director, Research & Policy, Urban Green Council

Barry Murphy, Energy Efficiency Program Specialist, Vermont Public Service Department

Don Brandt, ASHRAE Past VP and Current Instructor,

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified
Commercial Energy Committee Reason: Provides the optional ability for jurisdictions to adopt all-electric provisions to support further reducing carbon emissions and healthier buildings.

CED1-27-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C405.1 General. Electrical power and lighting systems and generation shall comply with this section. *Sleeping units* and *dwelling units* in hotels, motels, congregate living, and vacation timeshare properties shall comply with Section ~~C405.2.5~~ C405.2.10 and with Section C405.1.1 . *General lighting* shall consist of all lighting included when calculating the total connected interior lighting power in accordance with Section C405.3.1 and which does not require specific application controls in accordance with Section C405.2.5.

C405.2.5 Specific application controls. Specific application controls shall be provided for the following:

1. The following lighting shall be controlled by an occupant sensor complying with Section C405.2.1.1 or a time-switch control complying with Section C405.2.2.1. In addition, a manual control shall be provided to control such lighting separately from the general lighting in the space:

   1.1. Luminaires for which additional lighting power is claimed in accordance with Section C405.3.2.2.1.

   1.2. Display and accent lighting, including lighting in display cases.

   1.3. Lighting in display cases.

   1.3 Supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting.

   1.4 Lighting equipment that is for sale or demonstration in lighting education.

~~2. *Sleeping units* shall have control devices or systems that are configured to automatically switch off all installed luminaires and switched receptacles within 20 minutes after all occupants have left the unit.~~

~~**Exceptions:**~~

~~1. Lighting and switched receptacles controlled by card key controls in buildings containing fewer than 50 sleeping units.~~

~~2. Spaces where patient care is directly provided.~~

~~3.~~ 2. Lighting for nonvisual applications, such as plant growth and food warming, shall be controlled by a time switch control complying with Section C405.2.2.1 that is independent of the controls for other lighting within the room or space.

~~4.~~ 3. Task lighting for medical and dental purposes that is in addition to *general lighting* shall be provided with a *manual control*.

Add new text as follows:

C405.2.10 Sleeping unit and dwelling unit lighting and switched receptacle controls. *Sleeping units* and *dwelling units* shall be provided with lighting controls and switched receptacles as specified in C405.2.10.1 and C405.2.10.2.

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 two 125V, 15- and 20- amp switched receptacles per 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. The *manual* control shall be clearly labeled.

Reason: To improve usability, cost-effectiveness, energy efficiency, and functionality.

Usability

C405.2.5 "Specific Application Controls" includes requirements for special lighting applications which are found throughout many different space types on a project. When we have control requirements that are specific to a space type (like Parking Garages) this should be a separate subsection of C405.2, rather than being added to the list in C405.2.5.

The phrase "control devices or systems that are configured to automatically switch off..." is edited to "lighting controls that automatically switch off..."

The term "card key controls" is replaced with the defined term "*captive key override*" which has been in the code for the last couple of cycles.

Cost-Effectiveness

The exception that allows *captive key override* controls to be used instead of a more complicated and expensive occupancy-based control system is changed from hotels with 50 or fewer units to units with 6 or fewer lights and switched receptacles to control. This will allow basic guest rooms (two lights in the bathroom + a light at the door + a light on the ceiling + two switched receptacles) to continue to use *captive key override* controls, and will limit the requirement to use more expensive systems to larger units with more lighting to control. The number of units in the hotel is not related to how many lights are installed in each room.

Energy Efficiency

When a guest room in a hotel or motel has both a kitchen and a bathroom, it is a dwelling unit. Therefore the code currently has no requirement that lighting controls be provided in larger hotel suites, only in smaller guest rooms. This is backwards. By applying the controls requirements in hotels to include "dwelling units" we increase the stringency of the code.

"Vacation Timeshare Properties" is a classification in Group R-2 in the IBC. These properties are often indistinguishable from hotels and motels and share the characteristics of being pre-furnished and not having separately metered power for each unit. By adding "vacation timeshare properties" to the scope of these requirements we will improve energy efficiency.

Most lighting in hotel and motel guest rooms is plugged in. This lighting is not required to be shown when filing for permit, and is not subject to enforcement during inspections. In other words, the hotel owner is free to plug whatever they want into guest room receptacles when they furnish the room. This means that our energy code provisions related to guest room lighting controls are not terribly effective as they probably miss more than half of the lighting that actually goes into these rooms. This proposal would remedy that problem by requiring switched receptacles to be provided in bedrooms and living / sitting rooms. Two receptacles are required per room. These receptacles would be energized when the lighting system for the room is energized.

Functionality

The existing code language would require automatic control systems to be provided in all sleeping units except for I-2. This includes following space types: Alcohol and Drug Centers, Halfway Houses, Social Rehabilitation Facilities, Group Homes, and Prisons. People under custodial care in these facilities may not even have the ability to lock or unlock their own door. The code should not include specific lighting control requirements for these types of spaces - this should be determined exclusively by the functional requirements of the space.

"Congregate Living Facilities" is a defined term in Group R in the IBC. This includes Dormitories, Fraternities and Sororities, and similar occupancies. Living units in these occupancies are really more like dwelling units in their lighting control needs. Rather than requiring that these be controlled like hotel guest rooms, this proposal would require that they are provided with a master off switch by the door, similar to the requirement in L05 (Residential Light Control). For added efficiency, an occupant sensor is required in the bathroom.

Cost Impact: The code change proposal will decrease the cost of construction.
Provisions in this proposal will increase costs in some projects, and decrease costs in others. On the whole, the sensitivity to reducing costs in smaller, cheaper hotel rooms + the simplification of controls requirements in congregate living facilities will outweigh the additional cost in hotel suites and vacation timeshare properties and result in a net cost savings.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: Improves efficiency while providing reasonable exceptions for some sleeping units to not install occupant sensors.

CED1-29-22

Proponents: Diana Burk, representing New Buildings Institute (diana@newbuildings.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C405.1.1 Lighting for dwelling units. ~~No less than 90 percent of the p~~ Permanently installed lighting serving sleeping units and dwelling units shall be provided by lamps with an efficacy of not less than 65 lm/W or luminaires with an efficacy of not less than 45 lm/W.

Exceptions:

1. Lighting integral to a kitchen appliance or exhaust hood.
2. Antimicrobial lighting used for the sole purpose of disinfecting.
3. Luminaires with an input rating of less than 3W.

Reason: This proposal seeks to align the lighting requirements of multifamily dwelling units between the residential and commercial codes in order to ensure consistency between substantially similar multifamily buildings. Currently there are discrepancies in the lighting provisions between a three-story multifamily building and a four-story multifamily building. This leads to market confusion, enforcement inconsistencies, and large potential untapped energy savings. This revision seeks to close this gap by incorporating lighting requirements approved by the 2024 IECC residential consensus committee and create a common set of lighting requirements for multifamily buildings.
The 2022 version of Title 24 has created a new section to regulate multifamily buildings - similar to a more "omnibus" proposal submitted by NBI previously. Based on feedback from that submission, which advised not creating a new section, this proposal instead works to align the sections that currently exist.

Attached is a letter stating support for this proposal from 40 organizations, 9 of which are from local or state governments and universities, 11 of which are from NGOs, and 20 of which are from design and construction industry.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
These changes match current market availability of products and should not change the cost of construction.

Bibliography: https://newbuildings.org/resource/multifamily-building-guide/
https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency

Attached Files

- **NBI Sign On Letter Commercial 2024 IECC.pdf**
  https://energy.cdpaccess.com/proposal/694/2293/files/download/364/

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: to provide consistency with the residential code for dwelling units and add an exception for very low wattage luminaires.

Proposal # 694

CED1-30-22

Proponents: Anthony Floyd, representing Chair of SEHPCAC (sehpcac@iccsafe.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C405.13 Energy monitoring. New buildings ~~Buildings~~ with a gross conditioned floor area of not less than 10,000 square feet (929 m^2) shall be equipped to measure, monitor, record and report energy consumption data in compliance with Sections C405.13.1 through C405.13.5. A plan for quantifying annual energy type and end-use disclosure in compliance with Sections C405.13.1 through C405.13.8 shall be submitted with the construction documents.

Exceptions:

~~1.~~ ~~*Buildings* less than 10,000 square feet (929 m^2).~~

~~2.~~ ~~Existing buildings~~

~~3.~~ 1. R-2 occupancies ~~with less than 10,000 square feet (929 m^2) of *common area*~~.

~~4.~~ 2. Individual tenant spaces are not required to comply with this section provided that the space has its own utility services and meters and has less than 5,000 square feet (464.5 m^2) ~~with their own utility service and meter.~~ of conditioned floor area.

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* 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 ~~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 ~~can~~ shall be permitted to substitute ~~substituted~~ for individual meters if the equivalent data ~~can be made~~ is available for collection in Section C405.13.4 and reporting in Section C405.13.5.

C405.13.4 Electrical energy data acquisition system. A data acquisition system shall have the capability to store the data from the required meters and other sensing devices for a minimum of 36 months. The data acquisition system shall have the capability to store real-time energy consumption data and provide hourly, daily, monthly and yearly logged data for each end-use category required by Section C405.13.2.The data acquisition system shall have the capability of providing building total peak electric demand and the time(s) of day and time(s) ~~of year~~ per month at which the peak occurs. Peak demand shall be integrated over the same time period as the underlying whole building meter reading rat~~e, which is typically 15 minutes but shall be no longer than one hour~~.

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 ~~at least~~ not less than every hour, day, month and year for the previous 36 months. The graphical report shall ~~also~~ incorporate natural gas interval data or the ability to enter gas utility bills into the report.

C405.13.6 Non-electrical energy metering. Consumption of non-electrical fuel or energy sources including district heating or cooling,~~energy such as gas, district heating or cooling, unregulated fuel sources, or other non-renewable energy~~ shall be ~~automatically~~ metered in accordance with Section C405.13.2 and C405.12.3.~~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.~~

C405.13.7 Renewable energy. ~~The ability to measure the production of~~ on-site renewable energy sources shall be ~~provided~~ metered with ~~the same or greater~~ not less frequency ~~as~~ than non-renewable energy ~~metered~~ systems in accordance with Section C405.13.3..

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

1. Property information including: ~~building type, total gross floor area, year built or year planned for construction completion, and occupancy type~~.

1.1 Address

1.2 Gross floor area

1.3 Year occupied

1.4 Occupancy classifications, with respective floor areas

2. Total annual building site energy use ~~per~~ by unit area ~~(square foot) of gross floor area~~ as collected or documented through Section C405.13.5 ~~(electrical)~~ and Section C405.13.6 ~~(non-electrical)~~ sources, separated by energy and fuel type ~~(electric, gas, district cooling or heating, unregulated fuel sources etc.). Electrical energy shall be further broken down by load type as identified in Table C405.13.2~~.

3. Annual site generated renewable energy ~~per~~ by unit area~~ (square foot) of gross floor area~~.

~~4. Peak electric demand per unit area (square foot) of gross floor area, with an estimate of relative building system contribution to that peak, and the time and date of the peak.~~

~~5. For projects using the Section C407 Simulated Building Performance approach to show compliance, include the following information from the building simulation:~~

~~5.1 Modeling software used.~~

~~5.2 Assumptions made that impact the simulated annual energy use per unit (square foot or square meter) of gross floor area (e.g. occupancy schedules, daylighting assumptions, climate file, plug loads, envelope performance including use of shading systems).~~

~~5.3 Simulated annual energy use per unit (square foot or square meter) of gross floor area.~~

~~5.4 Peak load, the time of date and time of peak and the hourly load profile on the day that experiences peak load.~~

Reason: The initial proposal under CEPI-203 altered the sub-metering requirements to focus solely on electrical and renewable systems with non-electric systems only requiring a utility meter. This is a substantial content change that regressed metering requirements for non-electric metering in way that does not support efficient building operation. The proposed revisions would reinstate the non-electric metering requirements present in the code today while refining the language proposed for the additional electric submetering added by CEPI-203. This revision also revised the original proposed language for the Plan for Disclosure section, recommending removal of language typically used for simulated measurement and verification that is out of place in a section dedicated to metering. An additional change was made to the exceptions as currently listed in the code that serves to clarify the intent of those exceptions.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal is editorial in nature

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: The proposal will clarify application of metering requirements to include all energy.

Proposal # 766

CED1-31-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C405.13 Energy monitoring. Buildings shall be equipped to measure, monitor, record and report energy consumption data in compliance with Sections C405.13.1 through C405.13.5.A plan for quantifying annual energy type and use disclosure in compliance with Sections C405.13.1 through C405.13.8 shall be submitted with the construction documents.

Exceptions:

1. *Buildings* less than 10,000 square feet (929 m^2).
2. Existing buildings
3. *Dwelling units* in R-2 occupancies.
~~3.~~ 4. R-2 occupancies with less than 10,000 square feet (929 m^2) of *common area*.
~~4.~~ 5. Individual tenant spaces less than 5,000 square feet (464.5 m^2) with their own utility service and meter.

COMMON AREA. All conditioned spaces within ~~portions of~~ Group R occupancy buildings ~~occupancies~~ that are not *dwelling units* or *sleeping units*.

Reason: Section C405.6 already requires a meter for each R-2 dwelling unit. We are not seriously considering benchmarking for dwelling units, are we? That's just another disincentive for code adoption.
The 'common area' definition is imprecise. Does it include pool equipment houses? Utility rooms? Parking garages? Given that each dwelling unit has its own meter, there is little reason to believe that metering 'common area' will save any energy; rather it will just add expense.

Cost Impact: The code change proposal will decrease the cost of construction.
A low value - from an energy savings perspective - dwelling unit monitoring and reporting system is not required, reducing construction costs.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: The addition of the exception for dwelling units in R-2 buildings addresses the unique situation of actual living units in how they work in practice.

Proposal # 737

CED1-36-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

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

Reason: At many commercial buildings, there will be EV charging provided by third parties, such as EV charging companies or cities or counties or utilities. These charging stations will be metered and billed separately from the building, and the building owner will have no say or control over their use of energy.
This provision is needed to avoid unnecessary wiring and metering of third party systems.

Cost Impact: The code change proposal will decrease the cost of construction.
This will reduce costs for buildings that are provided EV charging by third parties.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: Ensures the monitoring of EV charging loads does not include equipment and systems that are supplied by a separate service from an energy monitored building.

Proposal # 778

CED1-39-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

ELECTRIC VEHICLE CAPABLE SPACE (EV CAPABLE SPACE). An ~~designated~~ automobile parking space ~~that is~~ provided with electrical infrastructure, such as, but not limited to, raceways, cables, enclosures, electrical capacity, and ~~panelboard or other~~ electrical distribution equipment space, necessary for ~~the future installation of an~~ connection to EVSE.

ELECTRIC VEHICLE READY SPACE (EV READY SPACE). An automobile parking space ~~that is~~ provided with a branch circuit and either an outlet or enclosure~~, junction box or receptacle, that will support an installed~~ for connection to EVSE.

ELECTRIC VEHICLE SUPPLY EQUIPMENT INSTALLED SPACE (EVSE SPACE). An automobile parking space ~~that is provided with a dedicated~~ where operational EVSE has been installed ~~connection~~.

C405.14 Electric Vehicle Power Transfer Infrastructure. ~~New~~ Parking facilities shall be provided with electric vehicle power transfer infrastructure in ~~compliance~~ accordance with Sections C405.14.1 through C405.14.6.

C405.14.2 EV Capable Spaces. Each EV capable space used to meet the requirements of Section C405.14.1 shall comply with ~~all of~~ the following:

1. A continuous raceway or cable assembly shall be installed between an enclosure or outlet located within 3 feet (914 mm) of the EV capable space and ~~a suitable panelboard or other onsite~~ electrical distribution equipment.
2. Installed raceway or cable assembly shall be sized and rated to supply an minimum circuit capactiy in accordance with C405.14.5
3. The electrical distribution equipment to which the raceway or cable assembly connects shall have ~~sufficient~~ dedicated overcurrent protection device space and ~~spare~~ electrical capacity to supply a calculated load in accordance with C405.14.5. ~~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)."
5. ~~Reserved capacity shall be no less than 4.1 kVA (20A 208/240V) for each EV capable space.~~

C405.14.3 EV Ready Spaces. Each branch circuit serving EV ready spaces used to meet the requirements of Section C405.14.1 shall comply with ~~all of~~ the following:

1. Terminate at an outlet or enclosure, located within 3 feet (914 mm) of each EV ready space it serves.
2. Have a minimum system and circuit capacity in accordance with C405.14.5.
3. The ~~panelboard or other~~ electrical distribution equipment directory shall designate the branch circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."

C405.14.4 EVSE Spaces. An installed EVSE with multiple output connections shall be permitted to serve multiple EVSE spaces. Each EVSE installed to meet the requirements of Section C405.14.1, serving either a single EVSE space or multiple EVSE spaces, shall comply with ~~all of~~ the following:

1. Have a minimum system and circuit capacity in accordance with C405.14.5.
2. ~~Have a minimum charging rate in accordance with C405.14.4.1.~~
3. Be located within 3 feet (914 mm) of each EVSE space it serves.
4. Be installed in accordance with Section C405.14.6.

~~**C405.14.4.1 EVSE Minimum Charging Rate.** Each installed EVSE shall comply with one of the following:~~

1. ~~Be capable of charging at a minimum rate of 6.2 kVA (or 30A at 208/240V).~~
2. ~~When serving multiple EVSE spaces and controlled by an energy management system providing load management, be capable of simultaneously sharing each EVSE space at a minimum rate of no less than 3.3 kVA.~~
3. ~~When serving EVSE spaces allowed to have a minimum circuit capacity of 2.7 kVA in accordance with C405.14.5.1 and controlled by an energy management system providing load management, be capable of simultaneously charging each ESVE space at a minimum rate of no less than 2.1 kVA.~~

C405.14.5 System and Circuit Capacity. C405.14.5.1 System Capacity. The electrical distribution equipment supplying the branch circuit(s) serving each EV capable space, EV ready space, and EVSE space shall comply with one of the following:

1. Have a calculated load of 7.2 kVA or the nameplate rating of the equipment, whichever is larger.
2. Meets the requirements of C405.14.5.3.1

C405.14.5.2 Circuit Capacity. The branch circuit ~~capacity of electrical infrastructure~~ serving each EV capable space, EV ready space, and EVSE space shall comply with one of the following:

1. ~~A branch circuit shall~~ Have a rated capacity not less than ~~8.3 kVA (or 40A at 208/240V)~~ 50 amperes or the nameplate rating of the equipment, whichever is larger. ~~for each EV ready space or EVSE space it serves~~.
2. Meets the requirements of C405.14.5. .3.2.

C405.14.5.3 System and Circuit Capacity Management. C405.14.5.3.1 System Capacity Management. The maximum equipment load on the electrical distribution equipment supplying the branch circuits(s) serving EV capable spaces, EV ready spaces, and EVSE spaces controlled by an energy management system shall be the maximum load permitted by the energy management system, but not less than 3.3 kVA per space. **C405.14.5.3.2 Circuit Capacity Management.** ~~The capacity of~~ Each branch circuit serving multiple EVSE spaces, EV ready spaces or EV capable spaces ~~designed to be~~ controlled by an energy management system ~~providing load management in accordance with NFPA 70,~~ shall comply with one of the following:

1. Have a minimum capacity of ~~4.1 kVA~~ 25 amperes per space.
2. Have a minimum capacity of ~~2.7 kVA~~ 20 amperes per space ~~when serving EV ready spaces or EVSE space~~ for R-2 occupancies when all ~~(100%) of the~~ automobile parking spaces ~~designated for R-2 occupancies~~ are ~~designed to be~~ EV ready spaces or EVSE spaces.

Reason: 1. Editorial revisions are made to the three definitions for added clarity and conciseness.
2. The term “new” is unnecessary in C405.14 for a Chapter 4 rule as requirements for existing buildings are located in Chapter 5.

3. List items 1-4 in C405.14.2 have been revised for conciseness and more technically correct terminology. List item 5 is no longer necessary as this is addressed in the revised list item 3.

4. C405.14.3 and C405.14.4 have been revised for clarity and conciseness.

5. C405.14.4.1 has been deleted as the EVSE “charging rate” is not the correct metric and better addressed in the revised C405.14.5 criteria.

6. C405.14.5 has been expanded into four sections covering system capacity and circuit capacity, with or without energy management. This aligns the criteria with the minimum requirements of the NEC while providing backstops to ensure effective system and circuit capacity is provided when the power rating of the EVSE is unknown or where an energy management system is utilized to reduce EVSE load demand.

7. C405.14.5.1 ensures the service or feeder that supplies EVSE branch circuits has the minimum required capacity as required by section 220.57 and 625.42 of the NEC.

8. C405.14.5.2 ensures the individual branch circuits that supply EVSE have the minimum required capacity as required by the 625.42 of the NEC.

9. C405.14.5.3.1 provides both a maximum and minimum calculated load for the service or feeder that supplies EVSE branch circuits controlled by an energy management system.

10. C405.14.5.3.2 ensures a minimum calculate load is provided for branch circuits controlled by and energy management system supplying more than EVSE as permitted in 625.40 of the NEC.

Here are examples of the calculations proposed in the public comment:

Example A: 10 EVSE spaces (kVA unknown)

C405.14.5.1 System Capacity: 10 x 7,200 VA = 72kVA capacity added to the service/feeder supplying EVSE branch circuits

C405.14.5.2 Circuit Capacity: 50A rated capacity for each of the 10 EVSE space branch circuits

Example B: 10 EVSE spaces, EMS installed having maximum EVSE capacity of 25kVA (kVA unknown)

C405.14.5.3.1 System Capacity Management: Maximum calculated load on the service/feeder supplying EVSE branch circuits is 25kVA with the minimum calculated load being 10 x 3,300 VA = 33 kVA.

C405.14.5.3.2 Circuit Capacity Management:

1. Each Branch Circuit, other than Group R-2, supplying 2 EVSE spaces each: 2 x 25A = 50A rated capacity for each of the 5 branch circuits

2. Each Branch Circuit, at Group R-2, supplying 2 EVSE spaces each: 2 x 20 A = 40A rated capacity for each for each of the 5 branch circuits.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change proposal will not increase nor decrease the cost of construction as it simply provides more compliance options to choose from.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: Provides important technical revisions, clarity and more enforceable language for EV charging.

Proposal # 800

CED1-45-22

Proponents: Sam Bauer, representing SWTCH (sam@theadhocgroup.com)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

TABLE C405.14.1 REQUIRED EV POWER TRANSFER INFRASTRUCTURE

Occupancy	EVSE Spaces	EV Ready Spaces	EV Capable Spaces
Group A	10%	0%	10%
Group B	15%	0%	30%
Group E	~~2%~~ 15%	0%	~~5%~~ 30%
Group F	2%	0%	5%
Group H	1%	0%	0%
Group I	~~2%~~ 15%	0%	~~5%~~ 30%
Group M	~~10%~~ 15%	0%	~~10%~~ 30%
Group R-1	20%	5%	75%
Group R-2	20%	5%	75%
Group R-3 and R-4	2%	0%	5%
Group S exclusive of parking garages	1%	0%	0%
Group S-2 parking garages	~~1%~~15%	0%	~~0%~~ 30%

Reason: We recommend that all public-facing Commercial S-2 parking garages have the same EVSE and EV capable requirements, matching what has been proposed for garages associated with Business (B) occupancies. There are two reasons that we believe justify this change:

1. There is no reason for the distinction between a parking garage associated with a business (B), a school (E), or a parking garage which serves a commercial district (S-2). All are commercial facilities with public-facing uses. There is precedent for considering these commercial building types together: the Denver EV infrastructure requirements require the same levels of EV-installed, EV-ready, and EV-capable for A, B, E, I M, and S-2 building types.[1] The Southwest Energy Efficiency Project (SWEEP) also considers Commercial buildings (Groups A, B, E, I, M, S-2) collectively, recommending at least 20% of the total parking spaces as EV Capable.[2]
2. Retrofits are significantly more costly than EV-enabled or EV-capable spaces from new construction. For example, a study by Energy Solutions (2019) showed that retrofits can cost as much as $4,600 more per space than those installed during construction.[3] Recent estimates suggest that half of all vehicles sold by 2030 will be electric.[4] New garage construction should be future-proofed to meet the needs of EV owners over the next 10 years – 1% of parking spaces with EVSE will not suffice, and retrofitting to meet the coming demand would be unnecessarily costly.

Cost Impact: The code change proposal will increase the cost of construction.
This code change would increase the initial cost of construction. However, as we noted in our reason statement this code change would ultimately save building owners as much as $4,600 per space compared to retrofitting.

Bibliography:

1. Electric Vehicle Charging for Residential and Commercial Energy Codes, Technical Brief, 2021. ,https://www.energycodes.gov/sites/default/files/2021-07/TechBrief_EV_Charging_July2021.pdf>
2. EV Infrastructure Building Codes: Adoption Toolkit, SWEEP. <https://www.swenergy.org/transportation/electric-vehicles/building-codes#:~:text=Progressive%20Requirements%3A&text=Denver's%20new%20building%20codes%20require,installation%20of%20an%20EV%2
3. Electric Vehicle Infrastructure Cost Analysis Report for Peninsula Clean Energy (PCE) & Silicon Valley Clean Energy (SVCE), Energy Solutions, 2019. <https://www.peninsulacleanenergy.com/wp-content/uploads/2020/08/PCE_SCVE-EV-Infrastructure-Cost-Analysis-Report-2019.11.05.pdf>
4. "More Than Half of US Car Sales Will Be Electric by 2030," Bloomberg, September 20, 2022. <https://www.bloomberg.com/news/articles/2022-09-20/more-than-half-of-us-car-sales-will-be-electric-by-2030#xj4y7vzkg>

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: Proposal would harmonize the requirements for B, E, I and M and S-2 and reduces the long-term costs associated with EV charging.

Proposal # 888

CED1-50-22

Proponents: Diana Burk, representing New Buildings Institute (diana@newbuildings.org); Rachael Dorothy, representing self (dorothy.2@osu.edu); Melissa Kops, representing CT Green Building Council (melissa@ctgbc.org); Andy Woommavovah, representing Healthcare (andy.woommavovah@trinity-health.org); Khaled Mansy, representing self (khaled.mansy@okstate.edu); Brad Smith, representing City of Fort Collins (brsmith@fcgov.com); Brad Hill, representing Honeywell International Inc. (brad.hill@honeywell.com); Emma Gonzalez-Laders, representing Dept. of State/DBSC (emma.gonzalez-laders@dos.ny.gov); David Goldstein, representing Natural Resources Defense Council (dgoldstein.nrdc@gmail.com)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C405.15.1 On-site renewable energy systems. *Buildings* shall be provided with ~~install equipment for~~ on-site renewable electricity generation systems with a direct current (DC) nameplate power rating of not less than 0.75 W/ft^2 (8.1 W/m^2) multiplied by the sum of the gross conditioned floor area of all floors not to exceed the combined gross conditioned floor area of the three largest floors.

Exceptions: The following buildings or building sites shall comply with Section C405.15.2:

1. A building site located where an unshaded flat plate collector oriented toward the equator and tilted at an angle from horizontal equal to the latitude receives an annual daily average incident solar radiation less than 1.1 kBtu/ft^2 - day (3.5 kWh/m^2 - day).
2. A *building* where more than 80 percent of the roof area is covered by any combination of permanent obstructions such as, but not limited to, mechanical equipment, vegetated space, access, pathways, or occupied roof terrace.
3. Any building where more than 50 percent of the roof area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2500 annual hours between 8:00 a.m. and 4:00 p.m.
4. A *building* with gross conditioned floor area less than 5,000 square feet (465 m^2).

C405.15.2 Off-site renewable energy. *Buildings* that qualify for one or more of the exceptions to Section 405.15.1 and do not meet the requirements of Section 405.15.1 ~~either in part or in full,~~ with an on-site renewable energy system, shall procure off-site renewable electrical energy, in accordance with C405.15.2.1 and C405.15.2.2, that shall not be less than the total off-site renewable electrical energy determined in accordance with Equation 4-14.

$$\text{TREoff} = (\text{RENoff} \times 0.75\ \text{W/ft}^2 \times \text{FLRA - IREon}) \times 15 \qquad \textbf{(Equation 4-14)}$$

TREoff = Total off-site renewable electrical energy in kilowatt-hours (kWh) to be procured in accordance with Table C405.15.2
RENoff = Annual off-site renewable electrical energy from Table C405.15.2, in units of kilowatt-hours per watt of array capacity
FLRA = the sum of the gross conditioned floor area of all floors not to exceed the combined floor area of the three largest floors
IREon = Annual on-site renewable electrical energy generation of a new on-site renewable energy system, to be installed as part of the building project, whose rated capacity is less than the rated capacity required in Section C405.15.1

C405.15.2.1 Off-site procurement. The building owner as defined in the *International Building Code* shall procure and be credited for the total amount of off-site renewable electrical energy, not less than required in accordance with Equation 4-14, with one or more of the following:

1. A *physical renewable energy power purchase agreement*
2. A *financial renewable energy power purchase agreement*
3. A *community renewable energy facility*
4. Off-site renewable energy system owned by the building property owner

The generation source shall be located where the energy can be delivered to the building *site* by any of the following:

1. Direct connection to the off-site renewable energy facility
2. The local utility or distribution entity
3. An interconnected electrical network where energy delivery capacity between the generator and the building *site* is available

C405.15.2.2 Off-site contract. The *renewable energy* shall be delivered or credited to the building site under an energy contract with a duration of not less than 10 years. The contract shall be structured to survive a partial or full transfer of ownership of the building property. ~~The total required off-site renewable electrical energy shall be procured in equal installments over the duration of the off-site contract.~~

C405.15.3 Renewable energy certificate documentation. The property owner or owner's authorized agent shall demon-strate that where RECs or EACs are associated with on-site and off-site renewable energy production required by Sections C405.15.1 and C405.15.2 all of the following criteria for RECs and EACs shall be met:

1. The RECS and EACS ~~Are~~ are retained and retired by or on behalf of the property owner or tenant for a period of not less than 15 years or the duration of the contract in C405.15.2.2 whichever is less;
2. The RECS and EACS ~~Are~~ are created within a 12-month period of the use of the REC; and
3. The RECS and EACS ~~Are~~ are from a generating asset ~~constructed~~ placed in service no more than 5 years before the issuance of the certificate of occupancy.

C405.15.4 Renewable energy certificate purchase. A *building* that qualifies for one or more of the exceptions to Section C405.15.1 and where it can be demonstrated to the *code official* that the requirements of Section C405.15.2 cannot be met, the building owner shall contract for the purchase of renewable electricity products before the certificate of occupancy complying with the Green-e Energy National Standard for Renewable Electricity products equivalent to five times the amount of total off-site renewable energy calculated in accordance with Equation 4-14.

Appendix CC ~~COMMUNITY RENEWABLE ENERGY FACILITY.~~ ~~A facility that produces energy from renewable energy systems and is qualified as a community energy facility under applicable jurisdictional statutes and rules.~~

Appendix CC ~~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."~~

Appendix CC ~~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.~~

Appendix CC ~~RENEWABLE ENERGY CERTIFICATE (REC).~~ ~~A market-based instrument that represents and conveys the environmental, social, and other non-power attributes of one megawatt hour of renewable electricity generation and could be sold separately from the underlying physical electricity associated with renewable energy systems; also known as an energy attribute and energy attribute certificate (EAC)~~.

RENEWABLE ENERGY INVESTMENT FUND (REIF). A fund established by a jurisdiction ~~the local government or other entity~~ to accept payment from ~~building~~ *building project* owners to construct or acquire interests in qualifying renewable energy systems, together with their associated RECS, ~~(along with RECs) on their~~ onthe *building project* owners' behalf.

Reason: NBI is proposing several suggested revisions to the off-site renewable energy requirements in the draft 2024 IECC. First, it is important that if a building installs off-site renewable energy to meet the on-site renewable energy requirement, those systems should be installed in a location where the off-site renewable energy can arguably contribute electricity to the building site. This can be done either with a direct connection from the off-site renewable energy system to the building site, or a direct connection to the local utility or distribution entity or in an interconnected electrical network. By requiring the off-site renewables are installed in one of these three locations, a state adopting the 2024 IECC can ensure that the renewable requirements whether installed on-site or off-site will reduce that building and state’s carbon emissions and result in improved air quality and a grid that is less reliant on fossil fuels. This language is based on a similar requirement for off-site renewables in the 2021 IgCC.
NBI is also proposing changes to section C405.15.2 requiring that contracts procure renewable energy in equal installments over the duration of the off-site contract. The majority of contracts for off-site renewable energy will not be equal either in energy or in cost because renewable energy system generation varies slightly on an annual basis and because many contracts include small annual adjustments to the cost paid per kWh. NBI is also clarifying that building owners purchase renewable energy credits before the certificate of occupancy because unbundled RECS are typically purchased at one time.

Finally, NBI is proposing small tweaks to the language in Section C405.15.3 for readability and clarity, deleting unneeded definitions in Appendix CC and clarifying the definition for the renewable energy investment fund.

NBI strongly believes that the renewable energy requirements are a new critical addition to the 2024 IECC. In 2020, 21% of the electricity used in the United States was sourced from renewable energy, primarily wind, an intermittent source of energy. [1] The Inflation Reduction Act of 2022 (IRA), which provides reliable tax credits for renewable energy until at least 2032, is estimated to double the deployment of renewable energy technology by making it more cost effective than ever. [2] This proposal requires new commercial buildings to place renewables on the building site, which will support more reliable distributed energy generation and aligns with the incentives being provided in the IRA.

Requiring renewables on new commercial buildings with only certain exceptions will:1) Economically benefit individuals and communities as the country transitions towards a low-carbon economy;2) Increase the resilience of communities during disruptions to centrally supplied power;

3) Reduce the impact of utility-scale renewables on critical wildlife habitat; and

4) Reduce building carbon emissions and improve air quality by ensuring that approximately 10% of a building’s energy use is from renewable energy sources.

In addition, this proposal will expand good paying jobs in one of the nation's fastest growing employment sectors. According to the Bureau of Labor Statistics, the two fastest growing occupations in the U.S. in 2019 were solar PV installers and wind turbine service technicians. [3] Because of the IRA, renewable energy manufacturers will be incentivized to locate their business in the U.S., and both renewable energy manufacturers and installers will be incentivized to provide good wages. This provision to require renewable energy on new commercial buildings will broaden and extend the IRA's positive impacts on the U.S. economy and positively impact our communities.

Attached is a letter stating support for this proposal from 40 organizations, 9 of which are from local or state governments and universities, 11 of which are from NGOs, and 20 of which are from design and construction industry.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal will not affect the cost of construction.

Bibliography: [1] Renewables Became the Second-Most Prevalent U.S. Electricity Source in 2020 , U.S. Energy Information Administration, https://www.eia.gov/todayinenergy/detail.php?id=48896.
[2] Esposito, Daniel. "Inflation reduction act benefits: Clean Energy Tax Credits could double deployment." Forbes Magazine. 23 Aug. 2022, https://www.forbes.com/sites/energyinnovation/2022/08/23/inflation-reduction-act-benefits-clean-energy-tax-credits-could-double-deployment/?sh=6e7381c76727

[3] The National Solar Job Census 2020, Interstate Renewable Energy Council, May 2021,

Richardson, Jake. Solar and Wind Tech Are the Fastest Growing Jobs in US, Red, Green, and Blue, 28 Jan. 2019, http://redgreenandblue.org/2019/01/27/solar-wind-tech-fastest-growing-jobs-us/.

Attached Files

- **NBI Sign On Letter Commercial 2024 IECC.pdf**
  https://energy.cdpaccess.com/proposal/647/3021/files/download/359/

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: Adds clarity to renewable electricity generation requirements, and removes redundant definitions.

Proposal # 647

CED1-55-22

Proponents: Charles Eley, representing Architecture 2030 (charles@eley.com)

2024 International Energy Conservation Code [CE Project]

Update standard(s) as follows:

C405.15.2.1 Off-site procurement. The building owner as defined in the *International Building Code* shall procure and be credited for the total amount of off-site renewable electrical energy, not less than required in accordance with Equation 4-14, with one or more of the following:

1. ~~A~~ *Physical renewable energy power purchase agreement*
2. ~~A~~*Financial renewable energy power purchase agreement*
3. ~~A~~ *Community renewable energy facility*
4. Off-site renewable energy system owned by the building property owner
5. *Green retail tariff*

Add new definition as follows:

C202 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% *renewable energy resources* without the purchase of unbundled RECs.

Reason: A green retail tariff is a special program offered by electric service providers (utilities) whereby they acquire 100% renewable energy to meet the electricity demands of a participating customer. The customer typically pays a premium in the range of one to two cents per kilowatt-hour (similar to participation in a community solar program). The delivered renewable energy is in addition to that required to meet applicable renewable portfolio standards and the RECs associated with the renewable energy are retired on behalf of the participating customer (as required by C405.15.3).
Section C405.15.2.2 would apply to green retail tariffs as it does to all off-site procurement options. A contract is required: (1) with a duration of at least 10 years, (2) that is structured to survive a transfer of ownership, and (3) and that acquires renewable energy in concert with energy consumption.

Retail green pricing is the most common method for procuring off-site renewable energy and the only option available to many building owners/managers. This is the option most widely used in Boston, San Francisco and other cities where the purchase of off-site renewable energy is already required for some building types and sizes.

Off-site renewable energy purchases are recognized in three places in the standard and this code change proposal strives to make the methods more consistent in section C405.15, Appendix CC and Appendix CD.

Not including this option will limit the ability of building owners to purchase off-site renewable energy and undermine the effectiveness of Section C405.15.

Cost Impact: The code change proposal will decrease the cost of construction.
The cost premium for 100% renewable energy through a green retail tariff is comparable to participation in a community renewables program. Providing more options for off-site procurement has the potential to reduce compliance costs.

Bibliography: ZERO Code 2.0, Off-Site Procurement of Renewable Energy, Technical Support Document, December 2020. Click here.
Clean Electricity, A practical path to zero-carbon buildings, Charles Eley, September 2022. Click here.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason:

CED1-56-22

Proponents: Charles Eley, representing Architecture 2030 (charles@eley.com)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C405.15.2.1 Off-site procurement. The building owner as defined in the *International Building Code* shall procure and be credited for the total amount of off-site renewable electrical energy, not less than required in accordance with Equation 4-14, with one or more of the following:

1. ~~A P~~*hysical renewable energy power purchase agreement*
2. ~~A~~*Financial renewable energy power purchase agreement*
3. ~~A~~ *Community renewable energy facility*
4. Off-site renewable energy system owned by the building property owner
5. *Renewable energy investment fund*

Add new definition as follows:

RENEWABLE ENERGY INVESTMENT FUND (REIF). A fund established by a jurisdiction to accept payment from building project owners to construct or acquire interests in qualifying renewable energy systems, together with their associated RECS, on the building project owners' behalf.

Reason: A renewable energy investment fund is recognized in Appendix CC and Appendix CD. For consistency, it should be included in C405.15.2.1.

Cost Impact: The code change proposal will decrease the cost of construction.
Providing more options for acquiring off-site renewable energy will not increase the cost of compliance and could result in a reduction.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: When on-site renewables is not feasible as defined by the exceptions, this proposal would offer an additional path for purchasing off-site renewables from the jurisdiction. This would offer more flexibility and lower cost.

Proposal # 768

CED1-57-22

Proponents: Michael Tillou, representing Pacific Northwest National Laboratory (michael.tillou@pnnl.gov); Michael Rosenberg, representing Pacific Northwest National Laboratory (michael.rosenberg@pnnl.gov)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C405.16 Electrical energy storage system. *Buildings* shall comply with ~~the one of~~ Section C405.16.1 or Section C405.16.2.

C405.16.1 Electrical energy storage energy capacity. Each *building* shall have one or more ESS with a total rated energy capacity and rated power capacity as follows:

1. ESS rated energy capacity (kWh)≥1.0 x Installed PV System Rated Power (kWDC)
2. ESS rated power capacity (kW)≥0.25 x Installed PV System Rated Power (kWDC).

Where installed, DC coupled battery systems shall meet the requirements for rated energy capacity alone.

Revise as follows:

C405.16.2 Electrical energy storage system ready. Each *building* shall have one or more reserved ESS-ready areas to accommodate future electrical storage in accordance ~~complying~~ with Sections C405.16.2.1 through C405.16.2.4.~~the following:~~

1. ~~Energy storage system rated energy capacity (kWH) ≥ Conditioned floor area of the three largest stories (ft²) x 0.0008 kWh/ft²~~
2. ~~Energy storage system rated power capacity (kW) ≥ Conditioned floor area of three largest stories (ft²) x 0.0002 kWh/ft²~~

C405.16.2.1 ESS-ready location. Each ESS-ready area shall be located in accordance with Section 1207 of the *International Fire Code.*

Revise as follows:

C405.16.2.2 ESS-ready minimum area requirements. Each ESS-ready area shall be sized in accordance with the spacing requirements of Section 1207 of the *International Fire Code* and the UL9540 or UL9540A designated rating of the planned system. Where rated to UL9540A, the area shall be sized in accordance with the manufacturer's instructions.

C405.16.2.3 Electrical distribution equipment. The onsite electrical distribution equipment shall have sufficient capacity, rating, and space to allow installation of overcurrent devices and circuit wiring in accordance with NFPA 70 for future electrical ESS installation complying with the capacity criteria of Section C405.16.2 .4.

Add new text 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) ≥ gross conditioned floor area of the three largest floors (ft^2) x 0.0002 kWh/ft^2

Reason: This proposal is editorial and recommends language to reduce ambiguity.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal is editorial and does not impact cost effectiveness of this requirement.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: This proposal adds clarity to the requirements by relocating system capacity requirements to a more-appropriate subsection. The modification includes editorial improvements.

CED1-62-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C405.16.1 Electrical energy storage energy capacity. Each *building* shall have one or more ESS with a total rated energy capacity and rated power capacity as follows:

1. ESS rated energy capacity (kWh)≥1.0 x Installed ~~PV~~ On-site Renewable Electric Energy System Rated Power (kWDC)
2. ESS rated power capacity (kW)≥0.25 x Installed ~~PV~~ On-Site Renewable Electric Energy System Rated Power (kWDC).

Where installed, DC coupled battery systems shall meet the requirements for rated energy capacity alone.

C405.16.2 Electrical energy storage system ready. Each *building* shall have one or more reserved ESS-ready areas to accommodate future electrical storage complying with the following:

1. Energy storage system rated energy capacity (~~kWH~~ kWh) ≥ Gross conditioned ~~Conditioned~~ floor area of the three largest ~~stories~~ floors (ft^2) x 0.0008 kWh/ft^2
2. Energy storage system rated power capacity (kW) ≥ ~~Conditioned~~ Gross conditioned floor area of three largest ~~stories~~ floors (ft^2) x 0.0002 ~~kWh~~ kW/ft^2

Reason: As currently written, battery energy storage systems are only required when PV systems are installed, so other renewable energy systems would be exempt. This revision would make the requirement applicable to all qualified on-site renewable energy systems that produce electricity.
The other part of the proposal makes technical corrections to the equations shown.

Cost Impact: The code change proposal will increase the cost of construction.
For buildings that install on-site renewable energy systems that are not PV systems.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: This proposal makes necessary technical corrections and allows the use of other on-site renewable electric energy production systems.

CED1-65-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C405.2 Lighting controls. Lighting systems powered through the energy service for the *building* and *building site* lighting for which the building owner is responsible shall be provided with controls that comply with Sections C405.2.1 through C405.2.9 .

Exceptions: Lighting controls are not required for the following:

1. Spaces where an automatic shutoff could endanger occupant safety or security.
2. Interior exit stairways, interior exit ramps and exit passageways.
3. Emergency lighting that is automatically off during normal operations.
4. Emergency lighting required by the *International Building Code* in exit access components which are not provided with fire alarm systems.
5. Up to 0.02 watts per square foot (0.06 W/m^2) of lighting in exit access components which are provided with fire alarm systems.

C405.5.1 Total connected ~~exterior building~~ exterior lighting power. The total exterior connected lighting power shall be the total maximum rated wattage of all exterior lighting that is powered through the energy service for the *building* and *building site* lighting for which the building owner is responsible.

Exception: Lighting used for the following applications shall not be included.

1. Lighting *approved* because of safety considerations.
2. Emergency lighting that is automatically off during normal operations .
3. Exit signs.
4. Specialized signal, directional and marker lighting associated with transportation.
5. Advertising signage or directional signage.
6. Integral to equipment or instrumentation and installed by its manufacturer.
7. Lighting in any location that is specifically used for video broadcasting, video or film recording, or live theatrical and music performance.
8. Athletic playing areas.
9. Temporary lighting.
10. Industrial production, material handling, transportation sites and associated storage areas.
11. Theme elements in theme/amusement parks.
12. Used to highlight features of art, public monuments and the national flag.
13. Lighting for water features and swimming pools.
14. Lighting controlled from within sleeping units and dwelling units, .
15. Lighting of the exterior means of egress as required by the *International Building Code*.

C405.5.2 Exterior lighting power allowance. The exterior lighting power allowance (watts) is calculated as follows:

1. Determine the Lighting Zone (LZ) for the building according to Table C405.5.2(1), unless otherwise specified by the code official.
2. For each exterior area that is to be illuminated by lighting that is powered through the energy service for the *building* and *building site* lighting for which the building owner is responsible, determine the applicable area type from Table C405.5.2(2). For area types not listed, select the area type that most closely represents the proposed use of the area.
3. Determine the total area or length of each area type and multiply by the value for the area type in Table C405.5.2(2) to determine the lighting power (watts) allowed for each area type.
4. The total exterior lighting power allowance (watts) is the sum of the base site allowance determined according to Table C405.5.2(2), plus the watts from each area type.

Reason: This proposal establishes energy efficiency for exterior lighting on a buildings site regardless of where the power for the lighting is being

sourced and closes an existing loophole that circumvents the energy code.
This provision will:

1. Increase energy efficiency

2. Close a loophole in the code

3. Establish consistency in code implementation

4. Simplifies compliance as does not require new or revised code provisions

5. Supports enforceability uniformly

The energy code currently limits the ability of the code to cover lighting on buildings sites where the electrical power distribution is separated from the building. Such applications, even though under the ownership and control of one entity, may have exterior lighting which should be under the code's governance. Some examples are parking lots on many retail, institutional, transportation and entertainment venue locations where the electrical distribution comes from a free-standing pedestal mounted electrical service. Additional applications are exterior lighting on plazas, walkways, outdoor amphitheaters, and similar that are part of a building site, but powered separately from the building.

Note that lighting controls are NOT required to follow energy code provisions per new language in the 2024 DRAFT section C405.2. Inserted into the draft (via a new proposal introduced as CEPI-150) is the following: "<u>not powered through the electrical service of the building</u>".

The intent of this proposal would remove or negate this new draft language.

From a technical perspective, exterior lighting located on building sites should be applied and be similarly just as efficient, no matter where the electrical power is served. This proposal would apply energy efficiency the same to all exterior lighting on a building site.

Exempting exterior lighting not powered through the electrical service of a building presents a loophole for enforcement. By choosing to set the electrical service separated from a building on a free-standing pedestal can be done simply to avoid energy efficiency compliance. This is a design practice in retail strip malls where a "house panel" will be set separate from the retail buildings, and power all lighting in mall parking areas.

As currently written and proposed by CEPI-150, exterior lighting on a building site powered separately from the building, may use any efficacy lighting and operate without the energy savings controls would provide. Essentially, this exterior lighting would be allowed to operate full on 24 hours a day, seven days a week without limits and without the code control provisions.

To resolve these inefficient situations, increase efficiency, reduce confusion and simplify enforcement, this proposal removes the language which limits controls and exterior lighting power. Approval of this proposal would support that all exterior lighting, regardless of electrical service location, would now comply and be as efficient as required for any building site.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The code change proposal will not increase or decrease the cost of construction

---

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: this improves the language of the section by addressing situations where third party lighting is installed. It also addresses lighting at the building site that is controlled by the building owner.

Proposal # 795

CED1-75-22

Proponents: Glenn Heinmiller, representing IALD (glenn@lampartners.com)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

TABLE C405.3.2(2) INTERIOR LIGHTING POWER ALLOWANCES: SPACE-BY-SPACE METHOD

Portions of table not shown remain unchanged.

COMMON SPACE TYPES[a]	LPD (watts/ft²)
Lobby	
For an elevator	0.64
In a facility for the visually impaired (and not used primarily by the staff)[b]	1.44
~~In a hotel~~	~~0.48~~
In a motion picture theater	0.20
In a performing arts theater	1.21
Otherwise	0.80

Reason: The proposed lighting power allowance for Hotel Lobbies is insufficient. Hotel Lobby allowances, before 2018, tracked much more closely to the allowance for Lobby, Otherwise. Eliminating the space type for Hotel Lobbies will mean that designers will use the allowance from the Lobby, Otherwise space type for Hotel Lobbies. Hotel lobbies are no less complex a design than lobbies for corporate buildings or high-rise residential buildings. Often, hotel lobby designs are more complex, to support the hospitality setting.

ASHRAE/IES 90.1	Year				90.1 Add. ba
	2010	2013	2016	2019	2022
Hotel Lobby	0.90	1.06	1.06	0.51	0.48
Lobbies, Otherwise	0.90	0.90	1.00	0.84	0.80

IECC	Year				PC Draft#1
	* 2012	2015	2018	2021	2024
Hotel Lobby	2.10	1.06	1.06	0.51	0.48
Lobbies, Otherwise	1.10	0.90	1.00	0.84	0.80

* No decorative allowance

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This lighting power allowance adjustment does not require the use of more expensive lighting equipment

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: This will allow hotel lobbies to match the requirements of other lobbies, as the lighting requirements are similar.

CED1-76-22

Proponents: Jonathan McHugh, representing McHugh Energy Consultants Inc. (jon@mchughenergy.com)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C405.3.2.2.1 Additional interior lighting power. Where using the Space-by-Space Method, an increase in the interior lighting power allowance is permitted for specific lighting functions. Additional power shall be permitted only where the specified lighting is installed and controlled in accordance with Section C405.2.5. ~~This~~ These additional power allowances shall be used only for the ~~specified~~ luminaires serving the specific lighting function and shall not be used for any other purpose. An increase in the interior lighting power allowance is permitted in the following cases:

1. For lighting equipment to be installed in sales areas specifically to highlight merchandise, the additional lighting power allowance shall be the connected lighting power of the luminaires specifically highlighting merchandise, calculated in accordance with Equation 4-12, or the additional power allowance ~~determined~~ calculated in accordance with Equation 4-13, whichever is less.

$$\text{Additional lighting power allowance} = 750\ \text{W} + (\text{Retail Area 1} \times 0.40\ \text{W/ft}^2) + (\text{Retail Area 2} \times 0.40\ \text{W/ft}^2) + (\text{Retail Area 3} \times 0.70\ \text{W/ft}^2) + (\text{Retail Area 4} \times 1.00\ \text{W/ft}^2)$$

For SI units:

$$\text{Additional lighting power allowance} = 750\ \text{W} + (\text{Retail Area 1} \times 4.3\ \text{W/m}^2) + (\text{Retail Area 2} \times 4.3\ \text{W/m}^2) + (\text{Retail Area 3} \times 7.5\ \text{W/m}^2) + (\text{Retail Area 4} \times 10.8\ \text{W/m}^2)$$

where: **(Equation 4-13)**

Retail Area 1 = The floor area for all products not listed in Retail Area 2, 3 or 4.

Retail Area 2 = The floor area used for the sale of vehicles, sporting goods and small electronics.

Retail Area 3 = The floor area used for the sale of furniture, clothing, cosmetics and artwork.

Retail Area 4 = The floor area used for the sale of jewelry, crystal and china.

Exception: Other merchandise categories are permitted to be included in Retail Areas 2 through 4, provided that justification documenting the need for additional lighting power based on visual inspection, contrast or other critical display is approved by the code official.

2. For spaces in which lighting is specified to be installed in addition to the general lighting for the purpose of decorative appearance or for highlighting art or exhibits, ~~provided that~~ the additional lighting power allowance for that space shall be ~~not more than~~ the smallest ~~wattage~~ of the following:

2.1 0.66 W/ft^2 (7.1W/m^2) in lobbies, ~~and~~

2.2 ~~not more than~~ 0.55 W/ft^2 (5.9 W/m^2) in other spaces~~.~~ , or

2,3 the connected lighting power of the luminaires specifically for ~~the purpose of~~ decorative appearance or for highlighting art or exhibits, calculated according to Equation 4-12.

Reason: The purpose of this proposal is to clarify what is the lighting power allowance associated with additional lighting allowed for retail display lighting and decorative lighting. The maximum possible additional lighting allowances are very large; they are equivalent in magnitude to the general lighting allowances and approximately allow for doubling the installed lighting power when these additional allowances are fully utilized.
The current wording has this phrase: “This additional power shall be used only for the specified luminaires and shall not be used for any other purpose.” This means that one cannot install additional general lighting above what is allowed by the general lighting LPD and use the additional lighting power allowance.
The definition of what is the maximum allowed total lighting power allowance has become controversial with the lighting control credit for installing reduced lighting power below the allowed lighting power [see Section C406.2.5.6 L06 Reduced Lighting Power]. One can receive credits for up to a 20% in the base allowance. Common practice is to not install decorative lighting in many spaces. If it is not clear that decorative lighting is not able to claim the difference between the maximum allowed and what is installed, one could have a 50% reduction in LPD without actually changing common practice for many interior lighting designs. This is not the intent of the reduced lighting power credit.
The current draft of Section C406.2.5.6 L06 Reduced Lighting Power only compares the net lighting power and the net allowances not including the additional lighting power. In this situation the clarification is not very important. However there has been an interest in reverting the reduced lighting power credit to the format in the 2021 IECC Section C406.3. In the 2021 version of the IECC, the total lighting power is compared to the total lighting power allowances including the additional lighting power allowances.
The aim of this proposal is to make clear that the additional lighting power allowances is the lesser of what additional lighting is installed and the allowances which are a product of a lighting power density and the area for the allowance. As a result there is no reduction associated with using less additional lighting power only reductions allocated to installing less general lighting power than the general lighting power allowances.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal has no impact on the cost of the standard; it is only clarifying what is already intended for the calculation of additional lighting power allowances.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: This proposal clarifies the existing requirements of the section. This has no impact on cost.

Proposal # 851

CED1-77-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C405.8 Electric motors. Electric motors shall meet the minimum efficiency requirements of Tables C405.8(1) through C405.8(4) when tested and rated in accordance with the DOE 10 CFR 431. 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 motor manufacturer.

Exception: The standards in this section shall not apply to the following exempt electric motors:

1. Air-over electric motors.
2. Component sets of an electric motor.
3. Liquid-cooled electric motors.
4. Submersible electric motors.
5. Inverter-only electric motors.
6. Definite purpose machines within the scope of ANSI/NEMA MG 1-2021, Part 18.

NEMA

National Electrical Manufacturers Association
1300 North 17th Street, Suite 900
Rosslyn, VA 22209

MG1—~~2016~~ 2021: Motors and Generators

Reason: The coverage of motors in this section as written is still too broad. In accordance with the DoE Small Motor Rule, efficiency regulations apply only to open drip-proof single- and three-phase general purpose motors and exclude definite purpose motors such as jet pump, belted fan, submersible, sump pump motors, etc. The full complement of definite purpose machines can be found in ANSI/NEMA MG 1-2021, Part 18.

Cost Impact: The code change proposal will decrease the cost of construction.
The current requirements would potentially increase the cost of manufacturing of definite purpose machines to make them more efficient than what Federal regulations presently require, thus increasing the cost of construction. This new exception will prevent this increased cost of construction.

Bibliography: I. ANSI/NEMA MG 1-2021
II. 10 CFR Part 431

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: This change ensures that the code is consistent with federal energy efficiency requirements and exceptions for motors.

Proposal # 796

CED1-78-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C405.9~~.1~~ Data Center<ins>s and Computer Rooms</ins> ~~Systems~~. ~~Transformers, uninterruptable power supplies, motors and electrical power processing equipment in data center systems shall comply with Section 8 of ASHRAE 90.4 in addition to this code.~~ <ins>Electrical equipment in data centers and computer rooms shall comply with this section.</ins>

Add new text as follows:

<ins>**C405.9.1 Data centers.** Transformers, uninterruptable power supplies, motors and electrical power processing equipment in *data centers* shall comply with Section 8 of ASHRAE 90.4 in addition to this code.</ins>

<ins>**C405.9.2 Computer Rooms.** Uninterruptable power supplies in *computer rooms* shall comply with the requirements in Tables 8.5 and 8.6 of ASHRAE 90.4 in addition to this code.</ins>
<ins>Exception: AC-output UPS that utilizes standardized NEMA 1-15P or NEMA 5-15P input plug, as specified in ANSI/NEMA WD-6-2016.</ins>

Add new standard(s) as follows:

ANSI

American National Standards Institute
25 West 43rd Street, 4th Floor
New York, NY 10036

<ins>WD-6-2016</ins>	<ins>Wiring Devices - Dimensional Specifications</ins> <ins>Section C405.9.2</ins>

Reason: There are no standards for Uninterruptible Power Supply (UPS) systems in computer rooms like there are for Data Centers. This code proposal introduces minimum UPS efficiency aligned with efficient levels in ASHRAE 90.4. Therefore, the UPS requirements for computer rooms and data centers are equivalent. A UPS with a NEMA 1-15P or NEMA 5-15P plug are exempt from this requirement because minimum standards for these devices are already covered by DOE.
A similar code provision was adopted in both the 2022 Title 24 updates as well as the 2021 Washington State Energy Code (WSEC) and was found to be a cost-effective approach even though the proposal targeted ENERGY STAR efficiency thresholds.

Cost Impact: The code change proposal will increase the cost of construction.
This proposal is a compromise from an earlier proposal that required alignment with ENERGY STAR specifications. The cost data from that proposal can be used here as it was found to be a cost-effective approach.

Incremental costs were found to be $112/kW for high efficiency UPS systems, and were converted to $/sqft based on a 500sqft room (the threshold for which a computer room does not qualify as a data center). Costs were found to be estimated at $0.22/sqft and detailed cost information obtained through Final CASE report for 2022 Title 24 attached to this proposal and accessed publicly here:
https://title24stakeholders.com/wpcontent/uploads/2021/03/NR-Computer-Room-Efficiency-Final-CASE-Report_Statewide-CASETeam_updated.pdf

Bibliography: ENERGY STAR Program Requirements for Uninterruptible Power Supplies (UPSs) Test Method - Rev. Dec-2017

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: This code change proposal aligns the efficiency requirements for UPS installed in computer rooms with the efficiency requirements for this same equipment installed in data centers. This will reduce the energy consumption of UPS in computer rooms while improving the overall energy efficiency of the occupancy.

CED1-81-22

Proponents: Glenn Heinmiller, representing IALD (glenn@lampartners.com)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

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

~~Where lighting energy credit measures include reductions in lighting power, the lighting shall achieve ANSI/IES recommended practice for minimum illuminance levels as referenced at "The Interactive Illuminance Selector," which includes minimum recommended illuminance levels from various ANSI/IESRP-## standards.~~

Reason: The purpose of this requirement was to prevent low-quality lighting design solutions that might be incentivized by reduced lighting power density. Although well-intentioned, this requirement must be deleted because:

· Lighting designers must have the flexibility to design to whatever light levels are appropriate to provide quality lighting with minimal energy use. Sometimes this might mean illuminance levels that are below IES recommendations. In this case, the requirement would force the use of more energy than necessary.

· The purpose of the code is to regulate building energy use, not design quality. The IECC is not a design guide.

· This requirement would add a massive compliance and enforcement burden, for no energy savings benefit.

· C405.2.5.6 L06 provides no incentive for lighting power density lower than 80% of allowed lighting power. There is no incentive to have exceptionally low lighting power density that *might* lead to poor lighting quality.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Removing this requirement will have no effect on the cost of equipment used

---

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: Current language does not provide energy savings and is unnecessary. The language is not enforceable.

Proposal # 735

CED1-84-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C408.3 Functional testing of lighting and receptacle controls. Automatic lighting and receptacle controls required by this code shall comply with this section.

C408.3.1 Functional testing. Prior to passing final inspection, the *registered design professional* or *approved agency* shall provide evidence that the lighting and receptacle control systems have been tested to ensure that control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the *construction documents* and manufacturer's instructions. Functional testing shall be in accordance with Sections C408.3.1.1 through C408.3.1.3 for the applicable control type.

C408.3.1.1 Occupant sensor controls. Where *occupant sensor controls* are provided, the following procedures shall be performed:

1. Certify that the *occupant sensor* has been located and aimed in accordance with manufacturer recommendations.
2. For projects with seven or fewer *occupant sensors*, each sensor shall be tested.
3. For projects with more than seven *occupant sensors,* testing shall be done for each unique combination of sensor type and space geometry. Where multiples of each unique combination of sensor type and space geometry are provided, not less than 10 percent and in no case fewer than one, of each combination shall be tested unless the *code official* or design professional requires a higher percentage to be tested. Where 30 percent or more of the tested controls fail, all remaining identical combinations shall be tested.

   For *occupant sensor controls* to be tested, verify the following:

   3.1. Where *occupant sensor controls* include status indicators, verify correct operation.

   3.2. The controlled lights and receptacles controlled by *occupant sensor controls* turn off or down to the permitted level within the required time upon vacancy of the space.

   3.3. For auto-on *occupant sensor controls*, the controlled lights and receptacles controlled by *occupant sensor controls*turn on when an occupant enters the space.

   3.4. For manual-on *occupant sensor controls*, the controlled lights and receptacles controlled by *occupant sensor controls* turn on only when manually activated.

   3.5. The lights are not incorrectly turned on by movement in adjacent areas or by HVAC operation.

C408.3.1.2 Time-switch controls. Where *time-switch controls* are provided~~, the following procedures shall be performed:~~ items 1 through 5 shall be performed for all time-switch controls. For projects with more than seven spaces where lighting or receptacles are controlled by *time-switch controls*, not less than 10 percent of spaces and in no case fewer than one, shall be tested according to items 6 and 7 unless the code official or design professional requires a higher percentage to be tested. Where 30 percent or more of the tested spaces fail any of the requirements in items 6 and 7, all remaining spaces shall be tested.

1. Confirm that the *time-switch control* is programmed with accurate weekday, weekend and holiday schedules.
2. Provide documentation to the owner of *time-switch controls* programming including weekday, weekend, holiday schedules, and set-up and preference program settings.
3. Verify the correct time and date in the time switch.
4. Verify that any battery back-up is installed and energized.
5. Verify that the override time limit is set to not more than 2 hours.
6. Simulate occupied condition. Verify and document the following:

   6.1. All lights can be turned on and off by their respective area control switch.

   6.2. The switch only operates lighting in the enclosed space in which the switch is located.

   6.3 Receptacles in the space controlled by the time-switch controls turn on.

7. Simulate unoccupied condition. Verify and document the following:

    7.1. Nonexempt lighting turns off.

    7.2. Manual override switch allows only the lights <u>and receptacles controlled by the *time-switch controls* </u>in the enclosed space where the override switch is located to turn on <u>controlled lighting and receptacles for no more than 2 hours </u>~~or remain on until the next scheduled shutoff occurs~~.

    <u>7.3</u> <u>Receptacles controlled by the *time-switch controls* turn off.</u>

8. Additional testing as specified by the *registered design professional.*

Reason: The new requirement for hotel guestroom is for <u>all</u> lighting and switched receptacles to be off when room is vacant. This provision will help ensure that the code captures control of <u>all</u> lighting (permanent hardwired lighting as well as plugged-in lighting) by requiring verification that any switched or automatically controlled receptacles are also off when the room is vacant for more than 20 minutes. This provision also ensures energy savings from controlled receptacles by requiring the controlled receptacles are functioning as intended as well as the lighting.

Cost Impact: The code change proposal will increase the cost of construction.
Potential slight increase in cost. Functional testing of lighting controls is already required. This provision simply adds verification that the controlled receptacles are also working as intended.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: Verifying efficiency through functional testing of controlled receptacles.

Proposal # 895

CED1-87-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C105.2.2 Building ~~T~~thermal envelope. Inspections shall verify the correct type of insulation, *R*-values, location of insulation, thermal bridge mitigation, fenestration, *U*-factor, SHGC and VT, and that air leakage controls are properly installed, as required by the code, *approved* plans and specifications.

Reason: Thermal bridging requirements were added in Section C402.7 of the draft standard. They should be included in the building thermal envelope items listed for inspection in Section C105.2.2. Thermal bridging details can be as important to building thermal envelope performance as the other items currently mentioned in C105.2.2 and, if not compliant, can severely impact performance. The proposal also uses the defined term "building thermal envelope" for the section title.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal just coordinates building thermal envelope inspections with provisions added to the IECC standard draft for thermal bridges.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: This proposal clarifies the inspection of thermal bridges, and also corrects a section title.

Proposal # 716

CED1-90-22

Proponents: Helen Sanders, representing Facade Tectonics Institute (helen.sanders@technoform.com)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C303.1.3 Fenestration product rating. *U*-factors, *solar heat gain coefficient* (SHGC), and *visible transmittance* (VT) of fenestration products shall be determined as follows:

1. For windows, doors and skylights, *U*-factor, SHGC and VT ratings shall be determined in accordance with NFRC 100 and NFRC 200.
2. Where required for garage doors and rolling doors, *U*-factor ratings shall be determined in accordance with either NFRC 100 or ANSI/DASMA 105.

U-factors ,SHGC, and VT shall be determined by an accredited, independent laboratory, and *labeled* and certified by the manufacturer by a label affixed to the product or a label certificate specific to the products in the project.

Products lacking such a *labeled* *U*-factor shall be assigned a default *U*-factor from Table C303.1.3(1) or Table C303.1.3(2). ~~The *solar heat gain coefficient* (SHGC) and *visible transmittance* (VT) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and *labeled* and certified by the manufacturer.~~ Products lacking such a *labeled* SHGC or VT shall be assigned a default SHGC or VT from Table C303.1.3(3). For Tubular Daylighting Devices, VT_{annual} shall be measured and rated in accordance with NFRC 203.

Reason: On larger projects using the performance path, where rigor is warranted, project-specific size and configuration yields more-accurate values for U-factor, SHGC and VT than NFRC 100 standard sizes. This helps ensure that HVAC equipment capacity sizing, energy consumption modeling and product comparisons are based on accurate values. This increased level of accuracy is becoming more important in order to meet energy efficiency targets and to ensure occupant comfort. The NFRC 100 and 200 standard size U-factor and SHGC values provide a simplified approach when employing the prescriptive path and do not deliver a robust output for HVAC sizing.
The new 2023 version of NFRC 100 and 200, which will be published next year (2023), introduces a new, easier to use, methodology (the Commercial Trendline Approach) for calculating commercial fenestration performance, and the accompanying NFRC certification process provides a project-size and configuration specific path for certifying commercial fenestration performance. The project specific size calculation methodology for U-factor (aspect ratio calculation) is described in Appendix A4 of NFRC 100-2023 which ensures consistency in size-specific calculation methodology. A pre-publication version of NFRC 100-2023 has been provided by NFRC for the purpose of supporting documentation for this proposal and is uploaded with this proposal. This standard has already been approved by the NFRC board and membership, and will be published once the new web tools and certification program are rolled out to accompany it in 2023. For ease of reference, the commercial trendline approach is detailed in section 5.12, starting on P121, and the size-specific U-factor determination is detailed in Appendix A4, page 135. In addition, the proposed language will help clarify the confusion among design teams on whether to consider NFRC sizes, or the project specific size and configurations, streamlining the design process. It also clarifies that the project size U-factor, SHGC and VT, shall be calculated according to the NFRC 100 and 200 standards and does not require separate physical testing.

The proposal does not change the fact that the NFRC 100 and 200 remains the standard by which performance is determined, and prescriptive U-factors and SHGC for fenestration remain based on the standard NFRC size.

Clause C402.4.3.4 Area-weighted U-factor listed below would still allow for using an area-weighted average of the different project size.

We have suggested this section of the code for this clarification to be inserted, but the committee may find a more appropriate place for it.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal aims to clarify and improve the way U-factor is defined in the total energy compliance path. There should be no impact in the cost of construction. Some project teams already simulate and submit both project size and NFRC size because of lack of clarity, so clarifying this point could actually reduce the cost of the design process.

Attached Files

- **ANSI NFRC 100-2023 ExAx_PrePublicationDRAFT.pdf**
  https://energy.cdpaccess.com/proposal/901/2893/files/download/400/

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: As modified, this proposal clarifies that either a label affixed to the product or a label certificate for the project in compliance with NFRC 100 and 200 may be provided for fenestration. This is also consistent with how ASHRAE 90.1 handles fenestration labeling.

Proposal # 901

CED1-91-22

Proponents: Brian Trimble, representing International Masonry Institute (btrimble@imiweb.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

TABLE C303.1.3(1) DEFAULT GLAZED WINDOW, GLASS DOOR AND SKYLIGHT U-FACTORS

FRAME TYPE	WINDOW AND GLASS DOOR		SKYLIGHT	
	Single	Double	Single	Double
Metal	1.20	0.80	2.00	1.30
Metal with Thermal Break	1.10	0.65	1.90	1.10
Nonmetal or Metal Clad	0.95	0.55	1.75	1.05
~~Glazed~~ Glass Block	0.60			

Reason: The proper term is glass block which is translucent. Glazed block is a different product. Glass Unit Masonry is more appropriate than Glass Block, but most designers know it as glass block.

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

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: The correct terminology is glass block. Glazed block has a different meaning.

Proposal # 847

CED1-92-22

Proponents: Aaron Phillips, representing Asphalt Roofing Manufacturers Association (aphillips@asphaltroofing.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C105.2.2 Building ~~Thermal~~ thermal envelope. Inspections shall verify the correct type of insulation, *R*-values, location of insulation, fenestration, *U*-factor, SHGC and VT, and that air leakage controls are properly installed, as required by the code, *approved* plans and specifications.

CONTINUOUS INSULATION (ci). Insulating material that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior or exterior or is integral to any opaque surface of the *building thermal envelope*~~building envelope~~.

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

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

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

SECTION C402
BUILDING THERMAL ENVELOPE REQUIREMENTS

C402.1 General. *Building thermal envelope* assemblies for buildings that are intended to comply with the code on a prescriptive basis in accordance with the compliance path described in Item 1 of Section C401.2.1 shall comply with the following:

1. The opaque portions of the *building thermal envelope* shall comply with the specific insulation requirements of Section C402.2 and the thermal requirements of either the U-, C- and F-factor based method of Section C402.1.2; the R-value based method of C402.1.3; or the component performance alternative of Section C402.1.4. Where the total area of the through-wall penetrations of mechanical equipment is greater than 1 percent of the opaque above-grade wall area, the building thermal envelope shall comply with Section C402.1.2.4.
2. Wall solar reflectance and thermal emittance shall comply with Section C402.3.
3. Roof solar reflectance and thermal emittance shall comply with Section C402.4.
4. Fenestration in *building thermal envelope*~~building envelope~~ assemblies shall comply with Section C402.5.
5. Air leakage of the building thermal envelope shall comply with Section C402.6.
6. Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with Section C403.12.
7. *Thermal bridges* in *above-grade walls* shall comply with Section C402.7.

Alternatively, where buildings have a vertical fenestration area or skylight area exceeding that allowed in Section C402.5, the building and *building thermal envelope* shall comply with Item 2 of Section C401.2.1 or Section C401.2.2.

C402.1.1.2 Greenhouses. Greenhouse structures or areas that are mechanically heated or cooled and that comply with all of the following shall be exempt from the *building thermal envelope*~~building envelope~~ requirements of this code:

1. Exterior opaque envelope assemblies comply with Sections C402.2 and C402.5.5.

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

2. Interior partition *building thermal envelope* assemblies that separate the greenhouse from *conditioned space* comply with Sections C402.2, C402.5.3 and C402.5.5.

3. Fenestration assemblies that comply with the *building thermal envelope*~~thermal envelope~~ requirements in Table C402.1.1.2. The *U*-factor for a roof shall be for the roof assembly or a roof that includes the assembly and an *internal curtain system*.

   Exception: Unconditioned greenhouses.

TABLE C402.1.1.2 FENESTRATION <u>BUILDING</u> THERMAL ENVELOPE MAXIMUM REQUIREMENTS

TABLE C402.1.2 OPAQUE BUILDING THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR METHOD[a, b]

CLIMATE ZONE	0 AND 1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above roof deck	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.031	U-0.029	U-0.029	U-0.029	U-0.026	U-0.026
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.017	U-0.017	U-0.017	U-0.017
Walls, above grade																
Mass[f]	U-0.151	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	U-0.037	U-0.037
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-0.050	U-0.050	U-0.050	U-0.050	U-0.050	U-0.044	U-0.039	U-0.039	U-0.039
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.055	U-0.055	U-0.049	U-0.049	U-0.049	U-0.042	U-0.037	U-0.037
Wood framed and other[c]	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.032	U-0.032
Walls, below grade																
Below-grade wall[c]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-0.119	C-0.092	C-0.119	C-0.092	C-0.092	C-0.063	C-0.063	C-0.063	C-0.063	C-0.063
Floors																
Mass[d]	U-0.322[e]	U-0.322[e]	U-0.107	U-0.087	U-0.074	U-0.074	U-0.057	U-0.051	U-0.057	U-0.051	U-0.051	U-0.051	U-0.042	U-0.042	U-0.038	U-0.038
Joist/framing	U-0.066[e]	U-0.066[e]	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027
Slab-on-grade floors																
Unheated slabs	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.54	F-0.52	F-0.52	F-0.52	F-0.51	F-0.51	F-0.434	F-0.51	F-0.434	F-0.434	F-0.424
Heated slabs	F-0.69	F-0.69	F-0.69	F-0.69	F-0.66	F-0.66	F-0.62	F-0.62	F-0.62	F-0.62	F-0.62	F-0.602	F-0.602	F-0.602	F-0.602	F-0.602
Opaque doors																
Nonswinging door	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31
Swinging door[g]	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Garage door < 14% glazing[h]	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31

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

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

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

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

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

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

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

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

g. Swinging door *U*-factors shall be determined in accordance with NFRC-100.

h. Garage doors having a single row of fenestration shall have an assembly *U*-factor less than or equal to 0.44 in Climate Zones 0 through 6 and less than or equal to 0.36 in Climate Zones 7 and 8, provided that the fenestration area is not less than 14 percent and not more than 25 percent of the total door area.

C402.1.2.2 U-factor thermal resistance of cold-formed steel assemblies. *U*-factors for *building thermal envelopes* ~~building envelopes~~ containing cold-formed steel framed ceilings and walls shall be permitted to be determined in accordance with~~with~~ AISI S250 as modified herein.

1. Where the steel-framed wall contains no cavity insulation, and uses continuous insulation to satisfy the U-factor maximum, the steel-framed wall member spacing is permitted to be installed at any on-center spacing.
2. Where the steel-framed wall contains framing at 24 inches (610 mm) on center with a 23 percent framing factor or framing at 16 inches (400 mm) on-center with a 25 percent framing factor, the next lower framing member spacing input values shall be used when calculating using AISI S250.
3. Where the steel-framed wall contains less than 23 percent framing factors the AISI S250 shall be used without any modifications.
4. Where the steel-framed wall contains other than standard C-shape framing members the AISI S250 calculation option for other than standard C-shape framing is permitted to be used.

TABLE C402.1.3 OPAQUE BUILDING THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE ALTERNATIVES [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/IESNA 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 or less 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 with Section C402.2.3.
f. "Mass walls" shall be in accordance with Section C402.2.2.
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 C402.2.4.1 .
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.

C402.1.4 Component performance alternative. *Building thermal envelope*~~Building envelope~~ values and fenestration areas determined in accordance with Equation 4-1 shall be an alternative to compliance with the *U*-, *F*-, psi-, chi-, and *C*-factors in Tables C402.1.2, C402.1.5, and C402.5 and the maximum allowable fenestration areas in Section C402.5.1. *Fenestration* shall meet the applicable SHGC requirements of Section C402.5.3.

$$A_P + B_P + C_P + T_P \leq A_T + B_T + C_T + T_T - V_F - V_S \quad \textbf{(Equation 4-1)}$$

A_P = Sum of the (area x U-factor) for each proposed building thermal envelope assembly, other than slab-on-grade or below-grade wall assemblies
B_P = Sum of the (length x F-factor) for each proposed slab-on-grade edge condition
C_P = Sum of the (area x C-factor) for each proposed below-grade wall assembly
T_P = Sum of the (ψL_P) and (χN_p) values for each type of thermal bridge condition of the building thermal envelope as identified in Section C402.6 in the proposed building. For the purposes of this section, the (ψL_P) and (χN_P) values for thermal bridges caused by materials with a thermal conductivity less than or equal to 3.0 Btu-in/h-ft^2-F shall be assigned as zero. For buildings or structures located in Climate Zones 0 through 3, the value of T_P shall be assigned as zero.
ψL_P= psi-factor × length of the thermal bridge elements in the proposed building thermal envelope.
χN_P = chi-factor x number of the thermal bridge point elements other than fasteners, ties, or brackets in the proposed building thermal envelope.
A_T = Sum of the (area x U-factor permitted by Tables C402.1.2 and C402.5) for each proposed building thermal envelope assembly, other than slab-on-grade or below-grade wall assemblies
B_T = Sum of the (length x F-factor permitted by Table C402.1.2 for each proposed slab-on-grade edge condition
C_T = Sum of the (area x C-factor permitted by Table C402.1.2) for each proposed below-grade wall assembly
T_T = Sum of the (ψL_T) and (χN_T) values for each type of thermal bridge condition in the proposed building thermal envelope as identified in Section C402.6 with values specified as "compliant" in Table C402.1.4. For the purposes of this section, the (ψL_T) and (χNT) values for thermal bridges caused by materials with a thermal conductivity less than or equal to 3.0 Btu-in/h-ft^2-F shall be assigned as zero. For buildings or structures located in Climate Zones 0 through 3, the value of T_T shall be assigned as zero.
ψL_T= (psi-factor specified as "compliant" in Table C402.1.5) × length of the thermal bridge elements in the proposed building thermal envelope.
χN_T = (chi-factor specified as "compliant" in Table C402.1.5) x number of the thermal bridge point elements other than fasteners, ties, or brackets in the proposed building thermal envelope.
P_F = Maximum vertical fenestration area allowable by Section C402.5.1, C402.5.1.1, or C402.5.1.2
Q_F = Proposed vertical fenestration area
R_F = Q_F – P_F, but not less than zero (excess vertical fenestration area)
S_F = Area-weighted average U-factor permitted by Table C402.5 of all vertical fenestration assemblies
T_F = Area-weighted average U-factor permitted by Table C402.1.2 of all exterior opaque wall assemblies
U_F = S_F – T_F (excess U-factor for excess vertical fenestration area)
V_F = R_F x U_F (excess UxA due to excess vertical fenestration area)
P_S = Maximum skylight area allowable by Section C402.1.2
Q_S = Actual skylight area

$R_S = Q_S – P_S$, but not less than zero (excess skylight area)
S_S = Area-weighted average U-factor permitted by Table C402.5 of all skylights
T_S = Area-weighted average U-factor permitted by Table C402.1.2 of all opaque roof assemblies
$U_S = S_S – T_S$ (excess U-factor for excess skylight area)
$V_S = R_S \times U_S$ (excess UxA due to excess skylight area)
A proposed psi- or chi-factor for each thermal bridge shall comply with one of the following as applicable:

1. Where the proposed mitigation of a thermal bridge is compliant with the requirements of Section C402.6, the “compliant” values in Table C402.1.4 shall be used for the proposed psi- or chi-factors.
2. Where a thermal bridge is not mitigated in a manner at least equivalent to Section C402.6, the “non-compliant” values in Table C402.1.4 shall be used for the proposed psi- or chi-factors.
3. Where the proposed mitigation of a thermal bridge provides a psi- or chi-factor less than the “compliant” values in Table C402.1.4, the proposed psi- or chi-factor shall be determined by thermal analysis, testing, or other approved sources.

Staff note existing items removed

TABLE C402.5 BUILDING THERMAL ENVELOPE FENESTRATION MAXIMUM U-FACTOR AND SHGC REQUIREMENTS

NR = No Requirement, PF = Projection Factor.

C402.6 Air leakage~~—~~building thermal envelope. The *building thermal envelope* shall comply with Sections C402.6.1 through C402.6.8.1.

C402.6.1.1 Air barrier design and documentation requirements . Design of the continuous air barrier shall be documented in the following manner:

1. Components comprising the continuous air barrier and their position within each *building thermal envelope* ~~building thermal envelope~~ assembly shall be identified.
2. Joints, interconnections, and penetrations of the continuous air barrier components shall be detailed.
3. The continuity of the air barrier building element assemblies that enclose conditioned space or provide a boundary between conditioned space and unconditioned space shall be identified.
4. Documentation of the continuous air barrier shall detail methods of sealing the air barrier such as wrapping, caulking, gasketing, taping or other approved methods at the following locations:

   4.1 Joints around fenestration and door frames.

   4.2 Joints between walls and floors, between walls at building corners, between walls and roofs including parapets and copings, where above-grade walls meet foundations, and similar intersections.

   4.3 Penetrations or attachments through the continuous air barrier in *building thermal envelope*~~building envelope~~ roofs, walls, and floors.

   4.4 Building assemblies used as ducts or plenums.

   4.5 Changes in continuous air barrier materials and assemblies.

5. Identify where testing will or will not be performed in accordance with Section C402.5.2 Where testing will not be performed, a plan for field inspections required by C402.5.2.3 shall be provided that includes the following:

   5.1 Schedule for periodic inspection,

   5.2 Continuous air barrier scope of work,

   5.3 List of critical inspection items,

   5.4 Inspection documentation requirements, and

   5.5 Provisions for corrective actions where needed.

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 appliable 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 ofC402.6.2.3.1 or C502.6.2.3.2. The air barrier shall remain accessible 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.

C402.6.5 Air intakes, exhaust openings, stairways and shafts. Stairway enclosures, elevator shaft vents and other outdoor air intakes and exhaust openings integral to the *building thermal envelope*~~building envelope~~ shall be provided with dampers in accordance with Section C403.7.7.

C403.4.1 Thermostatic controls. The supply of heating and cooling energy to each *zone* shall be controlled by individual thermostatic controls capable of responding to temperature within the *zone*. Where humidification or dehumidification or both is provided, not fewer than one humidity control device shall be provided for each humidity control system.

> **Exception:** Independent perimeter systems that are designed to offset only *building thermal envelope*~~building envelope~~ heat losses, gains or both serving one or more perimeter *zones* also served by an interior system provided that both of the following conditions are met:
>
> 1. The perimeter system includes not fewer than one thermostatic control *zone* for each building exposure having exterior walls facing only one orientation (within ±45 degrees) (0.8 rad) for more than 50 contiguous feet (15 240 mm).
> 2. The perimeter system heating and cooling supply is controlled by thermostats located within the *zones* served by the system.

C403.13.1 Duct and plenum insulation and sealing. Supply and return air ducts and plenums shall be insulated with not less than R-6 insulation where located in unconditioned spaces and where located outside the building with not less than R-8 insulation in *Climate Zones* 0 through 4 and not less than R-12 insulation in *Climate Zones* 5 through 8. Ducts located underground beneath buildings shall be insulated as required in this section or have an equivalent thermal distribution efficiency. Underground ducts utilizing the thermal distribution efficiency method shall be *listed* and *labeled* to indicate the *R*-value equivalency. Where located within a *building thermal envelope*~~building envelope~~ assembly, the duct or plenum shall be separated from the building exterior or unconditioned or exempt spaces by not less than R-8 insulation in *Climate Zones* 0 through 4 and not less than R-12 insulation in *Climate Zones* 5 through 8.

Exceptions:

1. Where located within equipment.
2. Where the design temperature difference between the interior and exterior of the duct or plenum is not greater than 15°F (8°C).

Ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with Section 603.9 of the International Mechanical Code.

C403.14 Mechanical systems located outside of the building thermal envelope. Mechanical systems providing heat outside of the *building thermal envelope*~~thermal envelope of a building~~ shall comply with Sections C403.14.1 through C403.14.4.

C406.1.3 Substantial Alterations to Existing Buildings. The *building* thermal *envelope*, *equipment*, and *systems* in *alterations* to *buildings* exceeding 5000 square feet (46.5 m^2) of *gross conditioned floor area* shall comply with the requirements of Section C406.1.1 and C406.1.2 where the alteration includes replacementof two or more of the following:

1. HVAC unitary systems or HVAC central heating or cooling equipment serving the alteration area, not including ductwork or *piping*.
2. 80% or more of the lighting fixtures in the *alteration* area.
3. *Building thermal envelope*~~Building envelope~~ components in the *alteration* area including new exterior cladding, fenestration, or insulation.

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*~~envelope~~ measures shall be installed to improve the energy performance ofthe project. The achieved energy credits shall be determined using Equation 4-15.

(Equation 4-15)

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

EC_{ENV}= E01 measure energy credits
EPFB= base envelope performance factor calculated in accordance with ASHRAE 90.1-2019-Appendix C.
EPF_P= proposed envelope performance factor calculated in accordance with ASHRAE 90.1-2019-Appendix C.

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 through 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.

TABLE C407.2(1) REQUIREMENTS FOR TOTAL SIMULATED BUILDING PERFORMANCE

SECTION [a]	TITLE
Envelope	
C401.3	*Building thermal envelope* Thermal envelope certificate
C402.2.1.1	Joints staggered
C402.2.1.2	Skylight curbs
C402.2.6	Insulation of radiant heating system
C402.6	Air leakage—*building thermal envelope* ~~thermal envelope~~
Mechanical	
C403.1.1	Calculation of heating and cooling loads
C403.1.2	Data centers
C403.2	System design
C403.3	Heating and cooling equipment efficiencies
C403.4	Thermostatic controls
C403.4.2	Off-hour controls
C403.4.7	HVAC system controls for operable openings to the outdoors
C403.5.5	Economizer fault detection and diagnostics
C403.7, except C403.7.4.1	Ventilation and exhaust systems
C403.8, except C403.8.6	Fan and fan controls
C403.9	Large-diameter ceiling fans
C403.12, except C403.12.3	Refrigeration equipment performance
C403.13	Construction of HVAC system elements
C403.14	Mechanical systems located outside of the building thermal envelope
C404	Service water heating
C405, except C405.3	Electrical power and lighting systems
C406.1.2	Additional renewable and load management credit requirements
C408	Maintenance information and system commisioning

a. Reference to a code section includes all the relative subsections except as indicated in the table.

C409.6.1.4 Building Thermal Envelope Components. *Building thermal envelope*~~Building envelope~~ components modeled in the standard reference design and the proposed design shall comply with the requirements of this Section.

C503.1 General. *Alterations* to any *building* or structure shall comply with the requirements of Section C503. *Alterations* shall be such that the existing *building* or structure is not less conforming to the provisions of this code than the existing *building* or structure was prior to the *alteration*. *Alterations* to an existing *building*, *building* system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portions of the existing *building* or *building* system to comply with this code. *Alterations* shall not create an unsafe or hazardous condition or overload existing *building* systems.

Exception: The following *alterations* need not comply with the requirements for new construction, provided that the energy use of the building is not increased:

1. Storm windows installed over existing *fenestration*.
2. Surface-applied window film installed on existing single-pane *fenestration* assemblies reducing solar heat gain, provided that the code does not require the glazing or *fenestration* to be replaced.
3. *Roof recover*.
4. Roof replacement where roof assembly insulation is integral to or located below the structural roof deck.
5. *Air barriers* shall not be required for *roof recover* and roof replacement where the *alterations* or renovations to the building do not include *alterations*, renovations or *repairs* to the remainder of the *building thermal envelope*~~building envelope~~.
6. An existing building undergoing alterations that complies with Section C407.

C503.2 Building thermal envelope. Alterations of existing *building thermal envelope* assemblies shall comply with this section. New *building thermal envelope*~~building envelope~~ assemblies that are part of the *alteration* shall comply with Section C402 . An area-weighted average *U*-factor for new and altered portions of the *building thermal envelope* shall be permitted to satisfy the *U*-factor requirements in Table C402.1.4. The existing *R*-value of insulation shall not be reduced or the *U*-factor of a *building thermal envelope* assembly be increased as part of a *building thermal envelope* alteration except where complying with Section C407.

Exception: Where the existing building exceeds the fenestration area limitations of Section C402.5.1 prior to alteration, the building is exempt from Section C402.5.1 provided that there is no increase in fenestration area.

C503.6 Additional energy efficiency credits. *Alterations* shall comply with measures from Sections C406.2 and C406.3 to achieve not less than 10 percent 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 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.

Exceptions:

1. *Alterations* that include replacement of no more than one of the following:

   1.1 HVAC unitary systems or HVAC central heating or cooling equipment serving the *work area* of the *alteration*.

   1.2 Water heating equipment serving the *work area* of the alteration.

   1.3 50 percent or more of the lighting fixtures in the *work area* of the alteration.

   1.4 50 percent or more of the area of interior surfaces of the *building thermal envelope*~~thermal envelope~~ in the *work area* of the alteration.

   1.5 50 percent or more of the building's *exterior wall envelope*, including fenestration.

2. *Alterations* to *buildings* in Utility and Miscellaneous Group U, Storage Group S, Factory Group F, High-Hazard Group H.
3. *Alterations* that do not contain conditioned space.
4. Portions of *buildings* devoted to manufacturing or industrial use.
5. *Buildings* in Climate Zone 0A.
6. *Alterations* that are permitted with an *addition* complying with Section C502.3.7.
7. *Alterations* that comply with Section C407.

C504.2 Application. For the purposes of this code, the following shall be considered to be repairs:

1. Glass-only replacements in an existing sash and frame.
2. *Roof repairs*.
3. Air barriers shall not be required for *roof repair* where the repairs to the building do not include *alterations*, renovations or *repairs* to the remainder of the *building thermal envelope*~~building envelope~~.
4. Replacement of existing doors that separate conditioned space from the exterior shall not require the installation of a vestibule or revolving door, provided that an existing vestibule that separates a conditioned space from the exterior shall not be removed.
5. *Repairs* where only the bulb, the ballast or both within the existing luminaires in a space are replaced, provided that the replacement does not increase the installed interior lighting power.

C505.2 Energy use intensities. *Building thermal envelope*~~Building envelope~~, space heating, cooling, ventilation, lighting and service water heating shall comply with Sec-tions C505.2.1 through C505.2.4.

Exceptions:

1. Where it is demonstrated by analysis approved by the *code official* that the change will not increase energy use intensity.
2. Where the occupancy or use change is less than 5,000 square feet (464 m^2) in area.

C505.2.1 Building thermal envelope. Where a *change of occupancy* or use is made to a whole building that the results in fenestration area greater than the maximum fenestration area allowed by Section C402.4.1, the *building* shall comply with Section C402.1.5, with a proposed UA that shall not be greater than 110 percent of the target UA.

Exception: Where the *change of occupancy* or use is made to a portion of the *building*, the new occupancy is exempt from Section C402.4.1 provided that there is not an increase in fenestration area.

Reason: "Building thermal envelope" is a defined term in the IECC, but "building envelope" and "thermal envelope" are not defined. This proposal attempts to standardize terminology throughout the commercial provisions by replacing all instances of "building envelope" and "thermal envelope" with the defined term "building thermal envelope." Within the commercial provisions of the First Public Comment Draft there are twenty-five uses of "building envelope" and twelve uses of "thermal envelope" that have been changed. If there are technically valid reasons to retain existing terminology in specific situations, please consider amending this proposal for those sections, as necessary.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal modifies terminology without intending to make technical changes. Therefore, there will be no impact on cost of construction.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: Consistent use of “building thermal envelope” terminology.

Proposal # 653

CED1-94-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C402.1 General. *Building thermal envelope* assemblies for buildings that are intended to comply with the code on a prescriptive basis in accordance with the compliance path described in Item 1 of Section C401.2.1 shall comply with the following:

1. The opaque portions of the *building thermal envelope* shall comply with the specific insulation requirements of Section C402.2 and the thermal requirements of either ~~the U-, C- and F-factor based method of~~ Section C402.1.2; ~~the R-value based method of~~ Section C402.1.3; or ~~the component performance method alternative of~~ Section C402.1.4. Where the total area of the through-wall penetrations of mechanical equipment is greater than 1 percent of the opaque above-grade wall area, the building thermal envelope shall comply with Section C402.1.2.4.
2. Wall solar reflectance and thermal emittance shall comply with Section C402.3.
3. Roof solar reflectance and thermal emittance shall comply with Section C402.4.
4. Fenestration in building envelope assemblies shall comply with Section C402.5.
5. Air leakage of the building thermal envelope shall comply with C402.6.

~~6.~~ 7. Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with Section C403.12.

~~7.~~ 6. *Thermal bridges* in *above-grade walls* shall comply with Section C402.7.

Alternatively, where buildings have a vertical fenestration area or skylight area exceeding that allowed in Section C402.5, the building and *building thermal envelope* shall comply with Item 2 of Section C401.2.1 or Section C401.2.2.

C402.1.2 Assembly U-factor, C-factor or F-factor~~-based~~ method. *Building thermal envelope* opaque assemblies shall have a *U*-, *C*- or *F*-factor not greater than that specified in Table C402.1.2. Commercial buildings or portions of commercial buildings enclosing *Group R* occupancies shall use the *U*-, *C*- or *F*-factor from the "*Group R*" column of Table C402.1.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than *Group R* shall use the *U*-, *C*- or *F*-factor from the "All other" column of Table C402.1.2

C402.1.3 Insulation component R-value method ~~alternatives~~. For opaque portions of the *building thermal envelope* using this section as an alternative to Section C402.1.2, the *R*-values for cavity insulation and continuous insulation shall be not less than that specified in Table C402.1.3. Commercial buildings or portions of commercial buildings enclosing *Group R* occupancies shall use the *R*-values from the "*Group R*" column of Table C402.1.3. Commercial buildings or portions of commercial buildings enclosing occupancies other than *Group R* shall use the *R*-values from the "All other" column of Table C402.1.3.

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

Portions of table not shown remain unchanged.

C402.1.4 Component performance method ~~alternative~~. Building envelope values and fenestration areas determined in accordance with Equation 4-1 shall be an alternative to compliance with the *U*-, *F*-, psi-, chi-, and *C*-factors in Tables C402.1.2, C402.1.5, and C402.5 and the maximum allowable fenestration areas in Section C402.5.1. *Fenestration* shall meet the applicable SHGC requirements of Section C402.5.3.
(remainder of section unchanged)

Reason: This proposal is a clean-up so that the U-factor, R-value, and component performance methods are all titled the same and referenced the same in Section C402.1. These editorial changes also make the section titles consistent with the titles of Tables C402.1.2 and C402.1.3. Also, two items listed in Section C402.1 are re-ordered to align with the sequence of requirements and sections in C402.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal is editorial in making section and table titles consistent. There are no changes in requirements.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: Editorial clean-up of section references and titles for prescriptive U-factor, R-value, and component performance methods.

Proposal # 720

CED1-95-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C402.1 General. *Building thermal envelope* assemblies for buildings that are intended to comply with the code on a prescriptive basis in accordance with the compliance path described in Item 1 of Section C401.2.1 shall comply with the following:

1. The opaque portions of the *building thermal envelope* shall comply with the specific insulation requirements of Section C402.2 and the thermal requirements of either the U-, C- and F-factor based method of Section C402.1.2; the R-value based method of C402.1.3; or the component performance alternative of Section C402.1.4. Where the total area of the through-wall penetrations of mechanical equipment is greater than 1 percent of the opaque above-grade wall area, the building thermal envelope shall comply with Section C402.1.2.4.
2. Wall solar reflectance and thermal emittance shall comply with Section C402.3.
3. Roof solar reflectance and thermal emittance shall comply with Section C402.4.
4. Fenestration in building envelope assemblies shall comply with Section C402.5. Where buildings have a vertical fenestration area or skylight area greater than allowed in Section C402.5, the building and *building thermal envelope* shall comply with Item 2 of Section C401.2.1, Section C401.2.2, or Section C402.1.4.
5. Air leakage of the building thermal envelope shall comply with C402.6.
6. Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with Section C403.12.
7. *Thermal bridges* in *above-grade walls* shall comply with Section C402.7.

~~Alternatively, where buildings have a vertical fenestration area or skylight area exceeding that allowed in Section C402.5, the building and *building thermal envelope* shall comply with Item 2 of Section C401.2.1 or Section C401.2.2.~~

Reason: This proposal is editorial clean-up and merely moves a "dangling" allowance for fenestration into item 5 of the list where fenestration is specifically addressed.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal makes no technical change and moves existing text to a more appropriate location.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: Clean-up and move requirements related to fenestration into one place (Item 4 of list) and add one missing section reference.

Proposal # 721

CED1-99-22

Proponents: Sumit Sunthankar, representing Custom Instrumentation Services Corporation (ssunthankar@ciscocems.com)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C402.1.1.3 Equipment Building. Buildings that comply with the following shall be exempt from the *building thermal envelope* provisions of this code:

1. Are separate buildings with floor area not more than 1,200 square feet (110 m^2).
2. Are intended to house electric equipment with installed equipment power totaling not less than 7 watts per square foot (75 W/m^2) and not intended for human occupancy.
3. Have a heating system capacity not greater than ~~(17,000 Btu/hr) (5 kW)~~ (20,000 Btu/hr) (6kW) and a heating thermostat setpoint that is restricted to not more than 50°F (10°C).
4. Have an average wall and roof *U*-factor less than 0.200 in *Climate Zones* 1 through 5 and less than 0.120 in *Climate Zones* 6 through 8.
5. Comply with the roof solar reflectance and thermal emittance provisions for *Climate Zone* 1.

Reason: Our company, Custom Instrumentation Services Corporation which is located in Denver, Colorado, manufactures small, steel commercial equipment shelters for shipment all around the country. These shelters, generally anywhere from an 8'x8' size to a 12'x20' size, house sensitive analyzer equipment that monitors the chemical emissions of power plants and other sources for environmental purposes, as well as other electronic components. The analyzer equipment, which monitor these emissions, are working continuously and they generate a lot of heat when monitoring therefore, because our shelters are small, the shelters are naturally heated by this equipment. We install an HVAC unit on the shelter keep the shelter cool to the appropriate set temperature and occasionally, due to customer requests, we install 2 HVAC units on the shelter where one is a redundant or backup unit in case of failure. These HVAC units are rarely used to heat the shelters, perhaps only in extreme cold conditions outside or when the analyzers are down due to failure or maintenance. Also, our shelters are unmanned/unoccupied so they generally fall under a U occupancy code. With the current IECC code standards for thermal envelope, if the criteria under section C402.1.2 for equipment buildings are not met, we are required to install anywhere from 3-6 inches of insulation inside and around our shelters between the interior and exterior panels. Because the shelter is already generating heat from the analyzers, this extra insulation requires us to install larger HVAC units than needed on the shelter in order to keep them cool which is counter-intuitive and an inefficient use of energy. During the winter months when the temperature is colder, if additional insulation is added, the HVAC will be producing more cooling energy which is counterintuitive to what we need since the shelters should be cooling naturally from the outside air. The attached HVAC calculation files provides the details on this. From our calculations and based on a temperature at 0 degrees Fahrenheit and 75 degree shelter temperature, if more insulation is added on our calculations for the HVAC unit, then the cooling BTU energy increases. Generally, another 1000 Btu/hr or so of cooling is generated by the HVAC for every inch of insulation that is added to the shelter walls, floor, and ceiling. The proposed revision to add exception item #6 under the C402.1.1.3 code is an exemption for small equipment buildings that house electronic components generating heat. Back in 2018, the State of Colorado voted to add the same statement in their Administrative Rules for Building Codes and Standards. If the exemption above cannot be received, then we have another proposal in regard to section C402.1.2 item 3 for the heating system capacity criteria of 17,000 Btu/hr (5kW). This capacity is insufficient and low for our shelters so we would like to propose increasing the heating system capacity to 20,000 Btu/hr (6kW). We cannot purchase an HVAC unit from our vendors that are lower than this capacity to meet the cooling requirements for the analyzer equipment in our shelters. Since our shelters require a 480V 3-phase electrical system and an HVAC unit with a large cooling capacity, generally between 20-30 kBTU/hr, the minimum that we can purchase is a unit with a 6 kW heating capacity.

Cost Impact: The code change proposal will decrease the cost of construction.
This change should decrease the cost of construction since less insulation material will be needed if the exemption is provided. This also means that there will be less HVAC energy usage since the equipment will provide the heating in the shelter. We may be able to save on HVAC unit costs if the full exemption is provided for equipment buildings.

Attached Files

- **HVAC Calc Data for Code Change Proposal-6 Inch Insulation.pdf**
  https://energy.cdpaccess.com/proposal/793/2972/files/download/355/
- **HVAC Calc Data for Code Change Proposal-3 Inch Insulation.pdf**
  https://energy.cdpaccess.com/proposal/793/2972/files/download/354/

- **2024 IECC Amendment Proposal updated 10-19-22.docx**
  https://energy.cdpaccess.com/proposal/793/2972/files/download/353/

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: This proposal as modified addresses the types of heating systems available for these types of buildings.

CED1-100-22

Proponents: Martha VanGeem, representing Masonry Alliance for Codes and Standards; Emily Lorenz, representing self (emilyblorenz@gmail.com)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

TABLE C402.1.2 OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR METHOD[a, b]

CLIMATE ZONE	0 AND 1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above roof deck	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.031	U-0.029	U-0.029	U-0.029	U-0.026	U-0.026
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.017	U-0.017	U-0.017	U-0.017
Walls, above grade																
Mass[f]	U-0.151	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	U-0.037	U-0.037
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-0.050	U-0.050	U-0.050	U-0.050	U-0.050	U-0.044	U-0.039	U-0.039	U-0.039
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.055	U-0.055	U-0.049	U-0.049	U-0.049	U-0.042	U-0.037	U-0.037
Wood framed and other[c]	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.032	U-0.032
Walls, below grade																
Below-grade wall[c]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-0.119	C-0.092	C-0.119	C-0.092	C-0.092	C-0.063	C-0.063	C-0.063	C-0.063	C-0.063
Floors																
Mass[d]	U-0.322[e]	U-0.322[e]	U-0.107	U-0.087	U-0.074	U-0.074	U-0.057	U-0.051	U-0.057	U-0.051	U-0.051	U-0.051	U-0.042	U-0.042	U-0.038	U-0.038
Joist/framing	U-0.066[e]	U-0.066[e]	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027
Slab-on-grade floors																
Unheated slabs	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.54	F-0.52	F-0.52	F-0.52	F-0.51	F-0.51	F-0.434	F-0.51	F-0.434	F-0.434	F-0.424
Heated slabs	F-0.69	F-0.69	F-0.69	F-0.69	F-0.66	F-0.66	F-0.62	F-0.62	F-0.62	F-0.62	F-0.62	F-0.602	F-0.602	F-0.602	F-0.602	F-0.602
Opaque doors																
Nonswinging door	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31
Swinging door[g]	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Garage door < 14% glazing[h]	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31

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

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

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

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

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

d. “Mass floors” shall be in accordance with Section C402.1.3.6~~C402.2.3~~.

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

f. “Mass walls” shall be in accordance with Section C402.1.3.6~~C402.2.2~~.

g. Swinging door *U*-factors shall be determined in accordance with NFRC-100.

h. Garage doors having a single row of fenestration shall have an assembly *U*-factor less than or equal to 0.44 in Climate Zones 0 through 6 and less than or equal to 0.36 in Climate Zones 7 and 8, provided that the fenestration area is not less than 14 percent and not more than 25 percent of the total door area.

C402.1.2.1.4 Mass walls and floors. Compliance with required maximum U-factors for mass walls and mass floors in accordance with Table C402.1.2 shall be permitted for assemblies complying with Section C402.1.3.~~3~~ 6.

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

Portions of table not shown remain unchanged.

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

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

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA 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 or less 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 with Section C402.1.3.6~~2.3~~.
f. “Mass walls” shall be in accordance with Section C402.1.3.6~~2.2~~.
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 C402.2.4.1 .
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.

C402.1.3.6 Mass walls and mass floors. Compliance with required maximum U-factors for mass walls and mass floors in accordance with Table C402.1.2 and minimum R-values for insulation components applied to mass walls and mass floors in accordance with Table C402.1.3 shall be permitted for assemblies complying with the following:

1. Where used as a component of the building thermal envelope, mass walls shall comply with one of the following:

   1.1 Weigh not less that 35 pounds per square foot (171 kg/m^2) of wall surface area.

   1.2 Weigh not less than 25 pounds per square foot (122 kg/m^2) of wall surface area where the material weight is not more than 120 pcf (1900 kg/m^3).

   1.3 Have a heat capacity exceeding 7 Btu/ft^2 × ºF (144 kJ/m^2 × K).

   1.4 Have a heat capacity exceeding 5 Btu/ft^2 × ºF (103 kJ/m^2 × K) where the material weight is not more than 120 pcf (1900 kg/m^3).

2. Where used as a component of the building thermal envelope of a building, the minimum weight of mass floors shall comply with provide one of the following:

   2.1 35 pounds per square foot (171 kg/m^2)of floor surface area.

   2.2 25 pounds per square foot (122 kg/m^2) of floor surface area where the material weight is not more than 120 pcf (1900 kg/m^3).

Reason: This proposal fixes Section C402.1.3.6, on mass walls and mass floors, to clarify the definition of mass walls and mass floors for U-factor compliance. It also fixes several errata of several section numbers.
First, although the pointers from the U-factor table, footnotes d and f, when corrected for errata, point to Section C402.1.3.6., this section says that mass walls and mass floors are used for the R-value table, Table C402.1.3. This new text clarifies that these definitions for mass walls and mass floors in Section C402.1.3.6 also apply to the U-factor table, C402.1.2.

The word "mass" has been added before "floors" in the section header of C402.1.3.6 so that users searching for "mass floors" clearly land in this section.

Errata:

C402.1.2.1.4 should point to Section C402.1.3.6.

Footnotes e and f in Table C402.1.3 should point to C402.1.3.6.

Footnotes d and f in Table C402.1.2 should point to C402.1.3.6.

Corrected superscripts and various degree and multiplication symbols in C402.1.3.6

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal clarifies text and fixes errata, so it does not affect the cost of construction.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: This clarifies the text and section numbers for mass walls and floors systems available for these types of buildings.

Proposal # 856

CED1-103-22

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

2024 International Energy Conservation Code [CE Project]

Add new text as follows:

C402.1.2.1.2 Suspended ceilings. Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the assembly *U*-factor of the roof-ceiling construction.

C402.1.3.3 Suspended ceilings. Insulation installed on suspended ceilings having removable ceiling tiles shall not be considered part of the thermal resistance (R-value) of roof insulation in roof-ceiling construction.

Reason: This proposal restores the suspended ceiling provision that was inadvertently deleted entirely from the code by conflicted actions on CEPI-27 (as modified/replaced) and CEPI-41, both of which did not intend to entirely delete this provision. This proposal adds the suspended ceiling under the U-factor determination requirements and also the R-value compliance provisions since it applies to both.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal does not impact cost because it is restoring a provision that was not intended to be deleted during the public input phase of developing the draft IECC standard.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: Proposal corrects omission of provisions for addressing U-factor and R-value limits for suspended ceilings.

Proposal # 757

CED1-106-22

Proponents: Michael Tillou, representing Pacific Northwest National Laboratory (michael.tillou@pnnl.gov); Michael Rosenberg, representing Pacific Northwest National Laboratory (michael.rosenberg@pnnl.gov)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

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

C402.1.2.4 Thermal Resistance of mechanical equipment penetrations. Where the total area of through-wall penetrations of mechanical equipment is greater than 1 percent of the opaque above grade wall area, such area shall be calculated as a separate wall assembly, in accordance with either Section C402.1.2.1.5 or Section C402.1.4, ~~with~~ using a published and approved U-factor for that equipment or a default U-factor of 0.5.

Reason: This proposal is editorial and adds language to clarify that above grade wall compliance with U-factor requirements can be based on the area weighted average of different above grade wall components having different U-factors. Without this language it is unclear whether a building meeting the threshold required to account for mechanical equipment penetrations can use the prescriptive U-factor method for demonstrating above grade wall U-factor compliance.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal is editorial and does not impact the cost effectiveness of the IECC 2024.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: This proposal is editorial. Without this language it is unclear whether a building meeting the threshold required to account for mechanical equipment penetrations can use the prescriptive U-factor method for demonstrating above grade wall U-factor compliance.

Proposal # 650

CED1-107-22

Proponents: Michael Tillou, representing Pacific Northwest National Laboratory (michael.tillou@pnnl.gov); Michael Rosenberg, representing Pacific Northwest National Laboratory (michael.rosenberg@pnnl.gov)

2024 International Energy Conservation Code [CE Project]

Add new text as follows:

C402.1.2.1.5 Area-weighted Averaging of Above-Grade Wall U-factors. For Where *above-grade walls* which include more than one assembly component type or a penetration of the opaque wall area, the area weighted U-factor of the entire *above-grade wall* may is permitted to be determined by an approved method accepted engineering practice.

Revise as follows:

C402.7.1 Balconies and floor decks. Balconies and concrete floor decks shall not penetrate the building thermal envelope. Such assemblies shall be separately sup-ported or shall be supported by structural attachments or elements that minimize thermal bridging through the building thermal envelope.
Exceptions: Balconies and concrete floor decks shall be permitted to penetrate the *building thermal envelope* where:

1. an area-weighted *U*-factor is used for *above-grade wall* compliance that ~~which~~ includes a *U*-factor of 0.8 Btu/h-°F-ft^2 for the area of the *above-grade wall* penetrated by the concrete floor deck in accordance with Section C402.1.2.1.5, or
2. an approved thermal break device of not less than R-10 is installed in accordance with the manufacturer's instructions, or ~~.~~
3. An *approved* design where the *above-grade wall U*-factor used for compliance accounts for all balcony and concrete floor deck *thermal bridges*.

Reason: This proposal is editorial and proposes language to clarify how to account for thermal bridges associated with floors that penetrate the wall plane. New language clarifying that above grade wall U-factors can be area weighted supports compliance Option 1. A new compliance requirement is proposed that aligns with language for the other thermal bridges and would allow a design to use either the Component Alternative Compliance approach or a Performance Compliance path.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal does not impact cost effectiveness.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: The proposed change clarifies the intent of Section C402.7.1 and adds new language that aligns with the requirements for other types of thermal bridges. It also corrects the units for chi factor.

Proposal # 651

CED1-108-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C402.1.2.1.4 ~~**C402.1.2.2 U-factor thermal resistance of c**~~ **Cold-formed steel assemblies.** *U*-factors for building envelopes containing cold-formed steel framed ceilings and walls shall be permitted to be determined in accordance withwith AISI S250 as modified herein.

1. Where the steel-framed wall contains no cavity insulation, and uses continuous insulation to satisfy the U-factor maximum, the steel-framed wall member spacing is permitted to be installed at any on-center spacing.
2. Where the steel-framed wall contains framing at 24 inches (610 mm) on center with a 23 percent framing factor or framing at 16 inches (400 mm) on-center with a 25 percent framing factor, the next lower framing member spacing input values shall be used when calculating using AISI S250.
3. Where the steel-framed wall contains less than 23 percent framing factors the AISI S250 shall be used without any modifications.
4. Where the steel-framed wall contains other than standard C-shape framing members the AISI S250 calculation option for other than standard C-shape framing is permitted to be used.

C402.1.2.1.5 ~~**C402.1.2.3 Thermal Resistance of**~~ **Spandrel Panels.** U-factors of opaque assemblies within fenestration framing systems shall be determined in accordance with the default values in Table C402.1.2.3, ASTM C1363, or ANSI/NFRC 100.

C402.1.2.1.6 ~~**C402.1.2.4 Thermal Resistance of m**~~ **Mechanical equipment penetrations.** Where the total area of through-wall penetrations of mechanical equipment is greater than 1 percent of the opaque above grade wall area, such area shall be calculated as a separate wall assembly with a published and approved U-factor for that equipment or a default U-factor of 0.5.

Reason: This proposal is editorial and moves sections that address how to determine U-factors and places them as subsections under Section C402.1.2.1 which is where methods and requirements for determining U-factors are located. In addition the subsection titles are revised to remove reference to "thermal resistance" since the provision is addressing U-factors, not R-values.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposal is editorial and does not change requirements. It just places them in the proper location within the intended framework of Section C402.1.2.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: move sections related to U-factor determination under section for U-factor determination and change title to remove reference to thermal resistance to be consistent focus on U-factors.

Proposal # 724

CED1-110-22

Proponents: Thomas Culp, representing Glazing Industry Code Committee and Aluminum Extruders Council (culp@birchpointconsulting.com)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

TABLE C402.1.2.3 EFFECTIVE U-FACTORS FOR SPANDREL PANELS[a]

Portions of table not shown remain unchanged.

c. This frame type chall be used for systems where a ~~urethan or~~ non-metallic element separates the metal exposed to the exterior from the metal that is exposed to the interior condition.

C402.5.5 Doors. Opaque swinging doors shall comply with Table C402.1.2. Opaque nonswinging doors shall comply with Table C402.1.2. Opaque doors shall be considered as part of the gross area of above-grade walls that are part of the *building thermal envelope*. Opaque doors shall comply with Section C402.5.5.1 or C402.5.5.2. Other doors shall comply with the provisions of Section ~~C402.4.3~~ C402.5.3 for vertical fenestration.

C402.7.4 Vertical fenestration. Vertical fenestration intersections with above grade walls shall comply with one or more of the following:

1. Where above-grade walls include continuous insulation, the plane of the exterior glazing layer or, for metal frame fenestration, a non-metal thermal break in the frame shall be positioned within 2 inches (610 mm) of the interior or exterior surface of the continuous insulation.
2. An approved design where the above-grade wall U-factor used to demonstrate compliance accounts for the beam or column thermal bridge.
3. The surface of the rough opening, not covered by the fenestration frame, shall be insulated with insulation of not less than R-3 material or covered with a wood buck that is not less than 1.5 inches (457 mm) thick.
4. For the intersection between vertical fenestration and opaque spandrel in a shared framing system, manufacturer's data for the spandrel *U*-factor shall account for *thermal bridges*.

Exceptions:

1. Where an approved design for the above-grade wall *U*-factor used for compliance accounts for *thermal bridges* at the intersection with the vertical fenestration.
2. Doors

C406.2.1.1 EO1 Improved envelope performance 901 Appendix C. *Building* envelope measures shall be installed to improve the energy performance ofthe project. The achieved energy credits shall be determined using Equation 4-15.

(Equation 4-15)

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

EC_{ENV}= E01 measure energy credits
EPFB= base envelope performance factor calculated in accordance with ASHRAE 90.1~~-2019~~ Appendix C.
EPF_P= proposed envelope performance factor calculated in accordance with ASHRAE 90.1~~-2019~~ Appendix C.

C505.2.1 Building envelope. Where a *change of occupancy* or use is made to a whole building that the results in fenestration area greater than the maximum fenestration area allowed by Section ~~C402.4.1~~ C402.5.1, the *building* shall comply with Section C402.1.5, with a proposed UA that shall not be greater than 110 percent of the target UA.

Exception: Where the *change of occupancy* or use is made to a portion of the *building*, the new occupancy is exempt from Section ~~C402.4.1~~ C402.5.1 provided that there is not an increase in fenestration area.

Reason: Various errata / corrections:

- In footnote c of Table C402.1.2.3, remove "urethan or" so it is not material specific and parallels footnote b. Or at a minimum, correct the spelling of "urethane."
- In item 3 of C402.7.4, “coved” should be “covered”
- In C402.5.5 Doors, the reference to C402.4.3 should be changed to C402.5.3 due to section renumbering.
- In C406.2.1.1, it should refer just to ASHRAE 90.1 Appendix C, not ASHRAE 90.1-2019 Appendix C. The proper year will be in Chapter 6 Reference Standards, and will be 2022, not 2019.
- In C505.2.1, the reference to sections C402.4.1 should be changed to C402.5.1 due to section renumbering in chapter 4.
- Also, in the pdf version, the titles for C402.5.1.1 and C402.5.1.2 are repeated twice. Remove first one. But this is not showing up in cdpAccess, so maybe fixed already?

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Editorial fixes. No cost impact.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: Corrects various errata per proponents reason statement.

Proposal # 866

CED1-111-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

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

Portions of table not shown remain unchanged.

Walls, above grade																
Mass[f]																
Metal building																
Metal framed [h, i]																
Wood framed and other [h, i]																

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

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

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA 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 or less 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 with Section C402.2.3.
f. “Mass walls” shall be in accordance with Section C402.2.2.
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 C402.2.4.1 .
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: Footnote 'i' was included as part of the modified CEPI-38 proposal but was inadvertently left out of the public review draft. This proposal includes footnote 'i' to address the omission. As stated in the reason for the modification to CEPI-38: "For R-value options where there is no cavity insulation and only continuous insulation providing the necessary minimum R-value for the wall assembly, the framing spacing (i.e. Framing Factor) becomes not relevant."

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
There is no cost impact as this proposal is corrective to align with the approved modification to CEPI-38 in the public input phase. The footnote does provide added flexibility and ease of compliance which may have a small indirect cost reduction.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: addresses errata of footnote omitted but previously approved as part of CEPI-38; additional revisions were made for clarity of application.

Proposal # 760

CED1-112-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C402.1.3 Insulation component R-value alternatives. For opaque portions of the *building thermal envelope* using this section as an alternative to Section C402.1.2, the *R*-values for cavity insulation and continuous insulation shall be not less than that specified in Table C402.1.3. ~~Commercial~~ *Group R* occupancy buildings or portions of commercial buildings enclosing *Group R* occupancies shall use the *R*-values from the "*Group R*" column of Table C402.1.3. Commercial buildings or portions of commercial buildings enclosing occupancies other than *Group R* shall use the *R*-values from the "All other" column of Table C402.1.3.

Reason: Conflicting language is corrected. As written the code requires all buildings to comply with Group R requirements

Cost Impact: The code change proposal will decrease the cost of construction.
Eliminating conflicting language in the code always saves $.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: Conflicting language is corrected. As written the code requires all buildings to comply with Group R requirements.

Proposal # 865

CED1-115-22

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

2024 International Energy Conservation Code [CE Project]

Delete without substitution:

~~**C402.1.3.3 Building materials and air spaces.** Building materials that are not insulation components complying with Chapter 3 shall be excluded from demonstrating compliance with the R-values of Table C402.1.3. Air spaces used to demonstrate compliance with Table C402.1.3 shall comply with Section C402.2.7.~~

~~**C402.1.3.4 Assembly construction.** Assembly constructions used for compliance with Table C402.1.3 shall be as described in ANSI/ASHRAE/IES 90.1 Appendix A.~~

~~**C402.1.3.5 Concrete masonry units, integral insulation.** The R-value of integral insulation installed in concrete masonry units shall not be used in determining compliance with Table C402.1.3 except as otherwise noted.~~

Reason: In CEPI-27 (as modified/replaced) three subsections were deleted from the original proposal. However, in the public review draft, these sections were not shown as deleted. This proposal makes those deletions as a procedural "correction" to the draft. I would prefer that these sections be retained (not deleted), but this would not be consistent with compromises made during the public input phase in gaining broad support for CEPI-27.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Deletion of these sub-sections do not change requirements that are found elsewhere in the code (e.g., table footnotes, other sections, etc.).

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: These deletions were previously agreed on. In CEPI-27 (as modified/replaced) three subsections were deleted from the original proposal. However, in the public review draft, these sections were not shown as deleted. This proposal makes those deletions as a procedural "correction" to the draft.

Proposal # 758

CED1-118-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C402.2.1 Roof-ceiling construction ~~assembly~~. ~~Roof i~~ Insulation materials in the roof-ceiling construction shall be installed between the roof or ceiling framing, continuously below ~~above~~ the ceiling framing, continuously above, below, ~~on~~ or within the roof deck ~~assembly~~ or in any approved combination thereof. Insulation installed above the roof deck shall comply with Sections C402.2.1.1 through C402.2.1.3.

Add new text 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: The proposal clarifies the title and wording of Section C402.2.1 and avoids misusing a defined term "roof assembly" in the building codes. Instead, a term roof-ceiling construction is used which more broadly encompasses the overall roof structure and components. In addition, a subsection that was inadvertently deleted from the CEPI-27 proposal approved during the public input phase is restored. This occurred because of competing proposals attempting to move this requirement into different places leaving it absent in the final correlation.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposal is a clarification and restores a section that was inadvertently omitted due to proposal correlation issues during the public input phase.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: Clarifies roof-ceiling construction insulation options and restores provision for minimum thickness of tapered insulation.

Proposal # 725

CED1-119-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C402.2.6 Insulation of radiant heating system~~s~~ panels. *Radiant heating system* panels, and their associated components that are installed in interior or exterior assemblies, shall be insulated to an *R*-value of not less than R-3.5 on all surfaces not facing the space being heated. *Radiant heating system* panels that are installed in the *building thermal envelope* shall be separated from the exterior of the building or unconditioned or exempt spaces by not less than the *R*-value of insulation installed in the opaque assembly in which they are installed or the assembly shall comply with Section C402.1.2.

~~**Exception:** Heated slabs on grade shall be insulated in accordance with Section C402.2.4 and Section C402.1.~~

Reason: This proposal clarifies that Section C402.2.6 is addressing radiant heating system panels. Also, heated slabs on grade are not an exception for heating system panels. It is an assembly that is addressed elsewhere in the code. Thus, the exception is moved to the last sentence and changed to a requirement that references appropriate sections for heated slab provisions.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposal clarifies an existing provisions without any changes in requirements.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: Clarify that the provisions are intended to apply to only to radiant heat system panels, not other type of radiant heating systems. The exception for heated slabs is deleted because they are not radiant heating system panels and the thermal requirements are addressed elsewhere.

Proposal # 727

CED1-121-22

Proponents: Emily Toto, representing ASHRAE (etoto@ashrae.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C402.3 Above-Grade Wall Solar Reflectance. For Climate Zone 0, above-grade east-oriented, south-oriented, and west-oriented walls shall comply with either of the following:

1. Not less than 75 percent of the **opaque** above-grade wall area shall have an area-weighted initial solar reflectance of not less than 0.30 where tested in accordance with ASTM C1549 with AM1.5GV, output or ASTM E903 with AM1.5GV output, or determined in accordance with an approved source. This above-grade wall area shall have an emittance or emissivity of not less than 0.75 where tested in accordance with ASTM C835, C1371, E408, or determined in accordance with an approved source. For the portion of the above-grade wall that is glass spandrel area, a solar reflectance of not less than 0.29, as determined in accordance with NFRC 300 or ISO 9050, shall be permitted. Area-weighted averaging is permitted only using ***south-, east-, and west-oriented walls*** enclosing the same occupancy classification.
2. Not less than 30 percent of the opaque above-grade wall area shall be shaded by manmade structures, existing buildings, hillsides, permanent building projections, on-site renewable energy systems, or a combination of these. Shade coverage shall be calculated by projecting the shading surface downward on the above-grade wall at an angle of 45 degrees.

Exception: Above-grade walls of low energy buildings complying with Section C402.1.1.1, greenhouses complying with Section C402.1.1.2, and equipment buildings complying with Section C402.1.1.3.

Add new definition as follows:

NORTH-ORIENTED. facing within 67.5 degrees of true north in the northern hemisphere or facing within 67.5 degrees of true south in the southern hemisphere.

SOUTH-ORIENTED. facing within 45 degrees of true south in the northern hemisphere or facing within 45 degrees of true north in the southern hemisphere.

EAST-ORIENTED. facing within 45 degrees of true east to the south and within less than 22.5 degrees of true east to the north in the northern hemisphere or facing within 45 degrees of true east to the north and within less than 22.5 degrees of true east to the south in the southern hemisphere.

WEST-ORIENTED. facing within 45 degrees of true west to the south and within less than 22.5 degrees of true west to the north in the northern hemisphere or facing within 45 degrees of true west to the north and within less than 22.5 degrees of true west to the south in the southern hemisphere.

Reason: We added the word opaque and the definitions of east-, west-, north-, and south-oriented to be consistent with ASHRAE 90.1 and the analysis performed in ASHRAE 90.1.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
An analysis was performed on the entire section that showed this proposal was cost effective in Climate zone 0. For the changes in this proposal there are no cost impacts

---

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: In addition to the original reason statement, approval as modified is editorial corrections of existing language.

Proposal # 709

CED1-126-22

Proponents: Helen Sanders, representing The Facade Tectonics Institute (helen.sanders@technoform.com)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

TABLE C402.5 BUILDING ENVELOPE FENESTRATION MAXIMUM U-FACTOR AND SHGC REQUIREMENTS

CLIMATE ZONE	0 AND 1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
Vertical fenestration																
***U*-factor**																
Fixed fenestration	0.50		0.45		~~0.42~~ 0.38		~~0.36~~ 0.34		~~0.36~~ 0.34		0.34		~~0.29~~ 0.28		~~0.26~~ 0.25	
Operable fenestration	0.62		0.60		0.54		0.45		0.45		0.42		0.36		0.32	
Entrance doors	0.83		0.77		0.68		0.63		0.63		0.63		0.63		0.63	
SHGC																
Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	
PF < 0.2	0.23	0.21	0.25	0.23	0.25	0.23	0.36	0.33	0.38	0.33	0.38	0.34	0.40	0.36	0.40	0.36
0.2 ≤ PF < 0.5	0.28	0.25	0.30	0.28	0.30	0.28	0.43	0.40	0.46	0.40	0.46	0.41	0.48	0.43	0.48	0.43
PF ≥ 0.5	0.37	0.34	0.40	0.37	0.40	0.37	0.58	0.53	0.61	0.53	0.61	0.54	0.64	0.58	0.64	0.58
Skylights																
U-factor	0.70		0.65		0.55		0.50		0.50		0.50		0.44		0.41	
SHGC	0.30		0.30		0.30		0.40		0.40		0.40		NR		NR	

NR = No Requirement, PF = Projection Factor.

Reason: The Department of Energy identified a "net zero energy" window as having a U-factor of 0.10 BTU/ºF.hr.ft^2 (Reference [1]) and they identified that fenestration with U-factors of 0.15 BTU/ºf.hr.ft^2 could save 1 Quadrillion BTUs annually over the current (2006) building stock (0.71 Quads from heating and 0.31 Quads from cooling) if implemented in all US buildings. This report also demonstrates the importance of U-factor in cooling climates based on the cooling energy reduction, as does a paper from the Façade Tectonics Institute's World Congress in 2020, which is included in the bibliography [2]. We recognize that to reach net zero goals by 2030, the IECC needs to ratchet down envelope energy efficiency quickly over the next two or three code revisions to achieve that goal. The fixed fenestration U-factors proposed here are a result of a cost-effectiveness evaluation done by the Façade Tectonics Institute (FTI), whose members include architects, engineers, consultants, general and sub-contractors, and glass, window and curtain wall suppliers.

Updated average costs have been gathered for a range of strategies that can be used to increase fenestration performance. These include, for example, adding argon gas to insulating glass, adding a warm-edge spacer, adding a fourth surface low-e, adding wider thermal barriers to the aluminum frame, move from double to triple pane etc. These updated average component costs have been used to estimate average costs to decrease U-factors in curtainwall from a baseline of 0.50 BTU/ºF.hr.ft^2 (the current climate zone 1 requirement) to achieve a range of U-factors from 0.46 to 0.24 BTU/ºf.hr.ft^2.These costs to achieve U-factors have then been used to assess cost effectiveness based on 3% and 7% discount rates, with and without including the social cost of carbon (SCC). Energy cost savings brought about by reducing U-factors from the current prescriptive value in each climate zone have been calculated using the regression models for the medium office, medium apartment, and a modified medium office (modified for fuel mix) which was used several years ago to support fenestration performance changes in the ASHRAE 90.1 2016 revision. The cost of energy (electric and gas) has not been updated for recent inflation, nor for expected future energy cost increases, from that 2016 analysis, and is likely to be higher than past historical trends. So, the energy cost savings in this analysis are likely to be underestimated and resulting U-factor change recommendations for products that will be impacting building energy use for decades into the future, will be very conservative. Resources from PNNL were not available to support completion of regression analyses of additional building types during the public comment period, which was why we used the regression equations developed for ASHRAE 90.1-2016.

We also note that the costs we have documented for thermal improvements in 2022 will also drop in the future as a specialty products transition to become standard practice, as higher demand triggers manufacturing investment in more efficient, lower cost manufacturing processes and as new R&D results in lower costs. The fenestration industry has seen these effects in the residential window market where a combination of the above code voluntary EnergyStar program and homeowner tax credits have driven above code EnergyStar windows to ~85% of all U.S. residential window sales. EPA announced this week that the new ENERGY STAR requirements, effective 10/2023, for the northern zone in the U.S. will require a U-factor of 0.22, a significant reduction from its current level of 0.27 which will provide significant market pressure to deliver even better performing products that will perform at these levels. We note that the EnergyStar requirements for residential windows are not directly translatable to commercial fenestration because of the increased structural requirements in commercial construction, but that the residential market has been pulled ahead of commercial fenestration in terms of performance because of this combination of standards and incentives. The drive to triple pane which will likely ensue in residential windows accompanying the new EnergyStar requirements may spill over into the commercial market and support reductions in costs for commercial triple pane units.

The details of the methodology, assumptions and the results of the analysis are shown in the attached documentation and are briefly reviewed by climate zone below. Values are given below in dollars per square foot of fenestration area and are the difference between the upfront cost incurred to improve the fenestration and the 40-year energy savings for the 4 measures: 3% and 7% discount rates with and without including the SCC. Negative numbers indicate the U-factor change is cost-effective based on the input assumptions (energy savings higher than upfront costs) and are highlighted in green:

Climate zone 8:

U=0.26 currently	Medium office building				Medium apartment					Adjusted medium office		
Fenestration U-factor	upfront cost above (below) breakeven @3% discount rate, $/sqft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft	upfront cost above (below) breakeven @3% discount rate, $/sq ft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft	upfront cost above (below) breakeven @3% discount rate, $/sqft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft
0.25	$ (0.53)	$ (0.34)	$ (0.80)	$ (0.56)	$ (0.04)	$ 0.08	$ (0.37)	$ (0.18)	$ (0.22)	$ (0.07)	$ (0.57)	$ (0.35)
0.24	$ 0.39	$ 0.77	$ (0.15)	$ 0.33	$ 1.38	$ 1.61	$ 0.71	$ 1.09	$ 1.01	$ 1.31	$ 0.30	$ 0.75

A reduction in U-factor from 0.26 to 0.25 is shown to be cost-effective for every building type in all of the 4 measures (except at the worst case 7% discount rate for the apartment). FTI recommends making a change to 0.25 BTU/ºF.hr.ft^2 at a minimum, based on this analysis. U=0.24 is cost-effective based on 3%+SCC for the medium office. A case could be made that 0.24 could be cost-effective in the apartment and without SCC if the energy costs of the analysis were increased to today's or future expected rates.

Climate zone 7:

U=0.29 currently	Medium office building				Medium apartment					Adjusted medium office		
Fenestration U-factor	upfront cost above (below) breakeven @3% discount rate, $/sqft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft	upfront cost above (below) breakeven @3% discount rate, $/sq ft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft	upfront cost above (below) breakeven @3% discount rate, $/sqft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft
0.26	$ 0.99	$ 1.43	$ 0.36	$ 0.92	$ 2.15	$ 2.41	$ 1.39	$ 1.82	$ 1.70	$ 2.05	$ 0.88	$ 1.40
0.27	$ 0.04	$ 0.34	$ (0.37)	$ 0.00	$ 0.82	$ 1.00	$ 0.31	$ 0.60	$ 0.52	$ 0.75	$ (0.03)	$ 0.32
0.28	$ (0.23)	$ (0.09)	$ (0.44)	$ (0.26)	$ 0.15	$ 0.24	$ (0.10)	$ 0.04	$ 0.00	$ 0.12	$ (0.27)	$ (0.10)

A U-factor of 0.28 is cost-effective for the medium office building in all 4-measures (3%, 7% with and without the SCC) and for the adjusted office except for at the 7% discount rate. U=0.28 is cost-effective for the medium apartment based on the SCC at 3%. FTI recommends making the change from 0.29 to 0.28 in this climate zone. A case could be made to make a change to 0.27 since that is cost-effective based on the social cost of carbon in the medium office, and any increase in energy cost assumptions could make it cost-effective in the office building and in other of the measures. Also, the cost of the strategies to achieve lower U-factors (like triple pane constructions) are currently higher than they could be because they are not currently "business as usual". Triple panes in Europe are business-as-usual and are reported to be substantially less expensive than those sold in North America.

Climate zone 6:

U=0.34 currently	Medium office building				Medium apartment					Adjusted medium office		
Fenestration U-factor	upfront cost above (below) breakeven @3% discount rate, $/sqft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft	upfront cost above (below) breakeven @3% discount rate, $/sq ft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft	upfront cost above (below) breakeven @3% discount rate, $/sqft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft
0.31	$ 0.70	$ 1.07	$ 0.20	$ 0.65	$ 1.60	$ 1.83	$ 0.95	$ 1.32	$ 1.29	$ 1.57	$ 0.62	$ 1.05
0.32	$ 0.63	$ 0.87	$ 0.29	$ 0.59	$ 1.22	$ 1.37	$ 0.79	$ 1.04	$ 1.02	$ 1.21	$ 0.57	$ 0.85
0.33	$ 0.23	$ 0.35	$ 0.06	$ 0.21	$ 0.52	$ 0.60	$ 0.31	$ 0.43	$ 0.42	$ 0.52	$ 0.20	$ 0.34

None of the U-factors tested below the current value of U=0.34 are shown to be cost-effective using the previous energy costs. Note that the cost-effectiveness situation is not only driven by older energy costs, but also because the strategies to achieve the lower U-factor are not yet "business-as-usual" (triple pane, fourth surface low-e etc.) and are therefore higher priced than they would be if used more regularly. If these strategies were used more, then cost-effectiveness would likely be seen. Based on this current analysis, FTI is not proposing a change to U-factor in this climate zone.

Climate zone 5

U=0.36 currently	Medium office building				Medium apartment				Adjusted medium office			
Fenestration U-factor	upfront cost above (below) breakeven @3% discount rate, $/sqft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft	upfront cost above (below) breakeven @3% discount rate, $/sq ft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft	upfront cost above (below) breakeven @3% discount rate, $/sqft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft
0.32	$ 0.49	$ 0.83	$ 0.00	$ 0.43	$ 1.44	$ 1.63	$ 0.86	$ 1.18	$ 1.03	$ 1.29	$ 0.39	$ 0.79
0.33	$ (0.10)	$ 0.15	$ (0.47)	$ (0.14)	$ 0.61	$ 0.76	$ 0.18	$ 0.42	$ 0.30	$ 0.50	$ (0.18)	$ 0.12
0.34	$ (0.52)	$ (0.35)	$ (0.76)	$ (0.55)	$ (0.04)	$ 0.05	$ (0.33)	$ (0.17)	$ (0.25)	$ (0.12)	$ (0.57)	$ (0.37)

A change from 0.36 to 0.34 is shown to be cost-effective in all building types evaluated at all four measures (except the most stringent test of 7% discount on energy alone in the medium apartment, where it misses by $0.05c/ft and would probably be cost-effective if higher energy costs were assumed). A larger change to 0.33 is cost-effective on 3 of the 4 measures in the unadjusted medium office. FTI is proposing a 0.34 requirement in this climate zone, based on this data.

Climate zone 4:

U=0.36 currently	Medium office building				Medium apartment				Adjusted medium office			
Fenestration U-factor	upfront cost above (below) breakeven @3% discount rate, $/sqft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft	upfront cost above (below) breakeven @3% discount rate, $/sq ft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft	upfront cost above (below) breakeven @3% discount rate, $/sqft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft
0.32	$ 1.05	$ 1.28	$ 0.71	$ 1.01	$ 1.73	$ 1.86	$ 1.35	$ 1.56	$ 1.42	$ 1.60	$ 0.98	$ 1.26
0.33	$ 0.32	$ 0.49	$ 0.07	$ 0.29	$ 0.83	$ 0.93	$ 0.55	$ 0.70	$ 0.60	$ 0.73	$ 0.27	$ 0.47
0.34	$ (0.24)	$ (0.12)	$ (0.41)	$ (0.26)	$ 0.10	$ 0.17	$ (0.09)	$ 0.02	$ (0.05)	$ 0.04	$ (0.27)	$ (0.13)

A change from 0.36 to 0.34 has been shown to be cost effective for the medium office building across all 4 measures and in the adjusted office building for 3 of the 4 measures (and close to breakeven with 7% discount rate on energy alone). It is cost effective in the medium apartment for the 3% + SCC measure (and close to breakeven on the three other measures). With higher energy cost assumptions, it is likely that the medium apartment would show cost-effectiveness. The City of Seattle (CZ 4) has already changed its fixed fenestration U-factor from 0.36 to 0.34 on the grounds of cost-effectiveness and ease of availability of products at this performance. For these reasons, FTI is proposing reducing the U-factor in this climate zone to 0.34. This would provide a uniform requirement for fixed fenestration of 0.34 from climate zone 4 to climate zone 6, responding to feedback from the subcommittee to not have a different number for each zone.

Climate zone 3:

U=0.42 currently	Medium office building				Medium apartment				Adjusted medium office			
Fenestration U-factor	upfront cost above (below) breakeven @3% discount rate, $/sqft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft	upfront cost above (below) breakeven @3% discount rate, $/sq ft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft	upfront cost above (below) breakeven @3% discount rate, $/sqft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	above (below) breakeven @7% discount rate with SCC, $/sq.ft
0.38	$ (0.15)	$ 0.01	$ (0.38)	$ (0.18)	$ 0.32	$ 0.41	$ 0.07	$ 0.21	$ 0.11	$ 0.24	$ (0.20)	$ (0.01)
0.39	$ (0.17)	$ (0.05)	$ (0.26)	$ (0.16)	$ 0.18	$ 0.24	$ (0.03)	$ 0.04	$ (0.01)	$ 0.05	$ (0.17)	$ (0.07)
0.40	$ (0.14)	$ (0.06)	$ (0.35)	$ (0.19)	$ 0.09	$ 0.14	$ (0.01)	$ 0.10	$ 0.02	$ 0.12	$ (0.21)	$ (0.07)

This analysis indicates that a change from U=0.42 to 0.38 is cost-effective for the medium office building on 3 of the 4 measures (and within 1c/sq.ft of breakeven at 7%) and the adjusted medium office building when including the social cost of carbon. U= 0.38 is cost-effective at 3%+SCC in the medium apartment and 4c/sq.ft away from breakeven at 7%+SCC. It likely would be cost-effective if higher energy costs were used instead of the older 90.1-2016 analysis values and there is no fundamental limitation to product/technology availability, as more stringent U-factors have been required in more northern climate zones for several code cycles. On this basis, FTI is recommending a move to 0.38.

Climate zone 2

U=0.45 currently	Medium office building				Medium apartment				Adjusted medium office			
Fenestration U-factor	upfront cost above (below) breakeven @3% discount rate, $/sqft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft	upfront cost above (below) breakeven @3% discount rate, $/sq ft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft	upfront cost above (below) breakeven @3% discount rate, $/sqft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft
0.40	$ 0.28	$ 0.33	$ 0.20	$ 0.27	$ 0.49	$ 0.50	$ 0.44	$ 0.47	$ 0.36	$ 0.41	$ 0.26	$ 0.33
0.41	$ 0.29	$ 0.34	$ 0.23	$ 0.29	$ 0.46	$ 0.47	$ 0.43	$ 0.45	$ 0.36	$ 0.40	$ 0.28	$ 0.33
0.42	$ 0.10	$ 0.13	$ 0.05	$ 0.09	$ 0.23	$ 0.24	$ 0.20	$ 0.22	$ 0.15	$ 0.18	$ 0.09	$ 0.13
0.43	$ 0.16	$ 0.18	$ 0.13	$ 0.15	$ 0.24	$ 0.25	$ 0.22	$ 0.23				
0.44	$ 0.12	$ 0.13	$ 0.11	$ 0.12								

The analysis for 5 different U-factor changes (from 0.45 to 0.40, 0.41, 0.42, 0.43, and 0.44) shows that the cost-effectiveness results go through an optimum at 0.42. In going from 0.45 to 0.44, there isn't enough improvement in energy performance to offset the small, but finite, increased upfront fenestration cost (est. $0.18/sq.ft). In going from 0.45 to 0.40, the energy savings are greater, but the higher upfront cost (est. $0.56/sq.ft) doesn't offset it sufficiently. Whereas changing to a U-factor of 0.42 achieves a minimum in the cost-effectiveness calculation (albeit not quite negative) - it delivers enough energy savings to balance an moderate increase in cost (est. $0.27/sq.ft). In this analysis, U=0.42 is not sufficient to get to breakeven using current energy and modeling assumptions.

Part of the challenge in CZ2 (and CZ1) in modeling the impact of U-factor is the modeling assumptions.

Modeling in solar heat gain dominated climates can show that lower U-factors can keep the building insulated, trapping solar heat gain, but typically it doesn’t account for the use of night ventilation (free) nor the use of economizers that address these issues. Also, reducing the U-factor reduces the SHGC of the fenestration, but we have not modeled this correlated relationship in this analysis, which would show reduced energy usage. Using higher energy costs as experiencing currently and likely in the future, plus improved modeling that supports the use of night ventilation and use of economizers to dissipate heat at night may show cost-effectiveness at 0.42. A case could be made to reduce the U-factor to 0.42 in climate zone 2, but in the spirit of achieving a consensus proposal, we are suggesting no change.

Climate zone 1:

U=0.50 currently	Medium office building				Medium apartment				Adjusted medium office			
Fenestration U-factor	upfront cost above (below) breakeven @3% discount rate, $/sqft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft	upfront cost above (below) breakeven @3% discount rate, $/sqft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft	upfront cost above (below) breakeven @3% discount rate, $/sqft	upfront cost above (below) breakeven @7% discount rate, $/sqft	upfront cost above (below) breakeven @3% discount rate with SCC, $/sqft	upfront cost above (below) breakeven @7% discount rate with SCC, $/sq.ft
0.45	$ 0.28	$ 0.28	$ 0.29	$ 0.29	$ 0.23	$ 0.24	$ 0.22	$ 0.23	$ 0.28	$ 0.28	$ 0.29	$ 0.28
0.46	$ 0.01	$ 0.01	$ 0.01	$ 0.01	$ (0.03)	$ (0.03)	$ (0.04)	$ (0.03)	$ 0.01	$ 0.01	$ 0.01	$ 0.01

For curtainwall systems, this analysis suggests that there is no additional cost to go from U=0.50 to U=0.46 because this lower U-factor is typically delivered while meeting the SHGC requirements. U=0.46 is cost-effective in this analysis in the medium apartment across all measures. It is not shown to be cost-effective for the medium office building because of the modeling assumptions, which suggest energy use will rise with lower U-factors. But the modeling does not include the use of free night ventilation nor economizer systems, and as such, the heat gain during the day is not allowed to dissipate as much as could be achieved if the building was designed with those strategies. Also, lower U-factor typically delivers lower SHGC, and the impacts of a correlated reduction in SHGC was not evaluated. For many curtainwall systems, a U=0.46 is already delivered by achieving the prescriptive SHGC, although that may not be the case for storefront systems. Therefore, FTI proposes to maintain the U-factor at 0.50, focusing on making changes in the other climate zones.

Additional discussion

According to Steve Selkowitz from LBNL, the results of several of studies indicate that fenestration U-factors between 0.10 to 0.20 Btu/ºf.hr.ft^2 are likely to be appropriate to get to net zero fenestration performance across even the northern climate zones, with variation also depending on orientation and window area (more area needing lower U-factor) and in some cases with dynamic solar control. U-factors in this range are already in use in some European countries. Whether 0.20 or 0.10 or somewhere in between is considered the future net-zero target, the IECC window performance change from cycle to cycle is not on a track to achieving close to net zero window performance by 2030. Even if we assume 0.15 BTU/ºf.hr.ft^2 is the target to meet, and we consider the current 0.29 in climate zone 8, the 2024, 2027 and 2030 values would need to be 0.24, 0.19 and 0.15 respectively. The lower climate zones need to have larger changes. For climate zone 6, to get to 0.15 BTU/ºf.hr.ft^2 in 2030, the values in 2024 and 2027 if changed linearly would need to be 0.28 and 0.21 respectively. If the target is 0.20, the reduction would be 0.29 and 0.24 in 2024 and 2027. This represents a significantly more aggressive path than we have proposed here, and the committee could consider taking larger steps in the IECC net zero path. The proposals here are in-line with what is deemed to be cost-effective (albeit with aged energy cost), and most recommendations FTI is making are on average cost-effective in at least one of the two building types without including the social cost of carbon and are proposed to drive to consensus. A more aggressive approach based on SCC and recognizing that higher energy costs will be higher in the future (and are currently higher) could be considered, especially since this code will not be used widely until 2026 or beyond. Higher performance fenestration may also allow HVAC system downsizing and resultant cost savings that represent offsets against the increased first cost of the façade. These higher performing solutions will also provide real, but difficult to quantify, benefits to owners in terms of the resilience of buildings to extreme weather and loss of power.

We have not included changes for operable fenestration because we do not want to discourage the use of operable fenestration, as this is very important for natural ventilation and indoor air quality. We would be open to suggestions on U-factor values for operable fenestration that would be equivalent to the fixed fenestration, with this in mind. More broadly there is a growing interest in the role of fenestration design and optimization with respect to occupant comfort, health and productivity, with its direct impact on daylight and access to views.

Cost Impact: The code change proposal will increase the cost of construction.
The cost-effectiveness analysis for each climate zone is detailed in the rationale and more detail can be found in the attached documentation. The proposals FTI is making here are in-line with what is deemed to be cost-effective (with old energy cost assumptions), and most recommendations

are on average cost-effective in at least one if not both of the two building types analyzed without including the social cost of carbon.

A more aggressive approach based on using SCC only and recognizing that higher energy costs will be higher in the future (and are currently higher) could be considered by the committee, especially since this code will not be used widely until 2026 and beyond.

Bibliography: [1] LBNL 60049: Zero Energy Windows; https://eta-publications.lbl.gov/sites/default/files/60049.pdf
[2] H. Sanders, U-factor matters in hot climates, Façade Tectonics World Congress 2020. https://www.facadetectonics.org/papers/u-factor-mattersin-hot-climates

Attached Files

- **CZ6.png**
  https://energy.cdpaccess.com/proposal/826/1700/files/download/399/
- **CZ7.jpg**
  https://energy.cdpaccess.com/proposal/826/1700/files/download/398/
- **CZ8.jpg**
  https://energy.cdpaccess.com/proposal/826/1700/files/download/397/
- **CZ5.jpg**
  https://energy.cdpaccess.com/proposal/826/1700/files/download/396/
- **CZ4.jpg**
  https://energy.cdpaccess.com/proposal/826/1700/files/download/395/
- **CZ3.jpg**
  https://energy.cdpaccess.com/proposal/826/1700/files/download/394/
- **CZ2.jpg**
  https://energy.cdpaccess.com/proposal/826/1700/files/download/393/
- **CZ1.jpg**
  https://energy.cdpaccess.com/proposal/826/1700/files/download/392/
- **FTI - Fenestration U-factor cost-effectiveness analysis - IECC proposal.pdf**
  https://energy.cdpaccess.com/proposal/826/1700/files/download/381/

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: Because these reductions in U-factors are technically feasible and cost-effective.

CED1-128-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C402.6.1 Air barriers. A continuous *air barrier* shall be provided throughout the *building thermal envelope*. The *air barrier* is permitted to be located at any combination of inside, outside, or within the *building thermal envelope*. The *air barrier* shall comply with Sections C402.6.1.2, and C402.6.1.3. The *air leakage* performance of the *air barrier* shall be verified in accordance with Section C402.6.2.

Exception: *Air barriers* are not required in buildings located in *Climate Zone* 2B.

C402.6.1.1 Air barrier design and documentation requirements . Design of the continuous *air barrier* shall be documented as follows~~in the following manner~~:

1. Components comprising the continuous *air barrier* and their position within each *building thermal envelope* assembly shall be identified.
2. Joints, interconnections, and penetrations of the continuous *air barrier* components shall be detailed.
3. The continuity of the *air barrier* building element assemblies that enclose conditioned space or provide a boundary between conditioned space and unconditioned space shall be identified.
4. Documentation of the continuous *air barrier* shall detail methods of sealing the *air barrier* such as wrapping, caulking, gasketing, taping or other *approved* methods at the following locations:

   4.1 Joints around fenestration and door frames.

   4.2 Joints between walls and floors, between walls at building corners, between walls and roofs including parapets and copings, where above-grade walls meet foundations, and similar intersections.

   4.3 Penetrations or attachments through the continuous *air barrier* ~~in building envelope roofs, walls, and floors~~.

   4.4 Building assemblies used as ducts or plenums.

   4.5 Changes in continuous *air barrier* materials and assemblies.

5. Identify where testing will or will not be performed in accordance with Section C402.6~~5~~.2 Where testing will not be performed, a plan for field inspections required by C402. 6~~5~~.2.3 shall be provided that includes the following:

   5.1 Schedule for periodic inspection,

   5.2 Continuous *air barrier* scope of work,

   5.3 List of critical inspection items,

   5.4 Inspection documentation requirements, and

   5.5 Provisions for corrective actions where needed.

C402.6.2.1 Whole building test method and reporting. The *building thermal envelope* shall be tested by an *approved* third ~~thrid~~ party for *air leakage* in accordance withASTM E3158 or an equivalent *approved* method. ~~method~~ A report that includes the tested surface area, floor area, air by volume, stories above grade, and *air leakage* rates shall be submitted to the code official and the building owner.

Exceptions: ~~Add optional paragraph text here~~

1. For buildings less than 10,000 ft^2 (1000 m^2) the entire *building thermal envelope* shall be permitted to be tested in accordance with ASTM E779, ASTM E3158, ~~or~~ ASTM E1827, or an equivalent *approved* method.
2. For buildings greater than 50,000 ft^2 (4645 m^2), portions of the building shall be permitted to be tested and the measured *air leakage* shall be area-weighted by the surface areas of the *building thermal envelope* in each portion. The weighted average tested *air leakage* shall not be greater than the whole building *air leakage* limit. The following portions of the building shall be tested:

   2.1 The entire *building thermal envelope* area of stories that have any conditioned spaces directly under a roof.

   2.2 The entire *building thermal envelope* area of stories that have a building entrance, a floor over unconditioned space, a loading dock, or that are below grade.

   2.3 Representative above-grade portions of the building totaling not less than 25 percent of the wall area enclosing the remaining conditioned space.

Reason: This proposal is editorial and is not meant to change the meaning or stringency of the requirements. Any changes submitted as part of the errata proposal for CECPI-3 are also included in this proposal to assist with correlation. Only five changes are included in this proposal that are new:
1. Section C402.6.1, changed "any combination of" to "located"

2. Section C402.6.1.1, changed "in the following manner" to "as follows"

3. Section C402.6.2.1, added "air" to "...and air leakage rates shall be submitted..." in the second sentence.

4. Section C402.6.2.1, exception 1, deleted "or" in "...ASTM E3158, ~~or~~ ASTM E1827, or an equivalent..."

5. Section C402.6.2.1, exception 2, added "air" to "...building air leakage limit." in the second sentence.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Proposal only includes editorial changes to language.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: clean-up of some terminology related to the use of "air leakage" and general grammar.

Proposal # 715

CED1-130-22

Proponents: Bob Zabcik, representing Metal Construction Association (bob@ztech-consulting.com)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C402.6.1.2 Air barrier construction. The *continuous air barrier* shall be constructed to comply with the following:

1. The air barrier shall be continuous for all assemblies that comprise the building thermal envelope and across the joints and assemblies.
2. Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure differentials such as those from ~~design~~ wind ~~loads~~, stack effect and mechanical ventilation.
3. Penetrations of the air barrier shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Sealing shall allow for expansion, contraction and mechanical vibration.Sealing materials shall be securely installed around the penetration so as not to dislodge, loosen or otherwise impair the pnetrations' ability to resist positive and negative pressure. Sealing of concealed fire sprinklers, where required, shall be in a manner that is recommended by the fire sprinkler manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.
4. Recessed lighting fixtures shall comply with Section C402.6.1.2.1. Where similar objects are installed that penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.
5. Electrical and communication boxes shall comply with C402.6.1.2.2 to maintain the integrity of the air barrier.
6. Electrical and communication boxes shall comply with C402.6.1.2.2. Where similar objects are installed that penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.

Reason: Using the term "design wind loads" implies that the continuous air barrier should be designed to the pressure as a structural element would be. Design wind speeds for typical buildings (i.e., Risk Category II in ASCE-7) are based on a 7% probability of exceedance in 50 years, which equated to a mean recurrence interval of 700 years. Higher Risk Category buildings are even higher. Designing the CAB for a 700-year wind event is excessive.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This change is needed to correct misuse of a term commonly used in building design for a completely different purpose.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: Design wind loads has specific structural meaning and may causes confusion to the intent of this section.

Proposal # 897

CED1-131-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C402.6.1.3 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 <u>or depressurized </u>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) 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 and I 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).

Reason: This proposal adds the option of inspection with the building under depressurization in addition to the current requirement for the building to pressurized. ASTM E1186 contains instructions for conducting the evaluation under either depressurization or pressurization. In some situations, depressurization may be more efficient than pressurization to conduct the inspection.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal does not add or delete requirements from the code. It provides more options on conducting a field evaluation to locate building air leakage.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: This proposal adds the option of inspection with the building under depressurization in addition to the current requirement for the building to pressurized. ASTM E1186 contains instructions for conducting the evaluation under either depressurization or pressurization. In some situations, depressurization may be more efficient than pressurization to conduct the inspection.

Proposal # 871

CED1-132-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C402.6.1.3 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 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) 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).

Reason: This proposal reflects the text that was approved during the committee review of CEPI-58, and so may be considered errata. It limits the dwelling/sleeping unit testing exception (vs. whole building testing) to R-2 and I-1 occupancies instead of the entire R and I occupancies.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal does not change which buildings are tested. It only provides more precise guidance on which buildings are appropriate to use dwelling unit testing as an alternate to whole building testing.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: This proposal corrects one of the air leakage section exceptions from “Group R and I occupancies” to “Group R-2 and I-1 occupancies”. While not reflected in the public comment draft, this is an erratum because we already voted last round to make that change to limit that exception to R-2 and I-1. As the public review draft mistakenly included just the Group R and I, and because it would be a substantive change to someone in the public who was not aware of what the committee did, we decided to handle it like a change and vote on it. Specifically, CEPI-58 was modified to allow dwelling unit air leakage testing in lieu of whole building air leakage testing in Group R-2 and I-1 occupancies instead of in all of Group R and I.

Proposal # 736

CED1-134-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C402.6.2.2 Dwelling and sleeping unit enclosure method and reporting. The *building thermal envelope* shall be tested for air leakage in accordance with ASTM E779, ANSI/RESNET/ICC 380, ASTM E1827 or an equivalent approved method. Testing shall be conducted by an approved third party.Where multiple dwelling units or sleeping units or other spaces are contained within one *building thermal envelope*, each shall be considered an individual testing unit, and the building air leakage shall be the weighted average of all tested unit results, weighted by each *testing unit enclosure area*. ~~testing unit's enclosure area~~. Units shall be tested without simultaneously testing adjacent units and shall be separately tested as follows:

1. Where buildings have less than eight total dwelling or sleeping units, each unit shall be tested.
2. Where buildings have eight or more dwelling or sleeping units, the greater of seven units or 20 percent of the units in the building shall be tested, including a top floor unit, a middle floor unit, a ground floor unit and a unit with the largest testing unit enclosure area. For each tested unit that exceeds the maximum air leakage rate, an additional three units shall be tested, including a mixture of testing unit types and locations.
3. Enclosed spaces with not less than one exterior wall in the building thermal envelope shall be tested in accordance with Section C402.6.2.1.

> **Exception:** Corridors, stairwells, and enclosed spaces having a conditioned floor area not greater than 1,500 ft (139 m2)shall be permitted to comply with Section C402.6.2.3 and either Section C402.6.2.3.1 or Section C402.6.2.3.2.

Reason: This proposal updates to the text to use defined terms.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal does not add or delete requirements. It is solely intended to use current defined terminology with in the text.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: Per proponent's reasoning statement, This proposal updates to the text to use defined terms "testing unit enclosure area."

Proposal # 892

CED1-138-22

Proponents: Alyson Hallander, representing Schoeck

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C402.7.1 Balconies and floor decks. Balconies and concrete floor decks shall not penetrate the building thermal envelope. Such assemblies shall be separately supported or shall be supported by structural attachments or elements that minimize thermal bridging through the building thermal envelope.
Exceptions: Balconies and concrete floor decks shall be permitted to penetrate the *building thermal envelope* where:

1. an area-weighted *U*-factor is used for *above-grade wall* compliance which includes a *U*-factor of 0.8 Btu/h- ° F-ft^2 for the area of the *above-grade wall* penetrated by the concrete floor deck, or
2. an approved ~~structural~~ thermal break device ~~of~~ <u>with</u> not less than R-10 <u>insulation material</u> is installed in accordance with the manufacturer's instructions.

C402.7.5 Parapets. Parapets shall comply with one or more of the following as applicable:

1. Where continuous insulation is installed on the exterior side of the *above-grade wall* and the roof is insulated with insulation entirely above deck, the continuous insulation shall extend up both sides of the parapet not less than 2 feet (610 mm) above the roof covering or to the top of the parapet, whichever is less. Parapets that are an integral part of a fire-resistance rated wall, and the exterior continuous insulation applied to the parapet, shall comply with the fire resistance ratings of the building code.
2. Where continuous insulation is installed on the exterior side of the above-grade wall and the roof insulation is below the roof deck, the continuous insulation shall extend up the exterior side of the parapet to not less than the height of the top surface of the roof assembly.
3. Where continuous insulation is not installed on the exterior side of the *above-grade wall* and the roof is insulated with insulation entirely above deck, the wall cavity or integral insulation shall extend into the parapet up to the exterior face of the roof insulation or equivalent R-value insulation shall be installed not less than 2 feet (610 mm) horizontally inward on the underside of the roof deck.
4. Where continuous insulation is not installed on the exterior side of the *above-grade wall* and the roof insulation is below the roof deck, the wall and roof insulation components shall be adjacent to each other at the roof-ceiling-wall intersection.
5. <u>Where a</u> ~~structural~~ <u>thermal break device with not less than R-10 insulation material aligned with the above-grade wall and roof insulation is installed in accordance with the manufacturer's instructions.</u>

Exception: An *approved* design where the *above-grade wall U*-factor used for compliance accounts for the parapet *thermal bridge*.

TABLE C402.1.4 PSI- and CHI-FACTORS TO DETERMINE THERMAL BRIDGES FOR THE COMPONENT PERFORMANCE ALTERNATIVE

Thermal Bridge per Section C402.7	Thermal Bridge Compliant with Section C402.7		Thermal Bridge Non-Compliant with Section C402.7	
	psi-factor (Btu/h-ft-°F)	chi-factor (Btu/h-~~ft~~-°F)	psi-factor (Btu/h-ft-°F)	chi-factor (Btu/h-~~ft~~-°F -)
C402.7.1 Balconies, slabs, and decks	0.2	n/a	0.5	n/a
C402.7.2 Cladding supports	0.2	n/a	0.3	n/a
C402.7.3 Structural beams and columns	n/a	1.0-carbon steel 0.3-concrete	n/a	2.0-carbon steel 1.0-concrete
C402.7.4 Vertical fenestration	0.15	n/a	0.3	n/a
C402.7.5 Parapets	0.2	n/a	0.4	n/a

For SI: W/m-K = 0.578 Btu/h-ft-°F; 1 W/K = 1.90 Btu/h-°F
n/a = not applicable

Reason: C402.7.1 reasons:
The proposed wording will make it feasible to meet thermal performance requirements with current structural thermal break products on the market.

The tweaks to the wording clarify that a manufactured structural thermal break is acceptable and that the R-value applies only to the **insulated material** of the manufactured assemblies.

Typical manufactured structural thermal breaks incorporate at least R-15 insulation material; however, when the thermal properties of the stainless steel reinforcement and the compression material of the devices are considered, the resulting assembly R-value is less than R-10 for nearly all structural thermal break assemblies.

C402.7.5 reasons:

Regarding parapets with adding C402.7.5.5, incorporating a structural thermal break within the parapet ensures a truly continuous building envelope compared to extending insulation 2' up along the parapet.

See below image for where a structural thermal break can be incorporated at a parapet to maintain continuous insulation:

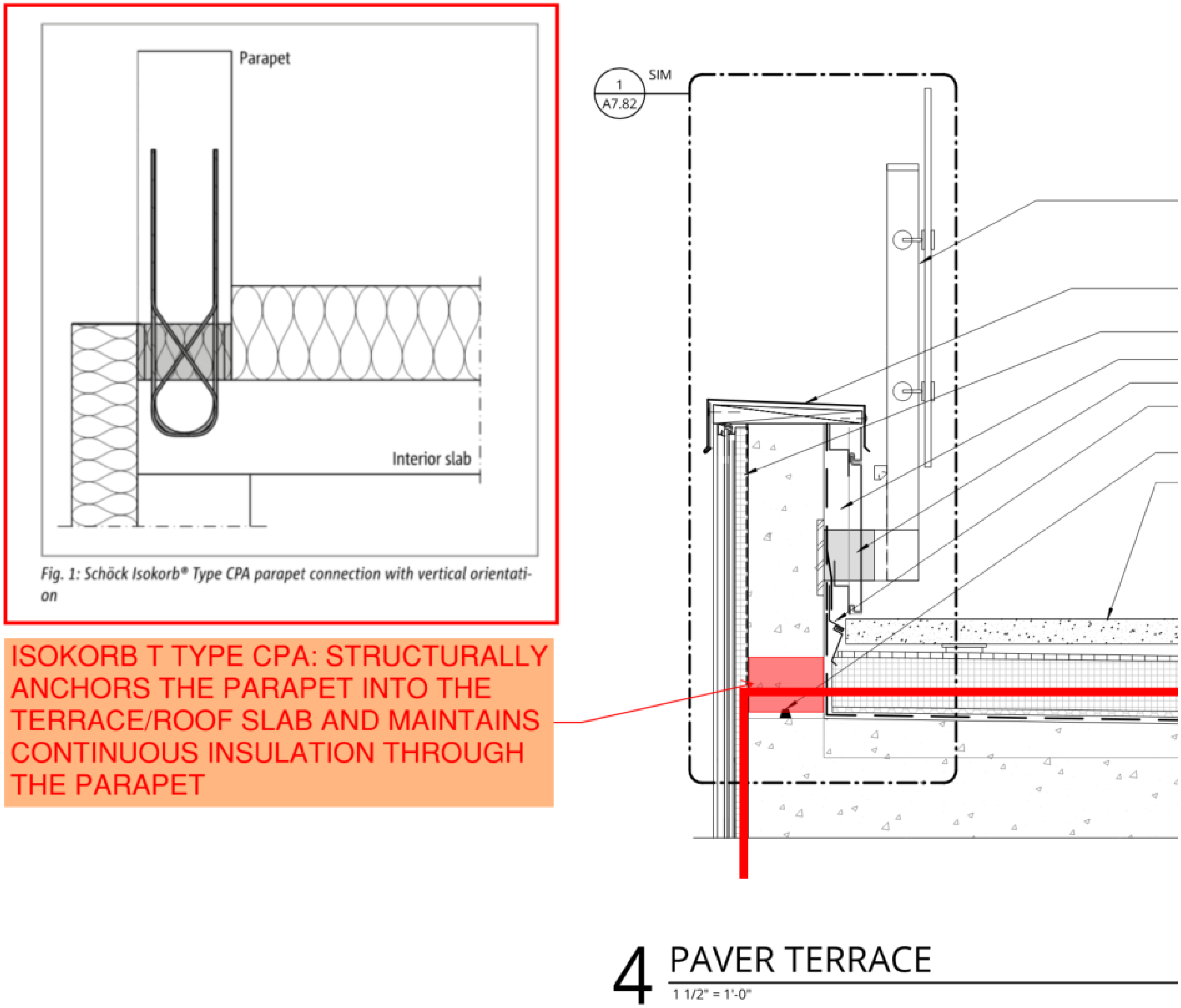


Fig. 1: Schöck Isokorb® Type CPA parapet connection with vertical orientation

Table C402.1.4 reasons:

The units for chi are Btu/h-°F. The units are currently correct in the footnotes of the table but not in the table.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposed code changes will make it feasible to meet thermal performance requirements with current structural thermal break products on the market.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: The proposed wording change will make it easier for current structural thermal break products on the market to meet the thermal performance requirements.

CED1-139-22

Proponents: Theresa Weston, representing Rainscreen Association in North America (RAiNA) (holtweston88@gmail.com)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C402.7.2 Cladding supports. Linear elements supporting opaque cladding shall be off-set from the structure with attachments that allow the continuous insulation, where present, to pass behind the cladding support element except at the point of attachment.

Exceptions:

1. An *approved* design where the above-grade wall *U*-factor used for compliance accounts for the cladding support element *thermal bridge*.
2. Anchoring for curtain wall and window wall systems where curtain wall and window wall systems comply with C402.7.4.

Reason: This proposal's intention is to make it clear that curtain wall and window wall systems are not being exempted from thermal bridge mitigation, but rather they are covered by a different section.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
There is no addition or deletion of code requirements. It only includes which sections cover which materials/assemblies.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason:

Proposal # 646

CED1-141-22

Proponents: Reid Hart, representing Pacific Northwest National Laboratory (reid.hart@pnnl.gov); Michael Tillou, representing Pacific Northwest National Laboratory (michael.tillou@pnnl.gov); Ellen Franconi, representing Pacific Northwest National Laboratory (ellen.franconi@pnnl.gov)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C406.3.4 G03 Automated Shading Load Management. Where fenestration on east, south, and west exposures ~~exceeds~~ is greater than 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~~ not less than 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 reflectance of not less than 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~~ not less than 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 not less than 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 for no longer than four hours. Such override shall be locked out during peak periods.

For this section, directional ~~east, south, or west~~ exposures shall exclude fenestration that ~~is plus or minus~~ has an orientation deviating by more than 45 degrees of facing the cardinal direction. ~~true north in the northern hemisphere.~~ In the southern hemisphere, where the south exposure is referred to, it shall be replaced by the north exposure ~~and the referenced sourth exposure shall be replaced by the north exposure~~.

Reason: The alternative approach for reduced credits for a reduced automatic shading area allows flexibility for certain building types and configurations. A simplified alternative approach was preferred to a formula that adjusts for actual shading area as it is less complex and aligned with a typical alternative choice regarding building exposures with automated shading.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The selection of individual load management credits is up to the designer, so individual specific credits are not specifically required by the code. Allowing for a reduced credit option here with less shading required could reduce cost in some situations when this option is chosen.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: The alternative approach for reduced credits for a reduced automatic shading area allows flexibility for certain building types and configurations.

Proposal # 662

CED1-144-22

Proponents: Aaron Phillips, representing Asphalt Roofing Manufacturers Association (aphillips@asphaltroofing.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C503.2.1 ~~Roof alterations, insulation entirely above deck~~ <u>Roof, ceiling, and attic alterations</u>. 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 ~~roof~~ alterations:

1. An alteration of roof-ceiling construction where there is no insulation above conditioned space.
2. Roof replacement for roofs with insula<u>ti</u>~~it~~on entirely above 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 other *approved* source 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 other *approved* source 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.

Insulation shall be installed in accordance with the requirements of Sections C402.2.1.2 through C402.2.1.5.

Reason: This proposal makes three minor modifications to Section C503.2.1:

1. A section title that encompasses the four enumerated alterations is added.
2. The word "roof" is removed because not all the alterations in the list are roof alterations.
3. A spelling error is corrected.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposal improves clarity of the section without making technical changes. No change in cost of construction should be expected if this comment is adopted.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: This proposal makes three minor changes to Section C503.2.1:
1) A section title that encompasses the enumerated alterations is added.
2) The word "roof" is removed because it is redundant; the section’s title and scope of alterations only addresses matters related to roof alterations.
3) A spelling error is corrected

Proposal # 712

CED1-145-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C503.2.1 . 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 roof alterations:

1. An alteration of roof-ceiling construction <u>other than *reroofing*</u> where <u>existing</u> ~~there is no~~ insulation <u>located below the roof deck or on an attic floor</u> above conditioned space <u>does not comply with Table C402.1.2</u>.
2. Roof replacement for roofs with insulaiton entirely above 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 other *approved* source 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 other *approved* source 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.

~~Insulation shall be installed in accordance with the requirements of Sections C402.2.1.2 through C402.2.1.5.~~

Reason: The deleted sentence is redundant with requirements already referenced in the charging language of Section C503.2.1. It also was not included as part of CEPI-221 which updated this section.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal is a clean-up and removes redundant text without any technical or cost impact.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: Removes redundant text and clarifies requirements for item 1.

Proposal # 761

CED1-146-22

Proponents: Jeff Mang, representing Polyisocyanurate Insulation Manufacturers Association (PIMA) (jeff@jcmangconsulting.com); Marcin Pazera, representing Polyisocyanurate Insulation Manufacturers Association (mpazera@pima.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C503.2.1 . 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 roof alterations:

1. An alteration of roof-ceiling construction where there is no insulation above conditioned space.
2. *Roof replacement*~~for roofs with insulaiton entirely above deck.~~ 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 other *approved* source 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 other *approved* source 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.

Insulation shall be installed in accordance with the requirements of Sections C402.2.1.2 through C402.2.1.5.

Reason: This proposed amendment clarifies which types of roof alterations trigger the insulation requirements under Section C503. As reflected in the Public Review Draft #1, the Commercial Consensus Committee has already approved several improvements related to roof alterations under Section C503.2.1. This proposed amendment builds on these improvements with further clarifying language.
The changes under Section C503.2.1 already approved by the Committee reinforce the long-standing requirement that all alterations involving roofs with insulation entirely above deck, other than roof recovers, are required to meet the insulation requirements under the energy code. This proposed amendment will eliminate confusion that can arise on jobs due to unique circumstances or work involved in completing a specific roof alteration project.

For example, this proposal clarifies that compliance with the energy code's insulation requirements is required where the roof membrane is removed, and various amounts of other existing roof materials are left in place (including existing insulation). This result is consistent with both the letter and the long-standing spirit of the code.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal clarifies an existing provision in the code and does not add any new requirements.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: Clarifies requirements for roof replacements where insulation is located entirely above deck.

Proposal # 762

CED1-147-22

Proponents: Glen Clapper, representing National Roof Contractors Association (gclapper@nrca.net)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C503.2.1 ~~Roof Alterations~~ 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 roof alterations:

1. An alteration of roof-ceiling construction where there is no insulation above conditioned space.
2. Roof replacement for roofs with ~~insulaiton~~ insulation entirely above 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~~other~~ *approved* ~~source~~ third party 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~~other~~ *approved* ~~source~~ third party 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.

Insulation shall be installed in accordance with the requirements of Sections C402.2.1.2 through C402.2.1.5.

Reason: This proposal adds the omitted section title included in CEPI-221 AM and corrects a typo. In addition, the proposal modifies who is allowed to provide the report and roof design, since *approved source* is a newly defined term approved as modified in the first Public Input Initial Draft and excludes qualified parties, such as the contractor and the suppliers. The proposed term "entity" is more inclusive as to who may provide the information required of this section and more closely aligns with published Addendum t of ASHRAE Standard 90.1-2019.

Cost Impact: The code change proposal will decrease the cost of construction.
This code change proposal will decrease the cost of construction when the information required is provided by an entity already on site to perform the work.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: The modification which requires a third-party report of roof conditions better meets the proponent's intent.

Proposal # 885

CED1-148-22

Proponents: Jeff Mang, representing Polyisocyanurate Insulation Manufacturers Association (PIMA) (jeff@jcmangconsulting.com); Marcin Pazera, representing Polyisocyanurate Insulation Manufacturers Association (mpazera@pima.org)

2024 International Energy Conservation Code [CE Project]

Add new text as follows:

503.3.8 Replacement or added roof mounted mechanical equipment. For *roofs* with insulation entirely above the roof deck and where existing roof-mounted mechanical equipment is replaced or new equipment is added, and the existing roof does not comply with the insulation requirements for new construction in accordance with Section C402.1 and Section C402.2.1, curbs for added or replaced equipment shall be of a height necessary to accommodate the future addition of above-deck roof insulation to be installed in accordance with Section C503.2.1, Item 2. Alternatively, the curb height shall comply with Table C503.3.8. Curb height shall be the distance measured from the top of the curb to the top of the roof deck.

Revise as follows:

Table 503.3.8 Roof Mounted Mechanical Equipment Curb Heights

CLIMATE ZONE	CURB HEIGHT, MINIMUM~~a~~
~~0 and 1~~	~~15.0 inches (381 mm)~~
0, 1, 2 and 3	16.0 inches (406.4 mm)
4, 5 and 6	17.0 inches (431.8 mm)
7 and 8	18.0 inches (457.2 mm)

~~a. Curb height shall be the distance measured from the top of the curb to the roof deck.~~

Reason: This proposed amendment complements the revisions to C503.2.1 of the Public Comment Draft #1 related to the insulation requirements for roof replacements. C503.2.1 of the Public Comment Draft creates a new exception regarding insulation requirements for roof replacements where there are practical difficulties for compliance caused by existing rooftop features. Equipment curbs that are too short are one of the most common difficulties to meeting the insulation requirements when roofs are replaced.
This intention of this proposed amendment is to mitigate challenges caused by low curb heights by requiring, at a relatively low (or no) cost, the installation of higher curbs when rooftop mechanical equipment is replaced even if the replacement work does not occur at the same time as the roof replacement project. The intent of the IECC is to move existing buildings toward compliance as alterations occur, which results in continual improvements to building energy efficiency. Modifying existing roof curbs during equipment replacement work adds minimal upfront costs and eliminates the cost of having to install a higher curb later during a roof replacement and when it would be more expensive.

Installation of curbs with minimum heights calculated to accommodate the amount of insulation needed for each climate zone would be required. Compliance can be met by either following the minimum heights listed in Table C503.3.8 or the contractor's or designer's best judgement. This flexibility may be needed to address situations that arise with tapered roof assemblies or sloped roofs. In these cases, the minimum curb heights listed under Table C503.3.8 may not be necessary or may be insufficient to achieve the goals of this amendment, depending on where the curb is located within the tapered or sloped system (i.e., at the low point, high point, or somewhere in between).

A similar amendment proposed by PIMA (CEPI-74) was disapproved by a close vote of 17-14-2 during consideration by the Commercial Subcommittee in May. In response to specific concerns raised about the original amendment, this amendment adds flexibility to deal with unusual roof conditions, drops the proposed changes to Chapter 4, and makes editorial changes. With respect to the potential burden on building owners, the intent of this requirement is to make it easier and less expensive to comply with the energy code when a roof is eventually replaced, which happens every 15 or 20 years on average. Adding a higher curb (if needed) when the equipment is being replaced is far less expensive than having to lift the equipment to install a higher curb during a roof replacement.

Explanation of Table C503.3.8: the minimum heights in the table would accommodate: (1) the 10 inches of curb height that is above the roof membrane/covering specified under the AHRI/SMACNA Guideline B-1997, "Guidelines for Roof Mounted Outdoor Air-Conditioner Installations"; (2) the amount of insulation necessary to comply with the prescriptive R-value requirements for each climate zone under the IECC; and (3) other materials that are typically part of the roof assembly, such as cover boards, slip sheets and membranes. While this proposal would require heights of between 15 to 18 inches depending on the specific climate zone, the Committee may decide to simply require 18 inches as the minimum curb height for all climate zones if that approach makes it easier for purposes of product supply and inventory.

Cost Impact: The code change proposal will increase the cost of construction.
A small increase in cost related to the purchase and installation of a new curb may be incurred. However, over the service life of the curb and mechanical equipment, this code change proposal is life-cycle cost effective due to decreased compliance costs for future reroofing work that is common for all buildings to undergo during the building service life as well as reduced energy costs resulting from the installation of a future, IECC-compliant replacement roof system.

Bibliography: *Guidelines for Roof Mounted Outdoor Air-Conditioner Installations* (Guideline B-1997), Air-Conditioning, Heating, and Refrigeration Institute (AHRI) and Sheet Meal and Air-Conditioning Contractors National Association (SMACNA). Available at: https://www.ahrinet.org/App_Content/ahri/files/Guidelines/AHRI_Guideline_B_1997.pdf.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: Adds needed provisions for equipment curbs to facilitate future roof replacements.

CED1-149-22

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

2024 International Energy Conservation Code [CE Project]

Delete without substitution:

~~**EXTERIOR WALL ENVELOPE.** A system or assembly of exterior wall components, including exterior wall finish materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space, from the detrimental effects of the exterior environment.~~

Revise as follows:

C503.6 Additional energy efficiency credits. *Alterations* shall comply with measures from Sections C406.2 and C406.3 to achieve not less than 10 percent 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 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.

Exceptions:

1. *Alterations* that include replacement of no more than one of the following:
   - 1.1 HVAC unitary systems or HVAC central heating or cooling equipment serving the *work area* of the *alteration*.
   - 1.2 Water heating equipment serving the *work area* of the alteration.
   - 1.3 50 percent or more of the lighting fixtures in the *work area* of the alteration.
   - 1.4 50 percent or more of the area of interior surfaces of the thermal envelope in the *work area* of the alteration.
   - 1.5 50 percent or more of the ~~building's~~ *exterior wall* <u>area of the *building thermal*</u> *envelope*, including <u>vertical</u> fenestration <u>area</u>.
2. *Alterations* to *buildings* in Utility and Miscellaneous Group U, Storage Group S, Factory Group F, High-Hazard Group H.
3. *Alterations* that do not contain conditioned space.
4. Portions of *buildings* devoted to manufacturing or industrial use.
5. *Buildings* in Climate Zone 0A.
6. *Alterations* that are permitted with an *addition* complying with Section C502.3.7.
7. *Alterations* that comply with Section C407.

Reason: The newly added "exterior wall envelope" definition is used only once in the entire IECC in the newly added Section C503.6, exception 1.5. The term is deleted and existing defined terms are used instead to revise exception 1.5 in Section C503.6 to retain its intent while not requiring a new term to be created and defined. The exception is also clarified to apply the percentage trigger on the basis of area, not length of walls, number of walls, or other possible metrics that are currently left open to interpretation. In addition, it is clarified that only vertical fenestration should be included in the area, not fenestration (which includes skylights). Finally, the new "exterior wall envelope" definition overlaps with the defined term "exterior wall covering" as used in the IBC and IRC and this could create confusion in coordination between the I-codes. Deleting the term and using existing definitions resolves this concern as well.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposal deletes and unnecessary definition and clarifies wording without changing requirements.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: cleans up wording using existing defined terms and removes an unneeded definition that is used only once in this one exception item and potentially conflicts with "exterior wall covering" defined term in the building code.

CED1-151-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

ASTM

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

D8052/D8052M~~—2017~~ 2022:	Standard Test Method for Quantification of Air Leakage in Low-Sloped Membrane Roof Assemblies
E283/E283M-2019~~—2004(2012)~~:	Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen
E779~~—10(2018):~~ 2019:	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
E1186~~-17~~ 2022:	Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
E1677~~—11:~~ 2019:	Specification for Air Barrier (AB) Material or ~~Systems~~ Assemblies for Low-rise Framed Building Walls
E1827~~—2011(2017):~~ 2022:	Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door
E2178~~—13:~~ 2021a:	Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permanence of Building Materials
E2357~~—2018:~~ 2022:	Standard Test Method for Determining Air Leakage of Air Barriers Assemblies

Reason: This proposal updates the ASTM standards that relate to air leakage performance (Section C402.6) to their most recent version.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal does add or delete any requirements, but only updates currently referenced standards to their most recent version.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: it keeps the reference standards up to date with the most recent version.

Proposal # 875

CED1-150-22

Proponents: Jonathan Humble, representing American Iron and Steel Institute (jhumble@steel.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

AISI

American Iron and Steel Institute
25 Massachusetts Avenue, NW, Suite 800
Washington, DC 20001

AISI S250-~~21~~ 22	North American Standard for Thermal Transmittance of Building Envelopes with Cold-Formed Steel Framing, with Supplement 1, dated 2022

Reason: Supplement #1 - 2022 modified Section B4.2 Standard Truss Framing equations by removing the parenthesis in the denominator, which were not intended to be included, in order to correctly illustrate the equation. No other modifications were made to Standard S250.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This modification to Standard S250 corrected an error to the 2021 edition.

Bibliography: AISI S250-21w/S1-22 North American Standard for Thermal Transmittance of Building Envelopes with Cold-Formed Steel Framing, American Iron and Steel Institute, Washington, DC, 2022.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: Agreed with the proponent's reason statement that this proposal corrected an error within the 2021 edition of the standard.

Proposal # 673

CED1-156-22

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

2024 International Energy Conservation Code [CE Project]

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.

ASHRAE

ASHRAE
180 Technology Parkway NW
Peachtree Corners, GA 30092

90.1—~~2019~~ 2022: Energy Standard for Buildings Except Low-rise Residential Buildings

Reason: ASHRAE 90.1-2022 will be published by November 2022 with updated mechanical efficiency tables. This change is a "marker" to have the IECC update its tables to be aligned with the updated values and metrics approved for ASHRAE 90.1-2022.

Cost Impact: The code change proposal will increase the cost of construction.
For buildings that use equipment where the efficiency values in the IECC are increased to match the values in ASHRAE 90.1-2022.

Where the efficiency values and metrics are the same in IECC 2021/2024 and ASHRAE 90.1-2022, there is no increase in the cost of construction.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: The proposal updates the table to match new DOE regulations, less those elements currently under legal challenge.

Proposal # 854

CED1-157-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

TABLE C403.3.2(6) GAS- AND OIL-FIRED BOILERS—MINIMUM EFFICIENCY REQUIREMENTS~~[i]~~

Portions of table not shown remain unchanged.

EQUIPMENT TYPE[b]	SUBCATEGORY OR RATING CONDITION	SIZE CATEGORY (INPUT)	~~MINIMUM EFFICIENCY~~	MINIMUM EFFICIENCY ~~AS OF 3/2/2022~~	TEST PROCEDURE[a]
Boilers, hot water	Gas fired	< 300,000 Btu/h[g, h] for applications outside US	~~82% AFUE~~	84~~2~~% AFUE	DOE 10 CFR 430 Appendix N
		≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h[e]	~~80% E_t[d]~~	84~~0~~% E_t[d]	DOE 10 CFR 431.86
		> 2,500,000 Btu/h and ≤ 10,000,000 Btu/h [b]	~~82% E_c[c]~~	82% E_c[c]	
		> 10,000,000 Btu/h [b]		82% E_c[c]	
	Oil fired[f]	< 300,000 Btu/h[g,h] for applications outside US	~~84% AFUE~~	86~~4~~% AFUE	DOE 10 CFR 430 Appendix N
		≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h[e]	~~82% E_t[d]~~	82% E_t[d]	DOE 10 CFR 431.86
		> 2,500,000 Btu/h and ≤ 10,000,000 Btu/h [b]	~~84% E_c[c]~~	84% E_c[c]	
		> 10,000,000 Btu/h [b]		84% E_c[c]	
Boilers, steam	Gas fired	< 300,000 Btu/h[g] for applications outside US	~~80% AFUE~~	82~~0~~% AFUE	DOE 10 CFR 430 Appendix N
	Gas fired-all, except natural draft	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h[e]	~~79% E_t[d]~~	79% E_t[d]	DOE 10 CFR 431.86
			~~79% E_t[d]~~	79% E_t[d]	
		>> 2,500,000 Btu/h and ≤ 10,000,000 Btu/h [b] 10,000,000 Btu/h [b]		79% E_t[d,i]	
	Gas fired—natural draft	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h[e]	77% E_t[d]	79% E_t[d]	
		> 2,500,000 Btu/h[b]	77% E_t[d]	79% E_t[d]	
	Oil fired[f]	< 300,000 Btu/h[g] for applications outside US	~~82% AFUE~~	82% AFUE	DOE 10 CFR 430 Appendix N
		≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h[e]	~~81% E_t[d]~~	84~~1~~% E_t[d]	DOE 10 CFR 431.86
		> 2,500,000 Btu/h and ≤ 10,000,000 Btu/h [b]	~~81% E_t[d]~~	81% E_t[d]	
		> 10,000,000 Btu/h [b]		81% E_t[d]	

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. This table is a replica of ASHRAE 90.1 Table 6.8.1-6 Gas- and Oil-Fired Boilers—Minimum Efficiency Requirements.~~

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 is permitted and meets Federal commercial packaged boiler energy conservation standards

Reason: On January 10, 2020 DOE published new boiler efficiency requirements for boilers manufacturer after 1/20/2023. This proposal updates the table for the 2024 IECC, with updates based on US DOE final rulemakings and removing values in effect for equipment installed before 3/2/2022. It also removes the reference to ASHRAE table under footnote i which may no longer apply until ASHRAE updates tables to reflect the proposed DOE rulemaking.
Finally, it removes the separate natural draft and non-natural draft commercial boiler categories as the new DOE rule does not differentiate efficiency requirements based on this technology. The one exception is for very large gas-fired boilers manufacturer prior to March 2022 which can have a 77% Et instead of 79% Et. Hence, a footnote is added to mark this single adjustment and shortens the table to avoid confusion.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This update simply aligns federal requirements with the efficiency tables listed in the IECC so they are up to date. These are DOE minimum efficiency standards and therefore no increase or decrease in cost is expected.

Bibliography: Energy Conservation Standards for Residential Boilers - Final Rule, US Department of Energy, Washington DC, January 10, 2020

https://www.ecfr.gov/current/title-10/chapter-II/subchapter-D/part-431/subpart-E/subject-group-ECFRe1ae92ed608f22e/section-431.87
Energy Conservation Standards for Residential Boilers - Final Rule, US Department of Energy, Washington DC, January 15, 2016 (as published in the US Federal Register, 81 Fed. Reg. 2320)

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: The residential boiler standards have been updated by DOE. However, even though DOE updated the commercial boiler energy conservation standards, there is a lawsuit to reverse the action that is still under contest. If the standards are reversed, jurisdictions that adopt the updated standards would be in violation of federal preemption, so those changes were struck from the proposal.

Proposal # 666

CED1-158-22

Proponents: Michael Tillou, representing Pacific Northwest National Laboratory (michael.tillou@pnnl.gov); Michael Rosenberg, representing Pacific Northwest National Laboratory (michael.rosenberg@pnnl.gov)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C403.3.4 Boilers. Boiler Systems shall comply with the following:

1. Combustion air positive shut-off shall be provided on all newly installed boiler systems that ~~complywith~~ meet one or more of the following conditions ~~as follows~~:

   1.1 ~~All boiler systems with an~~ The total input capacity is no less than ~~of~~ 2,500,000 Btu/h (732 kW) and ~~above~~ one or more of ~~in which~~ the boiler s ~~is~~ are designed to operate with a nonpositive vent static pressure.

   1.2 Any stack serving the ~~All~~ boiler system~~s~~ is connected to ~~where one stack serves~~ two or more boilers with a total combined input capacity ~~per stack~~ of not less than 2,500,000 Btu/h (732 kW).

2. ~~Each newly~~ Newly installed boilers or *boiler systems* with a ~~Boiler system~~ combustion air fan~~s with~~ motor~~s~~ *nameplate horsepower* rating of 10 horsepower (7.46 kW) or ~~larger~~ more shall comply with ~~meet~~ one of the following ~~for newly installed boilers~~:

   2.1 The fan motor shall be variable speed, or

   2.2 The fan motor shall include controls that ~~limit the fan motor demand to no more than 30 percent of the total design wattage at~~ modulate fan airflow as a function of the load to a ~~minimum~~ speed 50 percent or less of design air volume.

C403.3.4.1 Boiler oxygen concentration controls. Newly installed boilers with an input capacity of 5,000,000 Btu/h (1465 kW) and steady state full-load less than 90 percent shall maintain stack-gas oxygen concentrations not greater than the values specified in Table C403.3.4.1. Combustion air volume shall be controlled with respect to measured flue gas oxygen concentration. The use of a common gas and combustion air control linkage or jack shaft is not permitted ~~prohibited~~.

Exception: These concentration limits do not apply where 50 percent or more of the boiler system capacity serves Group R-2 occupancies.

TABLE C403.3.4.1 BOILER OXYGEN CONCENTRATIONS

Boiler ~~System~~ Application	~~Minimum~~ Maximum stack-gas oxygen concentration[a]
Commercial boilers or where ≤ 10% of the boiler system capacity is used for process applications at design conditions	5%
Process boilers	3%

a. Concentration levels measured by volume on a dry basis over firing rates of 20 to 100 percent.

Exception: These concentration limits do not apply 50 percent or more of the boiler system capacity serves Group R-2 occupancies.

Reason: This proposal is editorial and recommends alternative language to reduce ambiguity.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal is editorial and does not impact the cost effectiveness of the requirement.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: This proposal combines CED1-158-22 and CED1-159-22. Most of the changes are to add clarity. The 30 percent power at 50 percent speed for the fan was removed because boiler fans maintain constant pressure and do not move a long a system curve.

Proposal # 664

CED1-160-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C403.4.6.2 All other ~~HVAC~~ heating and cooling systems. Thermostats for ~~HVAC~~ heating and cooling systems shall be provided with a demand responsive control that complies with one of the following:

1. Certified OpenADR 2.0a VEN, as specified under Clause 11, Conformance
2. Certified OpenADR 2.0b VEN, as specified under Clause 11, Conformance
3. 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
4. IEC 62746-10-1
5. The communication protocol required by a controlling entity, such as a utility or service provider, to participate in an automated demand response program
6. The physical configuration and communication protocol of CTA 2045-A or CTA 2045-B.

C403.4.2.3 Optimum start and stop. Optimum start and stop controls shall be provided for each ~~HVAC~~ heating and cooling system with direct control of individual zones. The optimum start controls shall be configured to automatically adjust the daily start time of the ~~HVAC~~ heating and cooling system in order to bring each space to the desired occupied temperature immediately prior to scheduled occupancy. . The optimum stop controls shall be configured to reduce the ~~HVAC~~ heating and cooling system's heating temperature setpoint and increase the cooling temperature setpoint by not less than 2°F (1.11ºC) before scheduled unoccupied periods based on the thermal lag and acceptable drift in space temperature that is within comfort limits.

Exception: Dwelling units and sleeping units are not required to have optimum start controls.

C403.4.7 ~~HVAC~~ Heating and cooling system controls for operable openings to the outdoors . All doors from a conditioned space to the outdoors and all other operable openings from a conditioned space to the out-doors that are larger than 40 square feet (3.7 m^2) when fully open, shall have automatic controls interlocked with the heating and cooling system. The controls shall be configured to do the following within 5 minutes of opening:

1. Disable mechanical heating to the zone or reset the space heating temperature setpoint to 55°F (12.7°C) or less.
2. Disable mechanical cooling to the zone or reset the space cooling temperature setpoint to 90°F (32°C) or more. Mechanical cooling can remain enabled if the outdoor air temperature is below the space temperature.

Exceptions:

1. Building entrances with automatic closing devices.
2. Emergency exits with an automatic alarm that sounds when open.
3. Operable openings and doors serving enclosed spaces without a thermostat or ~~HVAC~~ heating or cooling temperature sensor.
4. Separately zoned areas associated with the preparation of food that contain appliances that contribute to the ~~HVAC~~ heating or cooling loads of a restaurant or similar type of occupancy.
5. Warehouses that utilize operable openings for the function of the occupancy where approved by the *code official*.
6. The first entrance doors where located in the exterior wall and are part of a vestibule system.
7. Operable openings into spaces served by radiant heating and cooling systems.
8. Alterations where walls would have to be opened solely for the purpose of meeting this requirement and where approved.
9. Doors served by air curtains meeting the requirements of Section C402.6.6.

Reason: Section C403.4 is entitled, "Heating and cooling system controls." As noted in the text within this charging section to subsection C403.4.6, the entire section is only applicable to controls for heating and cooling systems. A careful read of the subsections also supports the conclusion that the section only applies to controls for heating and cooling systems. To ensure that the terms in the section align with the meaning, please replace references to "HVAC" (i.e., heating, ventilation and cooling) with "heating and cooling."

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is an editorial clarification with no bearing on cost.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: This modification improves the language of this section.

Proposal # 623

CED1-161-22

Proponents: Reid Hart, representing Pacific Northwest National Laboratory (reid.hart@pnnl.gov); Michael Tillou, representing Pacific Northwest National Laboratory (michael.tillou@pnnl.gov); Ellen Franconi, representing Pacific Northwest National Laboratory (ellen.franconi@pnnl.gov)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C403.4.6 Demand responsive controls. Buildings 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. Controls that serve only fossil fuel equipment
6. Buildings that comply with Load Management measure G02 in Section C406.3.3

C406.3.3 G02 HVAC Load Management. Automatic load management controls shall be configured as follows:

1. Cooling termperature shift: Where electric cooling is in use ~~to~~ 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 ~~to~~ 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 ~~are~~ serv e ~~ing~~ multiple zones and have less than 70 percent outdoor air required, include controls that provide excess outdoor air preceding 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:

(Equation #)

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

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

Add new text as follows:

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

DEMAND RESPONSE SIGNAL AVAILABLE[a]	DEMAND RESPONSE REQUIRED BY SECTION C403.4.6.1[b]	INCLUDES VENTILATION SHIFT[c]	$EC_{G02\ Adj}$
No	No	Yes	100%
No	Yes	Yes	80%
Yes	No	Yes	80%
Yes	Yes	Yes	40%
No	No	No	70%
No	Yes	No	50%
Yes	No	No	50%
Yes	Yes	No	0%

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.

Reason: Providing an exception to HVAC demand response in Section C403.4.6 is appropriate where buildings comply with energy credit G02 in Section C406.3.3. G02 provides a generally superior method of control including gradually ramping temperature setpoints, ventilation deferment, and options for capacity reduction rather than temperature control. Further, G02 is not restricted to only open ADR methods, but can work with local building demand monitoring or a scheduled peak approach in smaller buildings. Including an exception for C403.4.6 also avoids the perception that a building must comply with both (possibly conflicting) requirements, as measures in C406 are chosen by the building designer to meet a required credit level.
To coordinate with C403.4.6 requirements, where an openADR demand response signal is available from the serving utility, the credits are reduced by half.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
In some cases the cost of construction is reduced, as the exception allows clear compliance with either requirement and not both.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: Standing on the reason statement with the proposal but with clearer language.

Proposal # 661

CED1-164-22

Proponents: Shannon Corcoran, representing American Gas Association (corcoransm@att.net); Renee Lani, representing American Public Gas Association (rlani@apga.org); Bruce Swiecicki, representing National Propane Gas Association (bswiecicki@npga.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C403.4.6 Demand responsive controls. ~~Buildings~~ 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. ~~Controls that serve only fossil fuel gas or fuel oil equipment~~

Reason: The term "fossil fuel" is an undefined term and should not be used in the IECC. In place of "fossil fuel", the terms "fuel gas or fuel oil" should be used. These terms are defined in the International Fuel Gas Code/National Fuel Gas Code or NFPA 31 respectively, and the terminology should be consistent amongst the various model codes.
There are 24 instances throughout the document where "fossil fuel" is used and should be changed to "fuel gas or fuel oil."

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposal does not change the cost of construction.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: The proposal clarifies that this section only applies to electric heating and cooling systems.

Proposal # 857

CED1-165-22

Proponents: Thomas Nagy, representing enVerid Systems (tnagy@enverid.com)

2024 International Energy Conservation Code [CE Project]

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).
4. 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.
5. 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.
6. ~~Spaces using air cleaning in compliance with the ASHRAE 62.1 Indoor Air Quality Procedure.~~ Spaces where the registered design professional demonstrates an engineered ventilation system design that complies with the following:

   6.1. It prevents the maximum concentration of contaminants from exceeding that obtainable by the required rate of outdoor air ventilation, and

   6.2 It allows the required minimum design rate of outdoor air to be reduced by no less than 15%.

Reason: There is a contradiction with ASHRAE Standard 62.1-2019 when it comes to using DCV. In section 6.2.6.1 of ASHRAE 62.1-2019 there is an exception that states the following: "CO_2-based DCV shall not be applied in zone with indoor sources of CO_2 other than occupants, or with CO_2 removal mechanisms, such as gaseous air cleaners." The reason for this is that using air cleaners with CO_2 scrubbing in conjunction with the Indoor Air Quality Procedure (IAQP) will allow for a lower OA minimum than the typical prescriptive OA minimum used with the ventilation rate procedure (VRP). If DCV was then used to lower the outside airflow further, that may lead to higher levels of other volatile organic compounds, above the acceptable limits.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This code change proposal will neither increase nor decrease the cost of construction.

Bibliography: ASHRAE 62.1-2019, page 25

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: To clarify DCV exception for engineered ventilation systems and for alignment with the International Mechanical Code.

Proposal # 862

CED1-166-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C403.7.2 Parking garage ventilation systems. Ventilation systems employed in enclosed parking garages ~~used for storing or handling automobiles operating under their own power~~ shall comply with Section 404.1 of the *International Mechanical Code* and the following: ~~meet all of the following~~:

1. Separate ventilation systems and control systems shall be provided for each parking garage section.
2. Control systems for each parking garage section shall ~~automatically detect and control contaminant levels in accordance with the *International Mechanical Code*, and~~ shall be capable of and configured to reduce fan airflow to not less than 0.05 cfm per square foot [0.00025 $m^3/(s \cdot m^2)$] of the floor area served and not more than 20 percent ~~or less~~ of the design capacity.
3. The ventilation system for each parking garage section shall have controls and devices that result in fan motor demand of no more than 30 percent of design wattage at 50 percent of the design airflow.

Exception: Garage ventilation systems serving a single parking garage section having a total ventilation system motor nameplate horsepower (ventilation system motor nameplate kilowatt) not exceeding 5 hp (3.7 kW) at fan system design conditions and where the parking garage section has no mechanical cooling or mechanical heating.

Nothing in this section shall be construed to require more than one parking garage section in any parking structure.

PARKING GARAGE SECTION. A part of an enclosed parking garage that is separated from all other parts of the garage by full-height solid walls or operable openings that are intended to remain closed during normal operation and where vehicles cannot pass to other parts of the garage. A parking garage can have one or more parking garage sections and parking garage sections can include multiple floors. ~~It may include multiple floors if there are ramps to allow vehicles to pass between the floors~~.

Reason: C403.7.2, as drafted, eliminates the distinction between enclosed and open parking garages. This would require ventilation systems even in garage systems open to exterior atmosphere. Further, the proposal does not clearly correlate with the International Mechanical Code.
The proposed resolution directs users to the IMC for pollutant detection and control. It also specifies the minimum standby ventilation rate required by the IMC of 0.05 cfm per square foot of the floor area served. This better correlates with IMC.

The proposed resolution also clarifies that an enclosed parking garage may have only one section, which was clearly stated in the foreword to ASHRAE 90.1-2019 Addendum d.

Several editorial improvements are suggested.

On cost justification: It simply is not adequate to say something is cost effective because of the opinion of the ASHRAE 90.1 committee. If it existed, the proponents of CECPI-6-21 - the original code change - should provide the same data and calculations that the 90.1 committee relied upon when it decided to publish Addendum d to ASHRAE 90.1-2019. Note that cost-effectiveness was not actually calculated for Addendum d. Instead, the foreword to Addendum d stated this:

"*Cost effectiveness is assured by the LCCA done for VAV systems, variable-flow chilled-water pumps, and cooling tower fans, which have the same 5 hp threshold yet operate fewer hours and/or much less turndown than garage ventilation fans.*"

In other words, the rationale for CECPI-6-21 relied upon cost justification that was not done.

The original proponents of CECPI-6-21 should do their own arithmetic and show the consensus committee the numbers.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Some costs may be avoided through clearer language.

Bibliography:
https://www.ashrae.org/file%20library/technical%20resources/standards%20and%20guidelines/standards%20addenda/90_1_2019_d_20210104.pdf

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: The proposal adds clarity to the parking garage ventilation requirements.

Proposal # 677

CED1-167-22

Proponents: Alex Smith, representing NAHB (asmith@nahb.org); Greg Johnson, representing National Multifamily Housing Council (gjohnsonconsulting@gmail.com); Armin Rudd, representing self, Principal (arudd@absystems.us)

2024 International Energy Conservation Code [CE Project]

C403.7.4 Energy recovery systems. Energy recovery ventilation systems shall be provided as specified in either Section C403.7.4.1 or C403.7.4.2, as applicable.

Revise as follows:

C403.7.4.1 Nontransient dwelling units. Nontransient dwelling units shall be provided with outdoor air energy recovery ventilation systems with an *enthalpy recovery ratio* of not less than 50 percent at cooling design condition and not less than 60 percent at heating design condition.

Exceptions:

1. Nontransient dwelling units in Climate Zone 3C.
2. Nontransient dwelling units with not more than 500 square feet (46 m^2) of *conditioned floor area* in Climate Zones 0, 1, 2, 3, 4C and 5C ~~and either adjoin an open-ended corridor or do not adjoin a corridor.~~.
3. ~~Nontransient dwelling units with not more than 500 square feet (46 m^2) of conditioned floor area that are located in Climate Zones 1A, 2B, 3B, and 3C.~~

~~4.~~ 3. *Enthalpy recovery ratio* requirements at heating design condition in Climate Zones 0, 1 and 2.

~~5.~~ 4. *Enthalpy recovery ratio* requirements at cooling design condition in Climate Zones 4, 5, 6, 7 and 8.

Reason: “Corridor” is not defined in Chapter 2 Definitions and adds a restriction that is not supported by the cost-effectiveness analysis provided. The cost-effectiveness analysis provided with this change had significant issues that must be addressed before the proposal can go forward. The proponent hand-picked the most favorable set of inputs and design assumptions possible to help justify the proposal. A more representative and evenhanded analysis will significantly change the results. We are prepared to review the analysis with the proponent in detail. This change applies only to very small apartments - 500 sqft or less - the most affordable type of housing. Just a few issues are mentioned below:

o The baseline case used for comparing the proposal assumes a balanced system without HRV/ERV. This is the most favorable point of comparison and a system that is not commonly used in practice. Section 403 of the IMC allows other ventilation options that are commonly used in buildings. This assumption by the proponent significantly overestimates the energy savings from installing HRV/ERV and significantly underestimates the incremental costs.

o One hour of labor for installing HRV/ERV significantly underestimates the level of effort that would be needed.

o The proponent does not explain the indoor ERV duct connections or ventilation air distribution strategy. These assumptions make a significant difference in energy use and construction costs and must be disclosed so that reviewers can evaluate this aspect of the analysis. These design choices also can make HRV/ERV unacceptable to the occupant.

o The proponent removes independent bathroom fan exhausts and combines ducting of all bathroom exhausts with the ERV. This strategy will not be acceptable to many designers and occupants. In addition, the analysis did not account for a needed boost in capacity when bathrooms are being used.

Cost Impact: The code change proposal will decrease the cost of construction.
This change will restore the exception for very small dwelling units (500 sqft and less) and will decrease the cost of construction for the most affordable type of housing -- small apartment units.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: To clarify DCV exception for engineered ventilation systems and for alignment with the International Mechanical Code.

Proposal # 679

CED1-168-22

IECC: C403.7.8, C403.7.8.1, C403.7.8.2

Proponents: Michael Tillou, representing Pacific Northwest National Laboratory (michael.tillou@pnnl.gov); Michael Rosenberg, representing Pacific Northwest National Laboratory (michael.rosenberg@pnnl.gov)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C403.7.8 Occupied standby controls. Occupied-standby controls, in accordance with C403.7.8.1 ~~and C403.7.8.2~~ , shall be ~~are~~ required for each zone of a system that complies with the following: ~~zones and systems serving zones where all spaces served by the zone are required to have occupant sensor lighting controls by Section C405.2.1 and are an ASHRAE Standard 62.1 occupancy category where the ASHRAE Standard 62.1 Ventilation Rate Procedure allows the ventilation air to be reduced to zero when the space is in occupied-standby mode.~~

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.

~~Spaces meeting these criteria include:~~

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

C403.7.8.1 Occupied Standby Zone Controls. ~~For zones meeting the occupied-standby control criteria, within~~ Within five (5) minutes of all ~~rooms~~ spaces in that zone entering *occupied-standby mode*, the zone control shall operate as follows:

1. Active heating set point shall be setback ~~at least~~ by not less than 1°F (0.55°C).
2. Active cooling set point shall be setup ~~at least~~ 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

~~**Exception:** Multiple zone systems without automatic zone flow control dampers.~~

~~**C403.7.8.2**~~ **C403.7.8.1.1** ~~**Occupied Standby System Controls**~~ **Multiple zone system controls.** Multiple zone systems required to ~~that can~~ automatically reset the effective minimum outdoor air setpoint , per Section C403.6.6 ~~and that serve zones with occupied-standby zone controls~~ shall reset the effective minimum outdoor air set-point based on a zone outdoor air requirement of zero for all zones in *occupied-standby mode*. Sequences of operation for system outside air reset shall comply with an approved method.

Reason: This proposal is editorial and recommends alternative language to reduce ambiguity.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal is editorial and does not impact cost effectiveness.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified
Commercial Energy Committee Reason: This modification improves the language of this section.

CED1-172-22

Proponents: Reid Hart, representing Pacific Northwest National Laboratory (reid.hart@pnnl.gov); Michael Tillou, representing Pacific Northwest National Laboratory (michael.tillou@pnnl.gov)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

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

Portions of table not shown remain unchanged.

ID	Energy Credit Measure	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
W09	SHW ~~distribution sizing~~	C406.2.3.5	~~45~~	~~46~~	~~55~~	~~54~~	~~63~~	~~65~~	~~74~~	~~73~~	~~89~~	~~75~~	~~80~~	~~89~~	~~74~~	~~81~~	~~95~~	~~68~~	~~77~~	~~72~~	~~70~~
W09	SHW flow reduction	C406.2.3.5	22	22	27	26	31	32	37	37	45	38	40	45	38	41	48	35	39	37	36

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

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

Portions of table not shown remain unchanged.

ID	Energy Credit Measure	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
W09	SHW flow reduction	C406.2.3.5	~~13~~	~~14~~	~~16~~	~~16~~	~~18~~	~~20~~	~~22~~	~~22~~	~~23~~	~~25~~	~~25~~	~~28~~	~~27~~	~~26~~	~~29~~	~~26~~	~~27~~	~~26~~	~~25~~
W09	SHW flow reduction	C406.2.3.5	<u>6</u>	<u>7</u>	<u>8</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>13</u>	<u>14</u>	<u>14</u>	<u>13</u>	<u>15</u>	<u>13</u>	<u>14</u>	<u>14</u>	<u>13</u>

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

TABLE C406.2.3.4 Maximum Flow Rating for Residential Plumbing Fixtures with Heated Water

Plumbing Fixture	Maximum Flow Rate
Faucet for private lavatory,[a] hand sinks, or bar sinks	~~1.50~~ 1.2 gpm at 60 psi (~~0.095 L/s~~ 4.5 L/m at 410 kPa)
Faucet for residential kitchen sink [a,b, c]	1.8 gpm at 60 psi ~~0.11 L/s~~ 6.8 L/m at 410 kPa)
Shower head (including hand-held shower spray) [a, b, d]	~~2.0~~ 1.8 gpm at 80 psi (~~0.13 L/s~~ 6.8 L/m at 550 kPa)

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 (~~0.14 L/s~~ 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.

Reason: The uniform pluming code recently lowered the flow limit for showerheads from 2.5 to 2.0 gpm (9.5 to 7.6 L/m). To maintain a savings for this energy credit measure, the limit for measure W09 is reduced to 1.8 gpm (6.8 L/m). In addition, other residential fixture flow is reduced to 1.2 gpm (4.5 L/m) This aligns with appliance standards in California, Colorado, Washington and possibly other jurisdictions. In addition, the maximum flow for residential lavatory fixtures is reduced to 1.2 gpm (4.5 L/m), aligning with those jurisdictions.
The energy impact was reanalyzed with the new differentials between base and improved, with the energy credits being cut in half.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The lower flow fixtures are readily available nationally, and there is not a cost increase related to flow. The primary cost driver for these finish pluming fixtures is related to finish and other parameters.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: The uniform pluming code recently lowered the flow limit for showerheads from 2.5 to 2.0 gpm (9.5 to 7.6 L/m). To maintain a savings for this energy credit measure, the limit for measure W09 is reduced to 1.8 gpm (6.8 L/m). In addition, other residential fixture flow is reduced to 1.2 gpm (4.5 L/m) This aligns with appliance standards in California, Colorado, Washington and possibly other jurisdictions. In addition, the maximum flow for residential lavatory fixtures is reduced to 1.2 gpm (4.5 L/m), aligning with those jurisdictions.
The energy impact was reanalyzed with the new differentials between base and improved, with the energy credits being cut in half.

Proposal # 655

CED1-173-22

Proponents: Reid Hart, representing Pacific Northwest National Laboratory (reid.hart@pnnl.gov); Michael Tillou, representing Pacific Northwest National Laboratory (michael.tillou@pnnl.gov)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

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 ~~outdoor~~ supply air.
2. Outdoor air shall be supplied by an independent ventilation system designed to provide no more than ~~110~~ 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 dehumidification 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:

(Equation 4-20)

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

Where:

EC_{DOAS}= Energy credits achieved for H05 ~~H06~~

EC_{base}= H05 ~~H06~~ 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.

Reason: Three minor changes are made to energy credit measure H05 (DOAS) to allow for flexibility.

1. The reference to heating/cooling supply fan operation during ventilation only mode of 0.12 W/cfm is changed from outdoor air to supply air. This is intended to allow continuous operation of destratification convective cooling fans or VRF cassette fans at low speed when heating or cooling is not active.
2. The maximum normal operation outdoor air is increased from 110% to 130% of the IMC minimum outdoor air required to allow for LEED indoor air quality points.
3. An exception for increased economizer operation of the DOAS system is added along with an allowance for emergency outdoor air flushing of spaces. An increased airflow economizer approach can save energy two ways: 1) using cool outdoor air instead of mechanical cooling, and 2) oversizing the ductwork for economizer operation resulting in reduced fan energy during normal operation.

In addition, there are editorial corrections in the formula symbols section.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The changes allow for optional additional controls or increased ductwork sizing that are not required. This measure is not a requirement of the code as it is one of multiple additional energy credit options that can be selected to meet C406 requirements.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: Three minor changes are made to energy credit measure H05 (DOAS) to allow for flexibility.

Proposal # 657

CED1-174-22

Proponents: Reid Hart, representing Pacific Northwest National Laboratory (reid.hart@pnnl.gov)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C406.2.3.2 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. **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.
2. **W05 Point of use water heaters.** Credits are available for office or school buildings larger than 5000 square feet ~~10,000 ft^2~~ (~~930~~ 460 m^2) where service water heating systems meet the following requirements:

   2.1. Fixtures requiring hot water shall be supplied from a local ~~ized source of hot~~ 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.

   2.2. 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. ~~C403.12.3 without e~~

   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.

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

   ~~2.1~~ 2.3.1. Non-residential ~~lavatories~~ Public lavatory faucets that are available for use by members of the general public : not more than 2 oz (60 mL)

   2.3.2 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.

   ~~2.2~~ 2.3.3. All other plumbing fixtures or appliances: not more than ~~0.25 gallons~~ 16 oz (~~0.95~~ 0.5 L)

   ~~**Exception:** Where all remotely located hot water uses meet the requirements for measure W05, separate water heaters serving commercial kitchens or showers in locker rooms shall be permitted to have a local recirculating system or heat trace piping.~~

3. **W06 Thermostatic balancing valves.** Credits are available where service water heating is provided centrally and distributed throughout the building. 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 115°F (46°C).
4. **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.

Reason: The changes are primarily editorial and for purposes of clarification. Two substantial changes include:
- Reducing the size of building where the credit is allowed, allowing for more applicability.
- Reducing the volume of fluid in the piping to other fixtures to 16 ounces. With 3/8" supply piping, a 3 or 4 floor stack of restrooms with 4 lavatories on each floor can be effectively served while allowing timely delivery of hot water to the fixtures.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The measure can be selected from a number of options, so this measure (W05) is not specifically required by the code.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: The changes are primarily editorial and for purposes of clarification. Three substantial changes include:
1)Reducing the size of building where the credit is allowed, allowing for more applicability.

2)The IECC HVACR and Water Heating Subcommittee added water piping volume requirements for commercial kitchens and showers.

3)Reducing the volume of fluid in the piping to other fixtures to 16 ounces. With 3/8" supply piping, a 3 floor stack of restrooms with 4 lavatories on each floor can be effectively served while allowing timely delivery of hot water to the fixtures.

Proposal # 671

CED1-175-22

Proponents: Reid Hart, representing Pacific Northwest National Laboratory (reid.hart@pnnl.gov); Michael Tillou, representing Pacific Northwest National Laboratory (michael.tillou@pnnl.gov)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C406.3 Renewable and Load Management Credits ~~achieved~~ Achieved. Renewable energy and load management measures shall achieve credits as follows:
~~installed in the building that comply with Sections C406.3.1 through C406.3.8 shall achieve the credits listed for the occupancy group in Tables C406.3(1) through C406.3(9) or where calculations are required in Sections C406.3 to determine credits or modify the table credits, the credits achieved shall be based upon the Section C406.3 calculations.~~

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 ~~1~~ The measure credit shall be the base ~~energy~~ 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 ~~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 measure 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 ~~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 ~~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 ~~3~~. 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 ~~4~~. An interface that complies with the communication protocol required by a controlling entity, to participate in an automated demand response program, or

3.7 ~~5~~. Where the controlling entity does not have a *demand response signal* ~~program or protocol~~ available for the building type and size, local ~~demand response~~ load management control shall be provided based on either:

3.7.1 ~~5.1~~ 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 ~~5.2~~ 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.

Reason: The proposed changes provide structure and clarification while reducing redundancy. There is no change in requirements.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The changes are editorial for clarification and do not change any requirements.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: This proposal provides clarification for achieving C406 renewable and load management credits. The proposal does not change any of the requirements.

Proposal # 672

CED1-176-22

Proponents: Reid Hart, representing Pacific Northwest National Laboratory (reid.hart@pnnl.gov); Michael Tillou, representing Pacific Northwest National Laboratory (michael.tillou@pnnl.gov)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C406.3.7 G06 SWH Energy Storage. Where SHW is heated by electricity, automatic load management controls that 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. ~~Where heat pump water heating is used, the credits achieved shall be 1/3 of the credits in Tables C406.3(1) through C406.3(9).~~

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

(Equation #)

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

where:

$EC_{G06\ ach}$ = 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

Add new text as follows:

TABLE C406.3.7 Energy Credit Adjustment Based on Use of Heat Pump Water Heater or Demand Response

DEMAND RESPONSE READY PER SECTION C404.10	DEMAND RESPONSE SIGNAL AVAILABLE[a]	HAS HPWH	$EC_{GO6\ Adj}$[b]
NO	NA	NO	100%
NO	NA	YES	33%
YES	NO	NO	50%
YES	NO	YES	17%
YES	YES	NA	0%

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.

Reason: The credit adjustments added here account for the difference between a capability being required in the base code and full implementation though the credit measure. Full credit is given here when either the base code requirement does not apply or there is not a demand response program available. Half credit is given when there is a demand response program and the base code requires compatible demand response controls.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The changes here are in response to base code changes and allow for partial credit when there is a capability requirement in the base code that is fully implemented here.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: Ensures that double credit is not given where baseline DR requirements exist. The modified proposal is clearer than the original.

Proposal # 699

CED1-177-22

Proponents: Aaron McEwin, representing Industry Professional (amcewin@jordanskala.com)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C408.2 Mechanical systems and service water-heating systems commissioning and completion requirements. Prior to the final mechanical and plumbing inspections, the *registered design professional or approved agency* shall provide evidence of mechanical systems *commissioning* and completion in accordance with the provisions of this section.
Construction document notes shall clearly indicate provisions for *commissioning* and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the owner or owner's authorized agent and made available to the *code official* upon request in accordance with Sections C408.2.4 and C408.2.5.

Exceptions: The following systems are exempt:

1. Buildings with less than 10,000 square feet (929 m^2) <u>gross conditioned floor area</u> andcombined heating, cooling, and service water-heating capacity of less than 960,000 Btu/h (280kW).

~~2. Systems included in Section C403.5 that serve individual dwelling units and sleeping units.~~

<u>2. Components within dwelling units and sleeping units served on of the following systems:</u>

2.1. <u>Simple unitary or packaged HVAC equipment listed in Table C403.3.2(1), Table C403.3.2(2), Table C403.3.2(4), Table C403.3.2(5) each serving one zone and controlled by a single thermostat in the zone served.</u>

2.2 <u>Two-pipe heating systems installed in the dwelling serving one or more zones.</u>

Reason: Under the 2012 IECC, the referenced section referred to "Simple" Systems. In the 2015 IECC, the definition of "Simple" system was removed and only the "Economizer" section was provided. The "Economizer" Section was referenced and did not make since from a commissioning stand point since economizers generally have complex controls that activate mechanical dampers based on a control input (i.e. dry bulb, enthalpy, etc.).
This change gets back to the original intent of less complex systems that serve individual dwelling units and sleeping units do not need to be commissioned.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This clarifies the original intent of the commissioning section prior to the removal of the "Simple" system section of the code.

A: It is the opinion of staff that Exception 2 of Section C408.2 only applies to packaged and split systems serving individual sleeping units and dwelling units. Subject to the approval of the Code Official, it is reasonable to determine that the intent of Exception 2 of Section C408.2 in the 2015 IECC is to exempt HVAC systems that serve individual sleeping units and dwelling units from the commissioning requirement when the systems are packaged or split systems. Exception 2 Section C408.2 of the 2015 IECC states the following.

"Systems included in Section C403.3 that serve individual dwelling units and sleeping units."

Note that Section C403.3 of the 2015 IECC is an economizer provision and does not provide specific language for dwelling units and sleeping units.

In the 2012 IECC Exception 2 of Section C408.2 had similar language. It stated the following.

"Systems included in Section C403.3 that serve dwelling units and sleeping units in hotels, motels, boarding houses or similar units."

Section C403.3 of the 2012 IECC stated the following.

"**C403.3 Simple HVAC systems and equipment (Prescriptive).** This section applies to buildings served by unitary or packaged HVAC equipment listed in Tables C403.2.3(1) through C403.2.3(8), each serving one zone and controlled by a single thermostat in the zone served. It also applies to two-pipe heating systems serving one or more zones, where no cooling system is installed."

In the 2012 IECC the intent of Exception 2 of Section C408.2 was to exempt the dwelling units and sleeping units described when they were served by simple HVAC systems that met the criteria of Section C403.3 (Simple HVAC systems). Exception 2 of Section C408.2 of the 2012 IECC was brought into the code through Public Comment 4 of the code change proposal EC147-09/10. EC147-09/10 was approved as modified with several public comments, including Public Comment 4. A portion of the reason statement for Public Comment 4 stated the following.

"… An exception was also placed in the requirements that will exempt systems installed in hotel/motel and high-rise residential that meet the simple building definition in Section 503.3. This will, for example, exempt packaged terminal heat pump (PTHP) systems commonly used in hotel/motel sleeping rooms that are intermittently occupied and where there may be additional costs of commissioning multiple small systems."

During the 2015 code development cycle Sections C403.3 of the 2012 IECC and C403.4 of the 2012 IECC were modified to, among other things, remove the distinction between simple and complex HVAC systems to make the 2015 IECC more user-friendly. In the process Section C403.3.1 of the 2012 IECC (Economizers) was renumbered to Section C403.3 of the 2015 IECC (Economizers).

Attached Files

- **C408.2 Clarification.pdf**
  https://energy.cdpaccess.com/proposal/775/2978/files/download/348/

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: To clarify the commissioning requirements for simple systems and the exception for certain components within dwelling units.

Proposal # 775

CED1-182-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

THERMAL BLOCK. A generic concept used in energy simulation. It can include one or more thermal zones. It represents a whole building or portion of a building with the same use type served by the same HVAC system type.

C409.3 Core & Shell / Initial Build-Out, and Future System Construction Analysis. Where the building permit applies to only a portion of the HVAC system in a *building* and the remaining components will be designed under a future building permit or were previously installed, the future or previously installed components shall be modeled as follows:

1. Where the HVAC zones that do not include HVAC systems in the current permit will be or are served by independent systems, then the thermal block including those zones shall not be included in the model.
2. Where the HVAC zones that do not include complete HVAC systems in the permit are intended to receive HVAC services from systems in the permit, their proposed zonal systems shall be modeled with equipment that meets, but does not exceed, the requirements of Section C403.
3. Where the zone equipment in the permit receives HVAC services from previously installed systems that are not in the permit, the previously installed systems shall be modeled with equipment matching the certified value of what is installed or equipment that meets the requirements of Section C403.
4. Where the central plant heating and cooling equipment is completely replaced and HVAC zones with existing systems receive HVAC services from systems in the permit, their proposed zonal systems shall be modeled with equipment that meets, but does not exceed, the requirements of Section C403.

C409.5.3.1 Compliance Report. Building permit submittals shall include:

1. A report produced by the simulation software that includes the following:

    1.1 Address of the building.

    1.2 Name of individual completing the compliance report.

    1.3 Name and version of the compliance software tool

    1.4 The dimensions, floor heights and number of floors for each thermal block.

    1.5 By thermal block, the U-factor, C-factor, or F-factor for each simulated opaque envelope component and the U-factor and SHGC for each fenestration component.

    1.6 By thermal block or by surface for each thermal block, the fenestration area.

    1.7 By thermal block, a list of the HVAC equipment simulated in the proposed design including the equipment type, fuel type, equipment efficiencies and system controls.

    1.8 Annual site HVAC energy use by end use for the proposed and baseline building.

    1.9 Annual sum of heating and cooling loads for the baseline building.

    1.10 The HVAC total system performance ratio for both the standard reference design and the proposed design.

2. A mapping of the actual building HVAC component characteristics and those simulated in the proposed design showing how individual pieces of HVAC equipment identified above have been combined into average inputs as required by Section C409.6.1.10 including:

   2.1 Fans

   2.2 Hydronic pumps

   2.3 Air handlers

   2.4 Packaged cooling equipment

   2.5 Furnaces

   2.6 Heat pumps

   2.7 Boilers

   2.8 Chillers

   2.9 Heat rejection equipment (open and closed-circuit cooling towers; dry coolers)

   2.10 Electric resistance coils

   2.11 Condensing units

   2.12 Motors for fans and pumps

   2.13 Energy recovery devices

3. For each piece of equipment identified above include the following as applicable:

   3.1 Equipment name or tag consistent with that found on the design documents.

   3.2 Rated Efficiency level.

   3.3 Rated Capacity.

   3.4 Where not provided by the simulation program report in item a, documention of the calculation of any weighted equipment efficiencies input into the program.

   3.5 Electrical input power for fans and pumps (before any speed or frequency control device) at design condition and calculation of input value (W/cfm or W/gpm).

4. Floor plan of the building identifying:

   4.1 How portions of the buildings are assigned to the simulated thermal blocks.

   4.2 Areas of the building that are not covered under the requirements of Section C403.1.1.

C409.6.1.1 ~~Block~~ Thermal block Geometry. The geometry of buildings shall be configured using one or more thermal blocks. Each thermal block shall define attributes including thermal block dimensions, number of floors, floor to floor height and floor to ceiling height. Simulation software may allow the use of simplified shapes (such as rectangle, L shape, H Shape, U shape or T shape) to represent thermal blocks. Where actual building shape does not match these pre-defined shapes, simplifications are permitted providing the following requirements are met:

1. The conditioned floor area and volume of each thermal block shall match the proposed design within 10 percent.
2. The area of each exterior envelope component from Table C402.1.4 is accounted for within 10 percent of the actual design.
3. The area of vertical fenestration and skylights is accounted for within 10 percent of the actual design.
4. The orientation of each component in 2 and 3 above is accounted for within 45 degrees of the actual design.

The creation of additional thermal blocks may be necessary to meet these requirements. A more complex zoning of the building shall be allowed where all thermal zones in the reference and proposed model are the same and rules related to thermal block geometry and HVAC system assignment to thermal blocks are met with appropriate assignment to thermal zones.

Exception: Portions of the building that are unconditioned or served by systems not covered by the requirements of Section C403.1.1 shall be omitted.

C409.6.1.1.1 Number of ~~Blocks~~ thermal blocks. One or more thermal blocks may be required per building based on the following restrictions:

1. Each thermal *block* can have only one occupancy type (multifamily *dwelling unit*, multifamily common area, office, library, education, hotel/motel or retail). Therefore, at least one single thermal *block* shall be created for each unique use type.

2. Each thermal block can be served by only one type of HVAC system. Therefore, a single block shall be created for each unique HVAC system and use type combination. Multiple HVAC units of the same type may be represented in one thermal block. Table D601.10.2 provides directions for combining multiple HVAC units or components of the same type into a single block.
3. Each thermal block can have a single definition of floor to floor or floor to ceiling heights. Where floor heights differ by more than two feet, unique thermal blocks should be created for the floors with varying heights.
4. Each block can include either above grade or below grade floors. For buildings with both above grade and below grade floors, separate blocks should be created for each. For buildings with floors partially above grade and partially below grade, if the total wall area of the floor(s) in consideration is greater than or equal to 50 percent above grade, then it should be simulated as a completely above grade block, otherwise it should be simulated as a below grade block.
5. Each wall on a façade of a block shall have similar vertical fenestration. The product of the proposed design U-factor times the area of windows (UA) on each façade of a given floor cannot differ by more than 15 percent of the average UA for that façade in each block. The product of the proposed design SHGC times the area of windows (SHGCA) on each façade of a given floor cannot differ by more than 15 percent of the average SHGCA for that façade in each block. If either of these conditions are not met, additional blocks shall be created consisting of floors with similar fenestration.
6. For a building model with multiple blocks, the blocks should be configured together to have the same adjacencies as the actual building design.

C409.6.1.2 Thermal Zoning. Each floor in a thermal block shall be modeled as a single thermal zone or as five thermal zones consisting of four perimeter zones and a core zone. Below grade floors shall be modeled as a single thermal block. If any façade in the thermal block is less than 45 feet in length, there shall only be a single thermal zone per floor. Otherwise each floor shall be modeled with five thermal zones. A perimeter zone shall be created extending from each façade to a depth of 15 feet. Where facades intersect, the zone boundary shall be formed by a 45 degree angle with the two facades. The remaining area or each floor shall be modeled as a core zone with no exterior walls.

C409.6.1.3.1 Occupancy Type. The occupancy type for each thermal block shall be consistent with the building area type as determined in accordance with Section C405.4.2.1. Portions of the building that are building area types other than multifamily dwelling unit, multifamily common area, office, school (education), library, or retail shall not be included in the simulation. Surfaces adjacent to such building portions shall be modeled as adiabatic in the simulation program.

C409.6.1.4.1 Roofs. Roofs will be modeled with insulation above a steel roof deck. The roof U-factor and area shall be modeled as in the proposed design. If different roof thermal properties are present in a single thermal block, an area weighted U-factor shall be used. Roof solar absorptance shall be modeled at 0.70 and emittance at 0.90.

C409.6.1.4.2 Above grade walls. Walls will be modeled as steel frame construction. The U-factor and area of above grade walls shall be modeled as in the proposed design. If different wall constructions exist on the façade of a thermal block an area-weighted U-factor shall be used.

C409.6.1.4.3 Below grade walls. The C-factor and area of below grade walls shall be modeled as in the proposed design. If different slab on grade floor constructions exist in a thermal block, an area-weighted C- factor shall be used.

C409.6.1.4.4 Above grade exterior floors. Exterior floors shall be modeled as steel frame. The U-factor and area of floors shall be modeled as in the proposed design. If different wall constructions exist in the thermal block an area-weighted U-factor shall be used.

C409.6.1.4.5 Slab on grade floors. The F-factor and area of slab on grade floors shall be modeled as in the proposed design. If different below grade wall constructions exist in a thermal block, an area-weighted F- factor shall be used.

C409.6.1.4.6 Vertical Fenestration. The window area and area weighted U-factor and SHGC shall be modeled for each façade based on the proposed design. Each exterior surface in a thermal block must comply with Section C409.6.1.1.1 item 5. Windows will be combined into a single window centered on each façade based on the area and sill height input by the user. When different U values, SHGC or sill heights exist on a single facade, area weighted average for each shall be input by the user.

C409.6.1.10.2 Proposed building HVAC system simulation. The HVAC systems shall be modeled as in the proposed design at design conditions unless otherwise stated with clarifications and simplifications as described in Tables C409.6.1.10.2(1) and C409.6.1.10.2(2). System parameters not described in the following sections shall be simulated to meet the minimum requirements of Section C403. All zones within a thermal block shall be served by the same HVAC system type as described in Section C409.6.1.1.1 item 2. Heat loss from ducts and pipes shall not be modeled. Table C409.6.1.10.2(1) Proposed Building System Parameters are based on input of full-load equipment efficiencies with adjustment using part-load curves integrated in the simulation program. Where other approaches to part-load adjustment are used, it is permitted for specific input parameter to vary. The simulation program shall model part-load HVAC equipment performance using either:

1. Full-load efficiency adjusted for fan power input that is modeled separately and typical part-load performance adjustments for the proposed equipment.
2. Part-load adjustments based on input of both full-load and part-load metrics, or
3. Equipment-specific adjustments based on performance data provided by the equipment manufacturer for the proposed equipment.

Where multiple system components serve a thermal block, average values weighed by the appropriate metric as described in this section shall be used.

1. Where multiple fan systems serve a single thermal block, fan power shall be based on weighted average using the design supply air cfm
2. Where multiple cooling systems serve a single thermal block, COP shall be based on a weighted average using cooling capacity. DX coils shall be entered as multi-stage if more than 50 percent of coil capacity serving the thermal block is multi-stage with staged controls.
3. Where multiple heating systems serve a single thermal block, thermal efficiency or heating COP shall be based on a weighted average using heating capacity.
4. Where multiple boilers or chillers serve a heating water or chilled water loop, efficiency shall be based on a weighted average for using heating or cooling capacity.
5. When multiple cooling towers serving a condenser water loop are combined, the cooling tower efficiency, cooling tower design approach and design range are based on a weighted average of the design water flow rate through each cooling tower.
6. Where multiple pumps serve a heating water, chilled water or condenser water loop, pump power shall be based on a weighted average for using design water flow rate.
7. When multiple system types with and without economizers are combined, the economizer maximum outside air fraction of the combined system shall be based on weighted average of 100 percent supply air for systems with economizers and design outdoor air for systems without economizers.
8. Multiple systems with and without ERVs cannot be combined.
9. Systems with and without supply air temperature reset cannot be combined.
10. Systems with different fan control (constant volume, multi-speed or VAV) for supply fans cannot be combined.

TABLE C409.6.1.10.2(1) PROPOSED BUILDING SYSTEM PARAMETERS

Category	Parameter	Fixed or User Defined	Required	Applicable Systems
HVAC System Type	System Type	User Defined	Selected from Table C409.6.1.10.1	All
System Sizing	Design Day Information	Fixed	99.6% heating design and 1% dry-bulb and 1% wet-bulb cooling design	All
	Zone Coil Capacity	Fixed	Sizing factors used are 1.25 for heating equipment and 1.15 for cooling equipment	All
	Supply Airflow	Fixed	Based on a supply-air-to-room-air temperature set-point difference of 20°F(11.11°C) or	1-11
		Fixed	Equal to required outdoor air ventilation	12
Outdoor Ventilation Air	Portion of supply air with proposed Filter ≥MERV 13	User defined	Percentage of supply air flow subject to higher filtration (Adjusts baseline Fan Power higher. Prorated)	All
	Outdoor Ventilation Air Flow Rate	Fixed	As specified in ASHRAE Standard 90.1 Normative Appendix C, adjusted for proposed DCV control	All
	Outdoor Ventilation Supply Air Flow Rate Adjustments	Fixed	Based on ASHRAE Standard 62.1 Section 6.2.4.3 System Ventilation Efficiency (Evs) is 0.75	9-11
		Fixed	System Ventilation Efficiency (Evs) is 1.0	1-8, 12
		Fixed	Basis is 1.0 Zone Air Distribution Effectiveness	All
System Operation	Space temperature set points	Fixed	As specified in ASHRAE Standard 90.1 Normative Appendix C, except -multifamily which shall use 68°F(20°C) heating and 76°F(24.4°C) cooling setpoints. -hotel/motel that shall be 70°F(21.1°C) heating and 72°F(22.2°C) cooling	1-11
	Fan Operation – Occupied	User defined	Runs continuously during occupied hours or cycles to meet load. Multispeed fans reduce airflow related to thermal loads.	1-11
	Fan Operation – Occupied	Fixed	Fan runs continuously during occupied hours	12
	Fan Operation – Night Cycle	Fixed	Fan cycles on to meet setback temperatures	1-11
Packaged Equipment Efficiency	DX Cooling Efficiency	User defined	Cooling COP without fan energy calculated in accordance with Section C409.6.1.10.2	1, 2, 3, 4, 5,7, 8, 9, 11,12
	DX Coil Number of Stages	User defined	Single Stage or Multistage	3, 4, 9, 10, 11, 12
	Heat Pump Efficiency	User defined	Heating COP without fan energy calculated in accordance with Section C409.6.1.10.2	2, 4, 5, 7, 8, 12
	Furnace Efficiency	User defined	Furnace thermal efficiency	3, 9, 11, 12
Heat Pump Supplemental Heat	Heat Source	User defined	Electric resistance or gas furnace	2, 4, 7, 8, 12
	Control	Fixed	Supplemental electric heat locked out above 40°F(4°C) OAT. Runs as needed in conjunction with compressor between 40°F(4°C) and 0°F(-17.8°C). Gas heat operates in place of the heat pump when the heat pump cannot meet load.	2, 4, 7, 8, 12
System Fan Power and Controls	Part-load Fan Controls -Constant Volume -Two Speed or three speed -VAV	User defined	Static pressure reset included for VAV.	1-8 (CAV, two or three speed), 9, 10, 11 (VAV), 12 (CAV and VAV)
	Design Fan Power (W/cfm)	User defined	Input electric power for all fans required to operate at fan system design conditions divided by the supply airflow rate This is a "wire to air" value including all drive, motor efficiency and other losses.	All

	Low-speed and medium speed fan power	User defined	Low speed input electric power for all fans required to operate at low-speed conditions divided by the low speed supply airflow rate. This is a "wire to air" value including all drive, motor efficiency and other losses. Also provide medium speed values for three-speed fans.	1-8
Variable Air Volume Systems	Supply Air Temperature (SAT) Controls	User defined	If not SAT reset then constant at 55°F(12.8°C).Options for reset based on outside air temperature (OAT) or warmest zone. If warmest zone, then the user can specify the minimum and maximum temperatures. If OAT reset, SAT is reset higher to 60°F(15.6°C) at outdoor low of 50°F(10°C). SAT is 55°F(12.8°C) at outdoor high of 70°F(21.1°C).	9, 10, 11
	Minimum Terminal Unit airflow percentage	User defined	Average minimum terminal unit airflow percentage for thermal block weighted by cfm or minimum required for outdoor air ventilation, whichever is higher.	9, 10, 11
	Terminal Unit Heating Source	User defined	Electric or hydronic	9, 10, 11
	Dual set point minimum VAV damper position	User defined	Heating maximum airflow fraction	9, 10
	Fan Powered Terminal Unit (FPTU) Type	User defined	Series or parallel FPTU	11
	Parallel FPTU Fan	Fixed	Sized for 50% peak primary air at 0.35 W/cfm	11
	Series FPTU Fan	Fixed	Sized for 50% peak primary air at 0.35 W/cfm	11
Economizer	Economizer Presence	User defined	Yes or No	3, 4, 5, 6, 9, 10, 11
	Economizer Control Type	Fixed	Lockout on Differential dry-bulb temperature (OAT>RAT) in 6A, 5A, All B & C climate zones; fixed enthalpy>28 Btu/lb (47kJ/kg) or fixed dry-bulb OAT>75°F(24°C) in 0A to 4A climate zones	3, 4, 5, 6, 9, 10, 11
Energy Recovery	Sensible Effectiveness	User defined	Heat exchanger sensible effectiveness at design heating and cooling conditions	3, 4, 9, 10, 11, 12
	Latent Effectiveness	User defined	Heat exchanger latent effectiveness at design heating and cooling conditions	3, 4, 9, 10, 11, 12
	Economizer Bypass	User defined	If ERV is bypassed or wheel rotation is slowed during economizer conditions (Yes/No)	3, 4, 9, 10, 11, 12
	Economizer Bypass active	Fixed	If there is a bypass, it will be active between 45°F(7.2°C) and 75°F(23.9°C) outside air temperature.	3, 4, 9, 10, 11, 12
	Bypass SAT Setpoint	User defined	If bypass, target supply air temperature	3, 4, 9, 10, 11, 12
	Fan Power Reduction during Bypass (W/cfm)	User defined	If ERV system include bypass, static pressure set point and variable speed fan, fan power can be reduced during economizer conditions	3, 4, 9, 10, 11, 12
Demand Controlled Ventilation	DCV Application on/off	User defined	Percent of thermal block floor area under occupied standby controls, ON/OFF only with occupancy sensor and no variable control	3, 4, 9, 10, 11, 12
	DCV Application CO2	User defined	Percentage of thermal block floor area under variable DCV control (CO2); may include both variable and ON/OFF control	3, 4, 9, 10, 11, 12
DOAS	DOAS Fan Power W/cfm	User defined	Fan electrical input power in W/cfm of supply airflow	12
	DOAS Supplemental Heating and Cooling	User defined	Heating source, cooling source, energy recovery and respective efficiencies	12
	Maximum SAT Set point (Cooling)	User defined	SAT set point if DOAS includes supplemental cooling	12

	Minimum SAT Set point (Heating)	User defined	SAT set point if DOAS includes supplemental heating	12
Heating plant	Boiler Efficiency	User defined	Boiler thermal efficiency	1, 6, 7, 9, 10, 11, 12
	Heating Water Loop Configuration	User defined	Constant flow primary only; Variable flow primary only; Constant flow primary – variable flow secondary, Variable flow primary and secondary	1, 6, 7, 9, 10, 11, 12
	Heating Water Primary Pump Power (W/gpm)	User defined	Heating water primary pump input W/gpm heating water flow	1, 6, 7, 9, 10, 11, 12
	Heating Water Secondary Pump Power (W/gpm)	User defined	Heating water secondary pump input W/gpm heating water flow (if primary/secondary)	1, 6, 7, 9, 10, 11, 12
	Heating Water Loop Temperature	User defined	Heating water supply and return temperatures, °F(°C)	1, 6, 9, 10,11
	Heating Water Loop Supply Temperature Reset	Fixed	Reset HWS by 27.3% of design delta-T (HWS-70°F(21.1°C) Space Heating temperature set point) between 20°F(-6.7°C) and 50°F(10°C) OAT	1, 6, 7, 9, 10, 11, 12
	Boiler type	Fixed	Non-condensing boiler where input thermal efficiency is less than 86%; Condensing boiler otherwise	1, 6, 7, 9, 10, 11, 12
Chilled Water Plant	Chiller Compressor Type	User defined	Screw/Scroll, Centrifugal or Reciprocating	6, 10, 11, 12
	Chiller Condenser Type	User defined	Air cooled or water cooled	6, 10, 11, 12
	Chiller Full Load Efficiency	User defined	Chiller COP	6, 10, 11, 12
	Chilled Water Loop Configuration	User defined	Variable flow primary only, constant flow primary – variable flow secondary, variable flow primary and secondary	6, 10, 11,12
	Chilled Water Primary Pump Power (W/gpm)	User defined	Primary pump input W/gpm chilled water flow	6, 10, 11,12
	Chilled Water Secondary Pump Power (W/gpm)	User defined	Secondary Pump input W/gpm chilled water flow (if primary/secondary)	6, 10, 11,12
	Chilled Water Temperature Reset Included	User defined	Yes/No	6, 10, 11,12
Chilled Water Plant (cont.)	Chilled Water Temperature Reset Schedule (if included)	Fixed	Outdoor air reset: CHW supply temperature of 44°F(6.7°C) at 80°F(26.7°C) outdoor air dry bulb and above, CHW supply temperature of 54°F(12.2°C) at 60°F(15.6°C) outdoor air dry bulb temperature and below, ramped linearly between	6, 10, 11,12
	Condenser Water Pump Power (W/gpm)	User defined	Pump input W/gpm condenser water flow	6, 7, 8, ,10, 11, 12
	Condenser Water Pump Control	User defined	Constant speed or variable speed	6, 7, 8, 10, 11,12
	Heat Rejection Equipment Efficiency	User defined	gpm/hp tower fan	6, 7, 10, 11, 12
	Heat Rejection Fan Control	User defined	Constant or variable speed	6, 7, 10, 11, 12
	Heat Rejection Approach and Range	User defined	Design cooling tower approach and range temperature	6, 7, 10, 11, 12

Heat Pump Loop	Loop flow and Heat Pump Control Valve	Fixed	Two position Valve with VFD on Pump. Loop flow at 3 gpm/ton	7, 8
	Heat Pump Loop minimum and maximum temperature control	User defined	User input: restrict to minimum 20°F(11.1°C) and maximum 40°F(22.2°C) temperature difference	7
GLHP Well Field	-	Fixed	Bore depth = 250 ft(76 m) Bore length 200 ft/ton (1.5 m/kW) for the greater of cooling or heating load Bore spacing = 15 ft(4.6 m) Bore diameter = 5 in (127 mm) ¾" (19 mm)Polyethylene pipe Ground and grout conductivity = 4.8 Btu-in/h-ft2-°F (0.69 W/(mK))	8

a. Part load fan power and pump power modified in accordance with Table C409.6.1.10.2(2)

C409.6.2.2 ~~Blocks~~ Thermal blocks. Same as proposed design.

Reason: This proposal is to change the new term "block" to "thermal block" in the definitions and leave the remainder of the definition the same. The term "block" is already used in the IECC with a lot of different meanings that are different from the one in this new definition of block in the current draft. The phrase "thermal block" is already used in C407 on simulations. So, I recommend that "thermal block" continue to be used in C407; and the sections in C407 that inserted the word "block" in this draft use the phrase "thermal block" or some other compound phrase in the next draft.

"Block" is already used in the IECC to mean many different things that are not defined: a concrete masonry unit, a thermal spacer block, something that gets in the way of sunlight, and as "blocking" (a type of framing).

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This is just a change in the definition for clarity throughout the standard.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: This proposal would change the definition of "block" to "thermal block" in the context of energy simulation. This definition change aligns with the use of "thermal block" in C407. A modification is proposed that updates the definition in C409.

Proposal # 750

CED1-185-22

Proponents: Reid Hart, representing Pacific Northwest National Laboratory (reid.hart@pnnl.gov); Michael Tillou, representing Pacific Northwest National Laboratory (michael.tillou@pnnl.gov)

2024 International Energy Conservation Code [CE Project]

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*

Revise as follows:

C406.1 Compliance. *Buildings* shall comply as follows:

1. *Buildings* with greater than 2000 square feet (190 m^2) of 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 the following:

1. *Buildings* with greater than 5000 (465 m) 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.

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

Building Occupancy Group	**Climate Zone**																	
	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	64	59	70	69	73	89	72	90	90	63	90	70	51	75	66	48	~~48~~ 58	50	42
I-2	31	32	33	32	33	36	31	40	34	32	43	32	29	37	33	34	~~34~~ 33	27	23
R-1	41	40	48	44	48	58	54	61	63	50	61	47	42	55	50	41	~~41~~ 51	40	32
B	63	64	74	75	78	89	83	90	90	77	90	86	68	90	83	72	~~72~~ 81	68	58
A-2	12	12	13	13	12	17	13	17	17	12	17	13	12	12	12	12	12	8	7
M	71	70	84	84	90	90	90	90	90	81	90	90	77	90	90	76	~~76~~ 84	71	58
E	49	55	64	61	69	83	73	90	90	67	90	75	61	86	74	66	~~66~~ 76	60	47
S-1 and S-2	90	90	90	90	90	90	90	90	90	90	90	90	70	90	90	61	~~61~~ 85	61	53
All Other	56	55	66	63	69	80	69	87	88	59	86	68	51	72	66	51	~~51~~ 60	48	40

[Note to staff and reviewers: some of the above revisions are overwritten by proposal 717 which takes precedence]

~~C406.1.1.1~~ C406.1.3 Building Core/Shell and ~~Initial~~ 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 in Table C406.1.1 in accordance with Section C406.2.

   1.2. Alternatively, the project shall achieve not less than 33 percent of the energy credits required in Table 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 in Table C406.1.1.

   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 in Table C406.1.1

   3.3. Where the core and shell building was approved in accordance with C407 under 2021 IECC or later.

Delete without substitution:

~~**C406.1.3 Substantial Alterations to Existing Buildings.** The *building envelope*, *equipment*, and *systems* in *alterations* to *buildings* exceeding 5000 square feet (46.5 m^2) of *gross conditioned floor area* shall comply with the requirements of Section C406.1.1 and C406.1.2 where the alteration includes replacementof two or more of the following:~~

1. ~~HVAC unitary systems or HVAC central heating or cooling equipment serving the alteration area, not including ductwork or *piping.*~~
2. ~~80% or more of the lighting fixtures in the *alteration* area.~~
3. ~~Building envelope components in the *alteration* area including new exterior cladding, fenestration, or insulation.~~

~~**C406.1.4 Energy Credits Achieved.** Energy credits achieved for the project shall be the sum of measure energy credits for individual measures included in the project.Credits are available for the measures listed in Section C406.2. Base energy credits are shown in Tables C406.1.4(1) through C406.1.4(9) based on building occupancies and climate zones. Measure energy credits achieved shall be determined in one of three ways, depending on the measure:~~

1. ~~The measure energy credit shall be the base energy credit for the measure where no adjustment factor or formula is shown in the measure description in Section C406.2.~~

2. ~~The measure energy credit shall be the base energy credit for the measure adjusted by a factor or formula as stated in the measure description in Section C406.2. Where adjustments are applied, each measure energy credit shall be rounded to the nearest whole number.~~

3. ~~The measure energy credit shall be by direct formula as stated in the measure description in Section C406.2, where each individual measure credit shall be rounded to the nearest whole number.~~

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 measure~~s~~ 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 floor area of each occupancy group to determine the weighted average project energy credits achieved.
2. ~~Credits for improved~~ Improved envelope efficiency (E01 through E06) and lighting reduction (L06) measure credits shall be determined for the building or permitted 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]

Portions of table not shown remain unchanged.

ID	Energy Credit Measure	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E03	~~Envelope leakage reduction~~ Reduced air leakage	C406.2.1.3	15	10	12	8	6	16	13	5	1	7	7	9	65	16	~~1~~ 11	73	43	52	26
E04	Add Roof Insulation	C406.2.1.4	1	1	1	1	1	1	4	3	1	5	3	4	6	5	~~1~~ 4	7	7	6	8
E05	Add Wall Insulation	C406.2.1.5	10	10	6	8	5	6	8	4	1	8	3	4	11	7	~~1~~ 3	14	12	13	13

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

[Note to reviewers and staff: Other proposals may update credits for E02 and W09 in all tables and take precedence]

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

Portions of table not shown remain unchanged.

ID	**Energy Credit Measure**	**Section**	**Climate Zone**																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E03	~~Envelope leakage reduction~~ Reduced air leakage	C406.2.1.3	5	3	4	3	5	8	8	3	2	6	2	2	7	3	1	9	7	19	5

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

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

Portions of table not shown remain unchanged.

ID	Energy Credit Measure	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E03	~~Envelope leakage reduction~~ Reduced air leakage	C406.2.1.3	~~5~~	~~3~~	~~4~~	~~2~~	~~2~~	~~2~~	~~5~~	~~1~~	~~1~~	~~8~~	~~1~~	~~2~~	~~13~~	~~4~~	1	~~18~~	~~9~~	~~18~~	~~7~~
E03	~~Envelope leakage reduction~~ Reduced air leakage	C406.2.1.3	15	9	12	8	6	16	7	5	10	14	3	1	19	5	1	28	16	28	18
E04	Add Roof Insulation	C406.2.1.4	~~2~~	~~2~~	~~2~~	2	2	~~2~~	~~3~~	~~2~~	1	~~3~~	1	2	~~3~~	~~2~~	2	3	~~3~~	2	3
E04	Add Roof Insulation	C406.2.1.4	1	1	1	2	2	1	2	1	1	2	1	2	2	1	2	3	**2**	**2**	**3**
E05	Add Wall Insulation	C406.2.1.5	~~13~~	~~14~~	~~8~~	~~11~~	~~4~~	4	~~7~~	~~4~~	~~1~~	~~5~~	2	4	~~6~~	4	~~3~~	~~9~~	~~7~~	~~10~~	~~8~~
E05	Add Wall Insulation	C406.2.1.5	18	26	11	25	3	4	5	3	1	6	2	4	7	4	4	8	6	8	5
E06	Improve Fenestration	C406.2.1.6	~~5~~	~~5~~	~~4~~	~~5~~	~~7~~	~~7~~	~~8~~	~~2~~	1	~~8~~	~~2~~	4	~~10~~	~~5~~	~~1~~	~~21~~	~~17~~	~~10~~	~~9~~
E06	Improve Fenestration	C406.2.1.6	2	2	1	2	2	3	5	3	1	6	3	4	9	7	6	13	8	6	6

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

[Note to reviewers and staff: replacements shown in separate rows for clarity; repeated cell values do not change unless struckout and underlined - typical for several tables]

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

Portions of table not shown remain unchanged.

ID	Energy Credit Measure	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E02	UA reduction (15%)	C406.2.1.2	4	7	4	7	3	4	7	2	~~0~~ 1	7	2	3	10	6	4	12	9	19	11
E03	~~Envelope leakage reduction~~ Reduced air leakage	C406.2.1.3	5	3	4	2	2	2	5	1	~~0~~ x	8	~~0~~ x	2	13	4	~~0~~ x	18	9	18	7

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

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

Portions of table not shown remain unchanged.

ID	Energy Credit Measure	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E03	~~Envelope leakage reduction~~ Reduced air leakage	C406.2.1.3	2	1	1	1	2	3	11	2	1	24	4	6	33	9	3	42	29	36	16
E04	Add Roof Insulation	C406.2.1.4	1	1	~~0~~ x	1	1	1	2	1	1	1	1	1	2	2	1	2	2	1	2
E05	Add Wall Insulation	C406.2.1.5	1	1	~~0~~ x	1	1	2	3	3	1	2	1	1	2	2	2	2	2	2	2
L02	Lighting dimming & tuning	C406.2.5.2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	1	1	~~0~~ x
L03	Increase occp. sensor	C406.2.5.3	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	~~0~~ x

a. "x" indicates measure is not available for that measure.

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

Portions of table not shown remain unchanged.

ID	Energy Credit Measure	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E03	~~Envelope leakage reduction~~ Reduced air leakage	C406.2.1.3	3	3	2	2	3	3	19	3	1	44	6	11	56	13	6	64	44	43	19
W05	Point of Use Water Heaters	C406.2.3.3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

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

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

Portions of table not shown remain unchanged.

ID	Energy Credit Measure	Section	Climate Zone																	
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E03	~~Envelope leakage reduction~~ Reduced air leakage	C406.2.1.3	4	3	3	3	2	5	2	1	1	1	1	1	1	1	1	2	1	1	1
E06	Improve Fenestration	C406.2.1.6	8	10	6	9	11	11	15	9	1	16	8	15	22	18	19	33	~~9~~ 29	19	18

a. "x" indicates measure is not available for that measure.

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

Portions of table not shown remain unchanged.

ID	**Energy Credit Measure**	**Section**	**Climate Zone**																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E03	~~Envelope leakage reduction~~ Reduced air leakage	C406.2.1.3	2	2	1	2	1	3	31	3	1	77	14	17	92	25	8	95	71	69	26

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

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

Portions of table not shown remain unchanged.

ID	Energy Credit Measure	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
H05	DOAS/fan control	C406.2.2.5	~~7~~ 37	36	31	34	30	28	43	32	23	61	42	49	75	61	49	90	77	93	90
W08	SHW submeters	C406.2.3.4	~~11~~	~~11~~	~~13~~	~~13~~	~~15~~	~~16~~	~~18~~	~~18~~	~~22~~	~~19~~	~~20~~	~~22~~	~~19~~	~~20~~	~~24~~	~~17~~	~~20~~	~~18~~	~~18~~
W08	SHW submeters	C406.2.3.4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
W09	SHW flow reduction	C406.2.3.5	~~29~~	~~30~~	~~36~~	~~35~~	~~41~~	~~43~~	~~48~~	~~48~~	~~56~~	~~50~~	~~53~~	~~59~~	~~51~~	~~54~~	~~62~~	~~47~~	~~52~~	~~49~~	~~48~~
W09	SHW flow reduction	C406.2.3.5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

a. "x" indicates measure is not available for that measure.

b. Other occupancy groups include all Groups except for Groups A-2, B, E, I, M, and R.

C406.2.1.6 E06 Improve fenestration. Energy credits ~~for one selected fenestration energy credit ID~~ shall be achieved for improved energy characteristics of all vertical fenestration in the project meeting the requirements in ~~one of the rows of~~ 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 ~~selected~~ table ~~row~~. The area-weighted average visible transmittance (VT) of allvertical fenestration shall be equal to or greater than the value shown in the ~~selected~~ table ~~row~~.

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, ~~EER/~~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

C406.2.2.2 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~~ *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 ~~are~~ 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 4-18 rounded to the nearest whole number.

(Equation 4-18)

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

where:

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~~ *building*, a heating capacity weighted average improvement shall be used. Where electric resistance primary heating or reheat is included in the ~~building~~ *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 ~~cooling~~ 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 ~~efficiency~~ performance in Table C403.3.2(7) shall also be increased by at least the chiller efficiency improvement. Where equipment exceeds both 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 4-19, 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.

(Equation 4-19)

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

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

EEC_5= the lesser of: the improvement above minimum cooling efficiency and heat rejection ~~efficiency~~ performance requirements expressed as a fraction, or 0.20 (20percent). Where cooling equipment with different minimum efficiencies are included in the ~~building~~ *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:
$CEI = (CM_{DES}/CM_{MIN}) - 1$
For 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:
$CEI = (AMLC_{MAX}/ AMLC_{DES}) - 1$
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 outdoor air.
2. Outdoor air shall be supplied by an independent ventilation system designed to provide no more than 110 percent of the minimum outdoor air to each individual occupied zone, as specified by the *International Mechanical Code*.
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:

(Equation 4-20)

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

where:

EC_{DOAS}= Energy credits achieved for H05 ~~H06~~

EC_{base}= ~~H06~~ H06 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

ERE_{adj} based on lower of actual heating or cooling energy recovery effectiveness where required		
Cooling ERR is ~~≥~~ at least	Heating enthalpy recovery ratio or sensible energy recovery ratio ~~is ≥~~ at least	Energy Recovery Effectiveness Adjustment (ERE_{adj})
65%	65%	1.00
60%	60%	0.67
55%	55%[a]	0.33
50%	50%[a]	0.25

a. In climate zones where heating recovery is required in Section C403 ~~for this measure~~, 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, ~~or~~ W03 , or a combination in accordance with Section C406.2.3.1.4
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.

C406.2.3.1.1 W01 Recovered or renewable water heating. The *building* service water-heating system shall have one or more of the following that are sized to provide not less than 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:

$$EC_{HPWH} = (EC_{BASE}/0.5) \times \{(CAP_{HPWH})/(ENDLOAD)\ [\text{not greater than } 2]\} \quad \textbf{(Equation 4-21)}$$

where:

EC_{HPWH}= Energy credits achieved for W02

EC_{BASE}= W02 base energy credits from Tables C406.2(1) through C406.2(9) ~~Section 13.5.3~~
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 4-20.

(Equation 4-22)

$$\text{W02 credit} = \text{base W02 table credit} \times (HP_{LF}/50\%)$$

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. ~~This measure shall receive only thirty percent of the listed energy credits for *buildings* required to comply with C404.2.1. Projects where the installed *building* service water heating capacity is less than 200,000 Btu/hr (59 kW) and weighted UEF is not less than 0.82 shall achieve 25 percent of the base table W03 credit.~~ 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)

Add new text as follows:

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 hot water 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.
[Note to reviewers and staff: this text is just relocated to a separate section from "Water heating distribution temperature maintenance" Renumber following sections as needed. Section numbers in tables already match new numbering]

Revise as follows:

C406.2.3.3 ~~C406.2.3.2~~ 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.~~ ~~**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.~~

~~2~~ 1. **W05 Point of use water heaters.** Credits are available for ~~office or school buildings~~ Group B or E *buildings* larger than 10,000 ft^2 (930 m^2). Fixtures requiring hot water shall be supplied from a localized source of hot water with no recirculating system or heat trace piping. Supply piping from the water heater to the termination of the fixture supply pipe shall be insulated to the levels shown in Table C403.12.3 without exception. The volume in piping from the water heater to the termination of the fixture supply pipe shall be limited as follows:

   ~~2.1~~ 1.1. Non-residential lavatories: not more than 2 oz (60 mL)

   ~~2.2~~ 1.2. All other plumbing fixtures or appliances: not more than 0.25 gallons (0.95 L)

   Exception: Where all remotely located hot water uses meet the requirements for measure W05, separate water heaters serving commercial kitchens or showers in locker rooms shall be permitted to have a local recirculating system or heat trace piping.

~~3~~ 2. **W06 Thermostatic balancing valves.** Credits are available where service water heating is provided centrally and distributed throughout the ~~building~~ *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 120°F (49°C) ~~115°F (46°C)~~.

~~4~~ 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.

[Renumber following water heating measures and tables as required]

C406.2.5.4 L04 Increase daylight area. The total daylight area of the project (DLA_{BLDG}) with continuous daylight dimming meeting the requirements of C405.2.4 shall be at least 5 percent greater than the typical daylit area (DLA_{TYP}).Credits for measure L04 shall be determined based on Equation 4-24:

(Equation 4-24)

$$\underline{EC_{DL} = EC_{DL5} \times 20 \times [(DLA_{BLDG}/GLFA) - DLA_{TYP}]}$$

where:

EC_{DL}= achieved L04 energy credits

ECDL5= C406.2.5.4 L04 base energy credits from Section C406.2
DLA_{BLDG} = The lesser of :

1. actual area of *daylight zones* in the *building* with continuous daylight dimming, ft^2 or m^2 ~~and~~
2. (GLFA x DLA_{max}) see TableC406.2.5.4.

Daylight zones shall meet the criteria in Sections C405.2.4.2 and C405.2.4.3 for primary sidelit *daylight zones*, secondary sidelit *daylight zones*, and toplit *daylight zones*.

GLFA = Project gross lighted fl oor area, ft^2 or m^2
DLATYP= Typical ~~%~~ percentage of *building* area with daylight control (as a fraction) from Table C406.2.5.4~~:~~
~~ECDL5= C406.2.5.4 L04 base energy credits from Section C406.2~~

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 4-26, rounded to the nearest whole credit. Projects with acompliance ratio below 0.5 do not qualify for this credit.

(Equation 4-26)

$$\underline{EC_e = EC_t \times CR_e}$$

where:

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

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

~~For SI: BTU/h = 0.293W~~

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:

(Equation 4-28)

$$EC_R = EC_{0.1} \times (R_t + R_{off} - R_{ex}) / (0.1 \times PGFA)$$

where:

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

~~R_t= Actual total rating of on-site renewable energy systems (W)~~
~~PGFA = Project gross fl oor area, ft^2~~
$EC_{0.1}$= 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 as 3413 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

C406.3.6 G05 Cooling Energy Storage. Automatic load management controls shall be capable of activating ice or chilled water storage equipment to reduced demand 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:

(Equation 4-31)

$$ECs = EC1.0 \times (1.44 \text{ X } SR + 0.71) / 2.15$$

[Note: Change EC1.0 to $EC_{1.0}$ with subscript in formula]
where:
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 ≤ SR ≤ 4.0

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 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 ~~through~~ 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.

C407.2 Mandatory requirements. Compliance based on total building performance requires that a proposed design meet all of the following:

1. The requirements of the sections indicated within Table C407.2(1).
2. An annual energy cost that is less than or equal to the percent of the annual energy cost (PAEC) of the *standard reference design* calculated in Equation 4-32. Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's *State Energy Data System Prices and Expenditures* reports. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations. The reduction in energy cost of the proposed design associated with *on-site renewable energy* shall be not more than 5 percent of the total energy cost. The amount of renewable energy purchased from off-site sources shall be the same in the *standard reference design* and the *proposed design*.

Exceptions:

1. Jurisdictions that require site energy (1 kWh = 3413 Btu) rather than energy cost as the metric of comparison.
2. Where energy use based on source energy expressed in Btu or Btu per square foot of conditioned floor area is substituted for the energy cost, the energy use shall be calculated using source energy factors from Table C407.2(2) For electricity, U.S. locations shall use values eGRID subregions. Locations outside the United States shall use the value for "All other electricity" or locally derived values.

PAEC = 100 x (0.80 ~~0.85~~ + 0.025 - ECr/1000 **(Equation 4-32)**
where:

PAEC = Percentage of annual energy cost applied to standard reference design

EC_r= Energy efficiency credits required for the building in accordance with Section C406.1 (do not include load management and renewable credits)

CF102.1 Advanced Energy Credit Package requirements. The requirements of this Section ~~supercede~~ 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 CD102.1 based on building occupancy group and climate zone. Projects with multiple occupancies, unconditioned parking garages, ~~*alterations*,~~ and *buildings* with separate shell-and-core and build-out construction permits shall comply as follows:
Where a project contains multiple occupancies, credits in Table CD102.1 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 Section C406 and Appendix CD.

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.

Reason: This public comment reconciles the as voted document from Subcommittee as modified and voted by the consensus committee from May 12, 2022. The changes are editorial in nature. A few additional editorial changes were made:

- E06 fenestration language was clarified
- H03 heat rejection efficiency changed to performance to match C403 table.
- H05 reference to allowed heating systems clarified
- C406.2.3 clarified that combinations are allowed per C406.2.3.1.4
- W03 adjustment language clarified
- W04, SHW piping insulation separated from distribution temperature maintenance measure group
- Equation variable subscripts clarified and variables reordered to match equation order
- Other minor editorial changes
- Where an "x" was provided in intermediate climate zones due to rounding down a partial credit, it was updated to 1 credit

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposal is editorial only.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: This proposal provides an editorial update to Section C406. Tables 406.2(4) and 406.2(5) have been modified by inserting an “x” to indicate that ECM credits are not available in certain climate zones. <u>Envelope Subcommittee:</u>
Agree with Modeling SC comments, and agree with envelope parts of the proposal. However, terminology regarding air leakage credit should be made consistent, and avoid any confusion between air leakage and water leakage.

ENVELOPE ADDITIONAL MOD: change “~~Envelope leakage reduction~~ <u>Reduced air leakage</u>” in Tables C406.2(1) through C406.2(9) to match the title of the E03 credit in C406.2.1.3.

Proposal # 637

CED1-187-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

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 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 SectionC406.

~~Exceptions~~ Exception:

~~1. Unconditioned parking garages that achieve 50% of the credits required for use groups S-1 and S-2 in Table C406.1.1.~~

~~2.~~ Portions of buildings devoted to manufacturing or industrial use.

C406.1 Compliance. Buildings shall comply as follows:

1. *Buildings* with greater than 2000 square feet (190 m) of *conditioned floor area* shall comply with Section C406.1.1.
2. *Buildings* with greater than 5000 square feet (465 m) 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) 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) 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.

C406.2 Additional Energy Efficiency Credits Achieved. Each energy effi ciency 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 for the measure where no adjustment factor or calculation is included in the description ofthe 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. Credits for improved envelope efficiency and lighting reduction (L06) shall be determined for the building or permitted *conditioned floor area* as a whole. Credits for other measures shall be taken from applicable tables or calculations weighted by the building occupancy group floor area.

Reason: Because it is impossible for unconditioned spaces to comply the code as written.
Consider an unconditioned parking garage. Tis has no insulation, fenestration, heating, cooling, hot water, or kitchen equipment. L03 is not possible because base code already requires every fixture to have an occupant sensor. P01 is not possible unless the building is smaller than 10,000 square feet (which would be a very small parking garage). The only credits you could achieve are:

L02 Light Dimming

L06 Light Power Reduction

Q01 Efficient Elevator

In Climate Zone 8 this is a maximum of 12 possible points. Per Table 406.1.1 the project would be required to achieve 45 points (50% of 90).

In Climate Zone 5A this is a maximum of 20 possible points. Per Table 406.1.1 the project would be required to achieve 45 points (50% of 90).

This problem is not limited to parking garages. Elevated train platforms, unconditioned warehouses, sports stadiums, etc. will all encounter the same problem.

Finally, the scoring of lighting credits shows much greater energy savings in warmer climates. This would only make sense if the the lights were installed in a conditioned space, and this seems to be the assumption in the modelling. If this is the assumption, then these energy credits should not be applied to unconditioned spaces.

Cost Impact: The code change proposal will decrease the cost of construction.
By eliminating compliance requirements from unconditioned spaces this proposal will reduce the cost of constructing these spaces.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: This proposal clarifies that only <u>conditioned</u> spaces are required to achieve C406 efficiency credits because it is impossible for unconditioned spaces to comply.

Proposal # 804

CED1-190-22

Proponents: Reid Hart, representing Pacific Northwest National Laboratory (reid.hart@pnnl.gov)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

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 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. Unconditioned parking garages that achieve 50% of the credits required for use groups S-1 and S-2 in Table C406.1.1(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 C406.1.2, surplus credits shall be permitted to reduce the required energy efficiency credits as follows:

$$EEC_{red} = EEC_{tbl} - \left\{the\ lesser\ of: \left(SRLM_{lim}, \quad SRLM_{adj} \times \left[RLM_{ach} - RLM_{req} \right] \right)\right\}$$

where: **(Equation #)**

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 equipment (excluding emergency 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

CD101.1 Prescriptive compliance. Where compliance is demonstrated using the prescriptive compliance option in Section C401.2.1, the number of additional efficiency credits required by Section C406.1 shall be 50 percent higher than that required by Table C406.1.1(1).
Exception: Where a building achieves more renewable and load management credits in Section C406.3 than are required in Section C406.1.2, surplus credits shall be permitted to reduce required energy efficiency credits as follows:

$$EEC_{red} = EEC_{tbl} - \left\{the\ lesser\ of: \left(SRLM_{lim}, \quad SRLM_{adj} \times \left[RLM_{ach} - RLM_{req} \right] \right)\right\}$$

where: **(Equation #)**

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 CD101.1
$SRLM_{adj}$ = 1.0 for all-electric or all-renewable buildings (excluding emergency generation)
0.7 for buildings with fossil fuel equipment (excluding emergency 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

CF102.1 Advanced Energy Credit Package requirements. The requirements of this Section ~~supercede~~ 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 ~~CD~~ CF102.1 (1) based on building occupancy group and climate zone. Projects with multiple occupancies, unconditioned parking garages, *alterations*, and *buildings* with separate shell-and-core and build-out construction permits shall comply as follows:
Where a project contains multiple occupancies, credits in Table ~~CD~~ CF102.1 (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 Section C406 and Appendix CF ~~CD~~.

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 Section C406.1.2, surplus credits shall be permitted to reduce required energy efficiency credits as follows:

$$EEC_{red} = EEC_{tbl} - \{the\ lesser\ of: (\ SRLM_{lim}\ , \quad SRLM_{adj} \times [\ RLM_{ach} - RLM_{req}\ ]\ )\}$$

where: **(Equation #)**

EEC_{red} = Reduced required energy efficiency credits
EEC_{tbl} = Required energy efficiency credits from Table CF102.1(1)
$SRLM_{lim}$ = Surplus renewable and load management credit limit from Table CF102.1(2)
$SRLM_{adj}$ = 1.0 for all-electric or all-renewable buildings (excluding emergency generation)
0.7 for buildings with fossil fuel equipment (excluding emergency 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 C406.1.1<u>(1)</u> ENERGY CREDIT REQUIREMENTS BY BUILDING OCCUPANCY GROUP

Add new text 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	6B	7	8
R-2, R-4, and I-1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
I-2	16	14	11	8	6	5	5	5	5	5	5	5	6	15	18	10	14	10	25
R-1	7	5	8	5	19	5	13	20	20	5	20	20	5	16	18	5	5	5	5
B	7	5	5	8	6	6	5	10	14	5	21	15	5	16	26	5	5	5	9
A-2	18	16	14	15	13	9	5	5	11	5	5	5	5	5	7	5	5	5	5
M	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
E	13	13	18	16	17	14	6	20	25	9	26	13	7	15	10	5	5	9	5
S-1 and S-2	5	5	5	5	5	5	5	5	5	5	5	5	5	14	5	5	5	5	17
All Other	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

TABLE CD101.1 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	19	25	27	29	33	20	15	37	36	5	37	34	5	8	36	5	5	5	5
I-2	17	13	10	5	5	5	5	5	5	5	5	5	7	16	20	15	21	20	43
R-1	9	5	9	5	22	7	13	23	25	5	22	19	5	18	16	5	5	5	6
B	5	5	5	5	6	6	5	9	13	10	26	20	9	25	34	5	9	9	32
A-2	31	28	25	26	23	16	5	8	16	5	8	7	5	5	9	5	5	5	5
M	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
E	17	15	23	16	20	14	5	22	27	10	32	16	10	21	12	5	5	15	10
S-1 and S-2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	43
All Other	5	5	5	5	5	5	5	5	6	5	5	5	5	5	5	5	5	5	5

Revise as follows:

TABLE CF102.1(1) Energy Credit Requirements by Building Occupancy Group

Add new text as follows:

TABLE CF102.1(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	6B	7	8
R-2, R-4, and I-1	100	100	114	110	113	91	95	115	101	73	102	99	54	73	101	45	50	66	62
I-2	30	25	26	20	28	33	38	31	33	37	30	32	41	41	50	53	56	75	80
R-1	20	8	20	5	26	22	20	28	30	19	26	23	24	28	28	27	30	43	54
B	25	19	18	20	15	15	15	24	25	31	36	32	37	40	43	42	40	51	66
A-2	9	5	5	5	5	5	5	5	5	9	5	5	21	9	5	32	19	49	61
M	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	10
E	24	24	31	29	29	28	19	33	39	31	43	33	34	37	33	31	33	46	54
S-1 and S-2	5	5	5	5	5	5	5	5	5	5	5	5	37	19	5	49	41	51	56
All Other	5	5	5	5	5	5	5	5	15	5	6	8	5	11	15	5	5	9	20

Reason: This proposal allows for excess renewable and load management credits to be applied to the requirements for energy efficiency credits. This change accomplishes two objectives:

1. The change will make the additional credit section more aligned with ASHRAE Standard 90.1, which has a credit requirement and allows up to a 60% contribution of renewable and load management credits to be mixed with energy efficiency credits to meet the total credit requirement in that standard.
2. By creating more flexibility in the type of credits used, it will be easier to meet the energy efficiency requirement without using any efficiency improvements to federally regulated equipment and appliances.

A cost-effective demonstration credit package was separately published. Where the focus is cost-effectiveness, selecting cost-effective higher efficiency regulated equipment is appropriate. The purpose of this modification and review is to demonstrate that a reasonable package can be assembled that does not rely on improvements to the efficiency of federally regulated equipment. To this end, a package of measures was selected to find how many credits from the renewable and load management category would be necessary to meet the energy efficiency credit requirement. The following measures were selected by use group:

Alternate reasonable measure selections without EPACT regulated equipment efficiency improvements										
Selections without EPACT regulated		R-2/4, I-1	I-2	R-1	B	A-2	M	E	S-1/2	
ID	Measure	MF	Health	Htl	Ofc	Rest	Rtl	Sch	Whse	
E03	Envelope Leakage Reduction	Y	Y	Y	Y	Y	Y	Y	Y	
E04	Add R-5 Roof Insulation	Y	Y	Y	Y	Y	Y	Y	Y	R-10 in CZ 8
E05	Add R-2.5ci Wall Insulation	Y	Y	Y	Y	Y	Y	Y	Y	R-5 in CZ 8
E06	Improve Fenestration	Y	Y	Y	Y	Y	Y	Y	Y	
H04	Residential HVAC control.	Y								
W01	SHW preheat recovery		30%							of SHW load
W02	Heat pump water heater			30%		30%				of SHW load
W04	SHW pipe insulation					Y	Y	Y		
W05	Point of use water heaters				Y			Y		
W06	Thermostatic balancing valves	Y	Y							
W07	SHW heat trace system			Y						
W09	SHW flow reduction	Y		Y						
L03	Increase occupancy sensor								Y	
L04	Increase daylight area				10%		20%		10%	of floor area
L05	Residential light control	Y								
L06	Lighting power reduction	10%	10%	10%	10%	10%	10%	10%	10%	of LPD
Q01	Efficient Elevator		Y	Y	Y	Y				
Q02	Efficient Commercial Kitchen Equipment					Y				
Q04	Fault detection		Y	Y	Y	Y	Y	Y	Y	

While in particular climate zones, all these measures would not need to be applied to meet the credit requirements, the same selections were applied across the board to determine how much extra credits from the renewable and load management category would be needed to meet the energy efficiency credit requirements without higher efficiency EPACT equipment. The needed points were determined as a percentage of the energy efficiency points as follows (a blank cell indicates that no additional points were required):

Carryover excess load management points needed as % of efficiency Requirement with no increases in EPACT regulated equipment efficiency																				
Use group and building type		0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
R-2, R-4, I-1	Multi-family/Dormitory								1%											
I-2	Healthcare	31%	29%	24%	16%	10%	4%					8%		8%	29%	36%	16%	26%	15%	43%
R-1	Hotel/Motel	1%		2%		14%		3%	13%	10%		11%	9%		3%	9%				
B	Office Buildings	19%	16%	17%	20%	18%	18%	6%	13%	17%	4%	26%	18%		19%	31%		5%	4%	17%
A-2	Restaurant Buildings	23%	20%	17%	18%	15%	7%		1%	10%		3%	2%			6%				
M	Retail Buildings															6%				
E	Education Buildings	19%	18%	29%	23%	26%	20%	7%	28%	39%	11%	36%	18%	7%	19%	11%			10%	
S-1, S-2	Warehouse														6%					13%

Based on this review, the exceptions were expanded to allow excess renewable and load management credits to be applied to the energy efficiency requirement with the following limits:

1. For use groups I-2 and E, up to 45% of carryover credits would be allowed.
2. For other use groups, up to 30% of carryover credits would be allowed.

While yet another table by climate zone could have been added to the code, this simplified limit was thought to be effective, while still preventing all energy efficiency to be replaced with renewable energy or load management. In addition to creating a requirement that can be met without using higher efficiency EPACT equipment, the carryover exceptions allow more flexibility in the energy credit structure. Appendix CF provides for a jurisdiction that has an aggressive energy saving policy to increase the energy credits required. A similar analysis was conducted, with higher requirements in the demonstration package, such as a 20% lighting power reduction, higher insulation levels, larger heat pump water heater load sizing, and some additional measures such as lighting tuning. When the results of this package was compared to the higher requirements in Appendix CF, it was determined that a higher carryover allowance of excess renewable and load management credits to be applied to the energy efficiency requirement with the following limits:

1. For use groups R-2, R-4, I-1 and E, up to 70% of carryover credits would be allowed.
2. For other use groups, up to 50% of carryover credits would be allowed.

Appendix CD provides for a glide path that increases the energy efficiency credit requirements to be 150% of the base code C406.1.1 requirements. This level is between the base and advanced Appendix CF requirements, and similar exceptions are added to Appendix CD to provide for renewable and load management carryover to energy efficiency credits.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The suggested changes relate to optional measures that can be selected in building design. Since there is no specific requirement for a particular measure, there is no impact on the cost of construction. There could be a reduction in cost from this particular proposal, as more flexibility in measure selection is provided, allowing possibly more cost effective renewable and load management measures to replace energy efficiency measures.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: This proposal allows for excess renewable and load management credits to be applied to the energy efficiency requirements. A workgroup was formed that modified the original proposal to ensure that compliance can be achieved without relying on measures for equipment efficiency in excess of EPACT requirements.

Proposal # 788

CED1-192-22

Proponents: Reid Hart, representing Pacific Northwest National Laboratory (reid.hart@pnnl.gov); Michael Tillou, representing Pacific Northwest National Laboratory (michael.tillou@pnnl.gov)

2024 International Energy Conservation Code [CE Project]

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 ~~the excess~~ surplus energy efficiency credits, not to exceed a 30 percent reduction.

Delete and substitute as follows:

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

~~**Building Occupancy Group**~~	~~**Climate Zone**~~																		
	~~**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~~	~~64~~	~~59~~	~~70~~	~~69~~	~~73~~	~~89~~	~~72~~	~~90~~	~~90~~	~~63~~	~~90~~	~~70~~	~~51~~	~~75~~	~~66~~	~~48~~	~~48~~	~~50~~	~~42~~
~~I-2~~	~~31~~	~~32~~	~~33~~	~~32~~	~~33~~	~~36~~	~~31~~	~~40~~	~~34~~	~~32~~	~~43~~	~~32~~	~~29~~	~~37~~	~~33~~	~~34~~	~~34~~	~~27~~	~~23~~
~~R-1~~	~~41~~	~~40~~	~~48~~	~~44~~	~~48~~	~~58~~	~~54~~	~~61~~	~~63~~	~~50~~	~~61~~	~~47~~	~~42~~	~~55~~	~~50~~	~~41~~	~~41~~	~~40~~	~~32~~
~~B~~	~~63~~	~~64~~	~~74~~	~~75~~	~~78~~	~~89~~	~~83~~	~~90~~	~~90~~	~~77~~	~~90~~	~~86~~	~~68~~	~~90~~	~~83~~	~~72~~	~~72~~	~~68~~	~~58~~
~~A-2~~	~~12~~	~~12~~	~~13~~	~~13~~	~~12~~	~~17~~	~~13~~	~~17~~	~~17~~	~~12~~	~~17~~	~~13~~	~~12~~	~~12~~	~~12~~	~~12~~	~~12~~	~~8~~	~~7~~
~~M~~	~~71~~	~~70~~	~~84~~	~~84~~	~~90~~	~~90~~	~~90~~	~~90~~	~~90~~	~~81~~	~~90~~	~~90~~	~~77~~	~~90~~	~~90~~	~~76~~	~~76~~	~~71~~	~~58~~
~~E~~	~~49~~	~~55~~	~~64~~	~~61~~	~~69~~	~~83~~	~~73~~	~~90~~	~~90~~	~~67~~	~~90~~	~~75~~	~~61~~	~~86~~	~~74~~	~~66~~	~~66~~	~~60~~	~~47~~
~~S-1 and S-2~~	~~90~~	~~90~~	~~90~~	~~90~~	~~90~~	~~90~~	~~90~~	~~90~~	~~90~~	~~90~~	~~90~~	~~90~~	~~70~~	~~90~~	~~90~~	~~61~~	~~61~~	~~61~~	~~53~~
~~All Other~~	~~56~~	~~55~~	~~66~~	~~63~~	~~69~~	~~80~~	~~69~~	~~87~~	~~88~~	~~59~~	~~86~~	~~68~~	~~51~~	~~72~~	~~66~~	~~51~~	~~51~~	~~48~~	~~40~~

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

Building Occupancy Group	**Climate Zone**																		
	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	34	37	31	46	48	56	49	56	38	31	42	32	26	33	34	23	27	25	25
I-2	23	24	25	25	25	28	26	30	22	25	32	24	25	28	29	26	28	22	20
R-1	30	28	35	30	34	36	34	37	41	32	37	27	28	33	32	25	29	22	18
B	38	39	45	42	45	49	47	56	57	44	55	42	38	47	46	38	45	38	31
A-2	8	8	9	9	8	9	9	11	13	8	11	9	8	10	9	8	9	8	3
M	32	32	42	37	39	47	44	58	57	42	54	46	38	48	5	42	45	38	34
E	27	34	38	37	39	47	44	58	57	42	54	46	38	48	50	42	45	38	34
S-1 and S-2	89	90	90	90	90	90	90	90	90	90	90	90	90	90	90	84	86	71	54
All Other	35	39	46	42	46	52	49	56	56	40	52	42	37	44	44	36	39	32	28

Reason: The requirements for renewable and load management credits were generally reduced to better align with other code changes for the reasons listed below. The average of all individual building type and climate zone requirements drops from 60 to 40 points or to 4% cost savings.

- In the as modified May 2022 version of CEPI-193, a new analysis of the renewable & load management credits available was conducted; however the requirements were not updated pending review of the other base code changes that were still pending. This new analysis expanded the analysis from selected prototypes to all PNNL prototype buildings and then weighted results based on the individual prototype construction weights in each use group. As a result, the available credits better reflect annual savings under a time of use electric pricing schedule.
- The base code added a renewable requirement for installation of 0.75 watts per square foot of solar generation or acquisition of equivalent off site power.
- A base code requirement for the capability of lighting load management, HVAC load management, and service water heating load management were required. These base requirements get controls in place to acheive these credits in larger buildings, but do not require the controls be activated. Where these controls are required, the related energy credits are reduced in a separate public comment.
- The revised table requirements proposed here are based on the available credits for 0.2 W/square foot of solar generation (R01) plus the lighting load management credit (G01). To acknowlege the base code addition of a solar requirement, this is reduced from the original proposed requirement based on the original available credits and 0.4 W/square foot of solar generation (R01) plus the lighting load management credit (G01). In both cases the credits for an individual building type and climate zone were limited to 90 points or 9% energy cost reduction. In the new schema, this limit only impacted the warehouse (s-1/S-2) use group.

Where site-based solar generation or lighting load management is not practical, or has reduced credits due to base requirements, off-site solar, or other load management measures can be implemented to achieve the required credits.

In addition, to enhance flexibility, allow credit for all measures implemented, and better align with the way energy efficiency and load management credits interact in ASHRAE Standard 90.1, an exception is added that allows the renewable and load management credits to be reduced by as much as 30% when the building achieves energy efficiency credits that are greater than the requirement.

Cost Impact: The code change proposal will decrease the cost of construction.
The requirements for renewable and load management credits are generally lowered across the board, so the cost to implement these credits will be reduced.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: The adjusted renewable and load management credits proposed in CED1-192 align with the proposed prescriptive renewable energy requirements in IECC 2024.

Proposal # 717

CED1-194-22

Proponents: Reid Hart, representing Pacific Northwest National Laboratory (reid.hart@pnnl.gov); Michael Tillou, representing Pacific Northwest National Laboratory (michael.tillou@pnnl.gov)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

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

Portions of table not shown remain unchanged.

ID	**Energy Credit Measure**	**Section**	**Climate Zone**																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	~~8~~	~~13~~	~~7~~	~~11~~	~~6~~	~~8~~	~~9~~	~~6~~	1	~~24~~	~~8~~	~~9~~	~~30~~	~~15~~	~~5~~	32	~~28~~	~~31~~	~~36~~
E02	UA reduction (15%)	C406.2.1.2	7	6	2	4	1	1	4	1	1	22	1	3	29	10	1	32	27	30	39

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]

Portions of table not shown remain unchanged.

ID	Energy Credit Measure	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	~~6~~	~~11~~	~~6~~	~~11~~	~~7~~	~~9~~	~~6~~	~~6~~	~~2~~	~~3~~	3	~~3~~	~~4~~	~~3~~	~~7~~	~~5~~	~~5~~	~~17~~	~~3~~
E02	UA reduction (15%)	C406.2.1.2	1	1	1	1	2	1	1	1	3	1	3	11	27	7	10	3	3	2	10

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]

Portions of table not shown remain unchanged.

ID	**Energy Credit Measure**	**Section**	**Climate Zone**																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	~~4~~	~~7~~	~~4~~	~~7~~	~~3~~	~~4~~	~~7~~	~~2~~	~~1~~	~~7~~	~~2~~	~~3~~	~~10~~	~~6~~	~~4~~	~~12~~	~~9~~	~~19~~	~~11~~
E02	UA reduction (15%)	C406.2.1.2	2	3	1	2	1	3	3	2	1	5	2	2	7	4	2	9	7	9	11

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]

Portions of table not shown remain unchanged.

ID	Energy Credit Measure	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	~~4~~	~~7~~	~~4~~	~~7~~	~~3~~	~~4~~	7	~~2~~	~~0~~	~~7~~	~~2~~	~~3~~	~~10~~	~~6~~	~~4~~	~~12~~	~~9~~	~~19~~	~~11~~
E02	UA reduction (15%)	C406.2.1.2	7	8	3	6	5	3	7	3	1	13	4	8	21	15	11	13	24	37	43

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

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

Portions of table not shown remain unchanged.

ID	**Energy Credit Measure**	**Section**	**Climate Zone**																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	1	1	1	1	~~2~~	~~2~~	~~9~~	2	1	~~19~~	4	5	~~26~~	~~7~~	~~3~~	~~33~~	~~23~~	~~29~~	~~13~~
E02	UA reduction (15%)	C406.2.1.2	1	1	1	1	13	1	3	2	1	4	4	5	5	5	6	6	6	6	6

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]

Portions of table not shown remain unchanged.

ID	Energy Credit Measure	Section	Climate Zone																	
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	~~2~~	~~2~~	~~2~~	~~2~~	~~2~~	~~3~~	~~15~~	~~2~~	1	~~36~~	~~5~~	~~9~~	~~45~~	~~11~~	~~5~~	~~51~~	~~36~~	~~35~~	~~15~~
E02	UA reduction (15%)	C406.2.1.2	14	14	8	13	7	9	20	15	1	35	18	28	41	37	40	43	44	46	31

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]

Portions of table not shown remain unchanged.

ID	Energy Credit Measure	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	~~9~~	~~22~~	~~8~~	~~20~~	~~9~~	~~12~~	~~5~~	~~11~~	~~3~~	~~4~~	~~9~~	~~2~~	~~3~~	~~6~~	~~0~~	~~4~~	~~3~~	~~4~~	~~3~~
E02	UA reduction (15%)	C406.2.1.2	8	18	7	19	12	13	20	17	11	24	20	17	33	32	29	40	38	46	44

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]

ID	Energy Credit Measure	Section	Climate Zone																	
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																	
E02	UA reduction (15%)	C406.2.1.2	~~1~~	~~2~~	1	~~1~~	1	~~2~~	~~25~~	~~2~~	~~1~~	~~62~~	~~11~~	~~14~~	~~74~~	~~21~~	~~6~~	~~75~~	~~57~~	~~58~~	~~21~~
E02	UA reduction (15%)	C406.2.1.2	14	14	1	12	1	9	27	16	2	37	29	39	44	47	50	43	52	55	74

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

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

Portions of table not shown remain unchanged.

ID	Energy Credit Measure	Section	Climate Zone																		
			0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
E01	Envelope Performance	C406.2.1.1	Determined in accordance with Section C406.2.1.1																		
E02	UA reduction (15%)	C406.2.1.2	~~5~~	~~9~~	~~5~~	~~8~~	5	~~6~~	~~10~~	~~5~~	2	~~20~~	~~6~~	~~6~~	~~25~~	~~10~~	~~4~~	~~28~~	~~22~~	~~26~~	~~16~~
E02	UA reduction (15%)	C406.2.1.2	<u>7</u>	<u>8</u>	<u>3</u>	<u>7</u>	5	<u>5</u>	<u>11</u>	<u>7</u>	2	<u>18</u>	<u>10</u>	<u>14</u>	<u>26</u>	<u>20</u>	<u>19</u>	<u>24</u>	<u>25</u>	<u>29</u>	<u>32</u>

a. "x" indicates measure is not available<u> in that climate zone</u> for that measure.

b. Other occupancy groups include all Groups except for Groups A-2, B, E, I, M, <u>S, </u>and R.

Reason: After CEPI-193 received the first vote, the credits for E02, UA reduction, were reanalyzed based on feedback. The reanalysis was also undertaken so that the analysis procedure was the same as it was for the alternative discrete envelope fenestration and insulation measures.

The result was an overall increase in credits by 130% as an unweighted average. There is a great deal of variation between climate zones and between building use groups. This is due to the fact that the credits are based on a percentage of total building use and not a fixed change in energy use. Often insulation savings impacts in the same numerical climate zone are different in each humidity regime, as the total base building use can vary quite a bit based on humidity. There is also a variation in heating type between prototypes. The average credits across climate zones (before/after/New%) is shown by building use in the table below: with the percentage new vs. prior on average shown.

E02 Envelope Improvement, 15% UA reduction

Compare average credits across climate zones

Building Use	New	Prior	New
Apartment	11.6	15.1	77%
Health	4.4	6.2	72%
Hotel	3.9	9.6	40%
Office	12.2	6.4	189%
Restaurant	4.0	9.6	42%
Retail	24.4	14.7	166%
Education	23.6	7.2	327%
Warehouse	29.7	22.9	130%
Other	14.3	11.5	125%
Average	14.2	11.5	130%

The two basis of analysis were different and the new analysis is expected to both be more accurate and better match the other discrete envelope measures in the credit section.

- The original analysis for this measure was from the 2021 IECC energy credit results adjusted to the 2024 credit metric. The original analysis was based on one representative building prototype for each use group.
- The improved analysis used baseline building parameters that were more up to date. It also used an automated measure parametric replacement approach and included all the prototypes relevant to that use group. Then the results from each prototype were averaged for the group by relative national construction weight.

In addition, the table footnotes were edited to be more consistent with each other.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
As an optional credit there is no direct requirement to implement particular measures, so a change in measure credits will not impact construction cost.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: After passage of CEPI-193, the E02 Credit (15% UA reduction) was reanalyzed based on feedback. This result is a significant increase, as an unweighted average, in credits.

CED1-195-22

Proponents: Thomas Culp, representing Aluminum Extruders Council (culp@birchpointconsulting.com)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C406.2.1.6 E06 Improve fenestration. Energy credits for one selected fenestration energy credit ID shall be achieved for improved energy characteristics ofall vertical fenestration in the project meeting the requirements in one of the rows of 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 selected table row. 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 selected table row.

TABLE C406.2.1.6 Vertical Fenestration Requirements for Energy Credit E06

Portions of table not shown remain unchanged.

Applicable Climate Zone	Maximum U-Factor		Maximum SHGC~~[a]~~	Minimum VT
	Fixed	Operable		

~~a. 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 Equation 4-4, the required maximum SHGC shall be multiplied by 1.2.~~

Reason: Credit E06 adds an efficiency credit for improved vertical fenestration, listing the required maximum U-factor, maximum SHGC, and minimum VT by climate zone. We agree with the intent of this credit, but note that the SHGC requirement forgot to include the ability to account for shading projection factor like in the main Table C402.5 or in ASHRAE 90.1. This proposal adds a footnote that clarifies that the maximum SHGC requirement shall be multiplied by 1.2 when there is permanently attached shading projection with PF >= 0.2 as calculated in accordance with Equation 4-4 in Section C402.5.3. Rather than listing separate SHGC values for different projection factors like in Table C402.5, this uses the same multiplier of 1.2 consistent with what is used in Table C402.5 for the PF >= 0.2 line. (We don't feel it is necessary to include an additional multiplier from the PF >= 0.5 line; as such, this accounts for some shading but is still conservative.)

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
This proposal only makes the SHGC requirement consistent with how Table C402.1.5 accounts for shading projection factor, but does not require shading. As such, there is no cost impact.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: This proposal updates the E06 additional energy credit to account for the shading projection factor when determining the maximum SHGC requirement.

Proposal # 876

CED1-197-22

Proponents: Aaron Phillips, representing Asphalt Roofing Manufacturers Association (aphillips@asphaltroofing.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

TABLE C407.4.1(1) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Space use classification	Same as proposed	The space use classification shall be chosen in accordance with Table C405.3.2(1) or C405.3.2(2) for all areas of the building covered by this permit. Where the space use classification for a building is not known, the building shall be categorized as an office building.
Roofs	Type: insulation entirely above deck	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table C402.1.2	As proposed
	Solar reflectance~~absorptance~~: 0.25~~0.75~~ , except as specified in Section C402.4 and Table C402.4 for Climate Zones 0, 1, 2, and 3	As proposed
	Emittance: 0.90, except as specified in Section C402.4 and Table C402.4 for Climate Zones 0, 1, 2, and 3	As proposed
Walls, above-grade	Type: same as proposed	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table C402.1.2	As proposed
	Thermal bridges: Account for heat transfer consistent with compliant *psi*- and *chi*-factors from Table C402.1.4 for *thermal bridges* as identified in Section C402.7 that are present in the proposed design.	As proposed; *psi*- and *chi*-factors for proposed *thermal bridges* shall be determined in accordance with requirements in Section C402.1.4.
	Solar reflectance~~absorptance~~: 0.25~~0.75~~	As proposed
	Emittance: 0.90	As proposed
Walls, below-grade	Type: mass wall	As proposed
	Gross area: same as proposed	As proposed
	U-Factor: as specified in Table C402.1.2 with insulation layer on interior side of walls	As proposed
Floors, above-grade	Type: joist/framed floor	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table C402.1.2	As proposed
Floors, slab-on-grade	Type: unheated	As proposed
	F-factor: as specified in Table C402.1.2	As proposed
Opaque doors	Type: swinging	As proposed
	Area: Same as proposed	As proposed
	U-factor: as specified in Table C402.1.2	As proposed
Vertical fenestration other than opaque doors	Area 1. The proposed vertical fenestration area; where the proposed vertical fenestration area is less than 40 percent of above-grade wall area. 2. 40 percent of above-grade wall area; where the proposed vertical fenestration area is 40 percent or more of the above-grade wall area.	As proposed
	U-factor: as specified in Table C402.5	As proposed
	SHGC: as specified in Table C402.5 except that for climates with no requirement (NR) SHGC = 0.40 shall be used	As proposed
	External shading and PF: none	As proposed
	Area	

Skylights	1. The proposed skylight area; where the proposed skylight area is less than that permitted by Section C402.1. 2. The area permitted by Section C402.1; where the proposed skylight area exceeds that permitted by Section C402.1.	As proposed
	U-factor: as specified in Table C402.5	As proposed
	SHGC: as specified in Table C402.5 except that for climates with no requirement (NR) SHGC = 0.40 shall be used.	As proposed
Lighting, interior	The interior lighting power shall be determined in accordance with Section C405.3.2. Where the occupancy of the building is not known, the lighting power density shall be 1.0 watt per square foot based on the categorization of buildings with unknown space classification as offices.	As proposed
Lighting, exterior	The lighting power shall be determined in accordance with Tables C405.5.2(1), C405.5.2(2) and C405.5.2(3). Areas and dimensions of surfaces shall be the same as proposed.	As proposed
Internal gains	Same as proposed	Receptacle, motor and process loads shall be modeled and estimated based on the space use classification. End-use load components within and associated with the building shall be modeled to include, but not be limited to, the following: exhaust fans, parking garage ventilation fans, exterior building lighting, swimming pool heaters and pumps, elevators, escalators, refrigeration equipment and cooking equipment.
Schedules	Same as proposed **Exception:** Thermostat settings and schedules for HVAC systems that utilize radiant heating, radiant cooling and elevated air speed, provided that equivalent levels of occupant thermal comfort are demonstrated by means of equal Standard Effective Temperature as calculated in Normative Appendix B of ASHRAE Standard 55.	Operating schedules shall include hourly profiles for daily operation and shall account for variations between weekdays, weekends, holidays and any seasonal operation. Schedules shall model the time-dependent variations in occupancy, illumination, receptacle loads, thermostat settings, mechanical ventilation, HVAC equipment availability, service hot water usage and any process loads. The schedules shall be typical of the proposed building type as determined by the designer and approved by the jurisdiction.
Outdoor airflow	Where the proposed design specifies mechanical ventilation: 1. For systems 1-4 as specified in Tables C407.4.1(2) and C407.4.1(3), the outdoor airflow rate shall be determined in accordance with Section C403.7 and *International Mechanical Code* Section 403.3.1.1.2.3.4 Equation 4-8, using a system ventilation efficiency (Ey) of 0.75._ 2.For systems 5-11 as specified in Tables C407.4.1(2) and C407.4.1(3), the outdoor airflow rate shall be determined in accordance with Section C403.7 and *International Mechanical Code* Section 403.3._ Where the proposed design specifies natural ventilation, as proposed.	As proposed, in accordance with Section C403.2.2.
Heating systems	Fuel type: same as proposed design	As proposed
	Equipment type[a]: as specified in Tables C407.4.1(2) and C407.4.1(3)	As proposed
	Efficiency: as specified in the tables in Section C403.3.2.	As proposed
	Capacity[b]: sized proportionally to the capacities in the	

	proposed design based on sizing runs, and shall be established such that no smaller number of unmet heating load hours and no larger heating capacity safety factors are provided than in the proposed design.	As proposed
Cooling systems	Fuel type: same as proposed design	As proposed
	Equipment type[c]: as specified in Tables C407.4.1(2) and C407.4.1(3)	As proposed
	Efficiency: as specified in Tables C403.3.2(1), C403.3.2(2) and C403.3.2(3)	As proposed
	Capacity[b]: sized proportionally to the capacities in the proposed design based on sizing runs, and shall be established such that no smaller number of unmet cooling load hours and no larger cooling capacity safety factors are provided than in the proposed design.	As proposed
	Economizer[d]: same as proposed, in accordance with Section C403.5.	As proposed
Service water heating[e]	Fuel type: same as proposed	As proposed
	Efficiency: as specified in Table C404.2	For Group R, as proposed multiplied by SWHF. For other than Group R, as proposed multiplied by efficiency as provided by the manufacturer of the DWHR unit.
	Capacity: same as proposed	As proposed
	Where no service water hot water system exists or is specified in the proposed design, no service hot water heating shall be modeled.	
Energy Recovery	Where the proposed design specifies mechanical ventilation, as specified in Section C403.7.4 based on the *standard reference design* airflows._ Where the proposed design specifies natural ventilation, as proposed.	As proposed
Fan power	As specified in Section C403.8 for the proposed design. **Exceptions:** 1. Where the fan power of the proposed design is exempted from the requirements of Section C403.8, as proposed._ 2. Fan systems addressed by Section C403.8.1: Fan system BHP power shall be as proposed or to the limits specified in Section C403.8.1, whichever is smaller. If the limit is reached, the power or each fan shall be reduced proportionally until the limit is met._ 3. Fan systems serving areas where the mechanical ventilation is provided in accordance with an engineered ventilation system design of Section 403.2 of the *International Mechanical Code* shall not use the particulate filtration or air cleaner pressure drop adjustment available in Table C403.8(1) when calculating the fan system BHP limit for the portion of the airflow being treated to comply with the engineered ventilation system design.	As proposed
	Where a system providing on-site renewable energy has been modeled in the proposed design the same system shall be modeled identically in the *standard reference design* except the rated capacity shall meet the requirements of Section C405.15.1_	

On-site Renewable Energy	Where no system is designed or included in the proposed design, model an unshaded photovoltaic system with the following characteristics: **Size:** Rated capacity per Section C405.15.1 **Module Type**: Crystalline Silicone Panel with glass cover, 19.1% nominal efficiency and temperature coefficient of -0.35%/°C, Performance shall be based on a reference temperature of 77°F (25°C), airmass of 1.5 atmosphere and irradiance of 317 Btu/h x ft^2 (1000 W/m^2). **Array Type:** Rack mounted array with installed nominal operating cell temperature (INOCT) of 103°F (45°C). Total System Losses (DC output to AC output): 11.3%. **Tilt:** 0-degrees (mounted horizontally). **Azimuth:** 180 degrees.	As proposed

For SI: 1 watt per square foot = 10.7 w/m^2.

SWHF = Service Water Heat Recovery factor, DWHR = Drain Water Heat Recovery.

a. Where no heating system exists or has been specified, the heating system shall be modeled as fossil fuel. The system characteristics shall be identical in both the standard reference design and proposed design.

b. The ratio between the capacities used in the annual simulations and the capacities determined by sizing runs shall be the same for both the standard reference design and proposed design.

c. Where no cooling system exists or no cooling system has been specified, the cooling system shall be modeled as an air-cooled single-zone system, one unit per thermal zone. The system characteristics shall be identical in both the standard reference design and proposed design.

d. If an economizer is required in accordance with Table C403.5(1) and where no economizer exists or is specified in the proposed design, then a supply-air economizer shall be provided in the standard reference design in accordance with Section C403.5.

e. The SWHF shall be applied as follows:

1. Where potable water from the DWHR unit supplies not less than one shower and not greater than two showers, of which the drain water from the same showers flows through the DWHR unit then SWHF = [1 – (DWHR unit efficiency × 0.36)].
2. Where potable water from the DWHR unit supplies not less than three showers and not greater than four showers, of which the drain water from the same showers flows through the DWHR unit then SWHF = [1 – (DWHR unit efficiency × 0.33)].
3. Where potable water from the DWHR unit supplies not less than five showers and not greater than six showers, of which the drain water from the same showers flows through the DWHR unit, then SWHF = [1 – (DWHR unit efficiency × 0.26)].
4. Where Items 1 through 3 are not met, SWHF = 1.0.

C409.6.1.4.1 Roofs. Roofs will be modeled with insulation above a steel roof deck. The roof U-factor and area shall be modeled as in the proposed design. If different roof thermal properties are present in a single block, an area weighted U-factor shall be used. Roof solar reflectance~~absorptance~~ shall be modeled at 0.30~~0.70~~ and emittance at 0.90.

Reason: Within the IECC commercial provisions of the 1st Public Comment Draft, there are only three instances where "solar absorptance" is used. In contrast, there are eighteen uses of "solar reflectance." This comment changes those three instances, and the associated values, to make all uses consistent throughout the commercial provisions. The end result will be less confusion in understanding roof and wall radiative property requirements in different sections of the IECC.
ARMA submitted a separate comment that changes the solar absorptance value in Section C409.6.1.4.1. If both comments are accepted, the value of solar reflectance in C409.6.1.4.1 will need to be updated to properly correlate the two comments.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The changes proposed in this comment align language across sections of the code without making technical modifications. Therefore, there is no impact on cost of construction.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: correlate use of solar reflectance with other parts of the code.

Proposal # 754

CED1-198-22

Proponents: Reid Hart, representing Pacific Northwest National Laboratory (reid.hart@pnnl.gov); Michael Tillou, representing Pacific Northwest National Laboratory (michael.tillou@pnnl.gov)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C403.1 General. Mechanical systems and equipment serving the building heating, cooling, ventilating or refrigerating needs shall comply with one of the following:

1. Sections C403.1.1 and Sections C403.2 through Section C403.14
2. Data Centers shall comply with Section C403.1.1, Section C403.1.2 and Section C403.6 through Section C403.14
3. Section C409 ~~C403.1.3 and sections within Section C403 that are listed in Table C407.2(1)~~.

C406.2.2.1 H01 HVAC Performance (TSPR). H01 energy credits shall be achieved ~~for~~ where systems are permitted ~~allowed~~ to use Section C409 ~~C403.1.3, HVAC total system performance ratio,~~ and where the proposed TSPR exceeds the minimum TSPR requirement by 5 percent or more. If improvement is greater than 5 percent, ~~base energy credits from Table C406.2(1) through C406.2(9) are permitted to be prorated up to a 20 percent improvement~~ determine H01 achieved credits using Equation 4-17. Energy credits for H01 ~~may~~ shall not be combined with energy credits from HVAC measures H02, H03 ~~and~~ or H05.

(Equation 4-17)

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

where:

TSPRs = 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]
~~TSPRt = TSPRr / MPF~~
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

SECTION 409
CALCULATION OF HVAC TOTAL SYSTEM PERFORMANCE RATIO

Revise as follows:

C409.1 Applicability ~~Purpose~~. ~~Section 409 establishes criteria for demonstrating compliance with the requirements of C403.1.1,~~ Use of the HVAC Total System Performance Ratio ~~total system performance ratio~~ (~~HVAC~~ TSPR) method shall comply with this section.

C409.2 ~~Scope~~ Permitted Uses. ~~Section C409 applies to new~~ Only HVAC systems that serve building~~s~~ occupancies and uses in ~~Section C403.1.3.1 and are not excluded from using HVAC TSPR by Section C403.1.3. All applicable HVAC systems shall comply with Section C409.~~ Table C409.4 and not excluded by Section C409.2.1 shall be permitted to use the TSPR method.

Delete without substitution:

~~**C403.1.3 HVAC total system performance ratio (HVAC TSPR).** HVAC systems serving buildings or portions of buildings listed in Section C403.1.3.1 that are not served by systems listed in Section C403.1.3.2 shall have an HVAC total system performance ratio (HVAC TSPR) of the proposed design HVAC systems that is greater than or equal to the HVAC TSPR of the standard reference design divided by the applicable mechanical performance factor (MPF) from Table C409.4. HVAC TSPR shall be calculated in accordance with Section C409, Calculation of HVAC Total System Performance Ratio. Systems using the HVAC TSPR method shall also meet requirements in Section C403.1.3.3.~~

~~**C403.1.3.1 Included Building Types.** Only HVAC systems that serve the following building use types are allowed to use the TSPR Method:~~

1. ~~Office (including medical office) (occupancy group B)~~

~~2. Retail (occupancy group M),~~

~~3. Library (occupancy group A-3),~~

~~4. Education (occupancy group E),~~

~~5. Hotel/motel occupancies (occupancy group R-1),~~

~~6. The *dwelling units* and *common areas* within occupancy group R-2 multifamily buildings.~~

Revise as follows:

C409.2.1 ~~C403.1.3.2 Excluded~~ Systems Not Permitted. The following HVAC systems are not permitted to use Section C403.1(3): ~~excluded from using the TSPR Method:~~

1. HVAC Systems using
   1.1 District heating water, chilled water or steam
   1.2 Small duct high velocity air cooled, space constrained air cooled, single package vertical air conditioner, single package vertical heat pump, or double-duct air conditioner or double-duct heat pump as defined in subpart F to 10CFR part 431
   1.3 Packaged terminal air conditioners and packaged terminal heat pumps that have cooling capacity greater than 12,000 Btu/hr (3500 kW)
   1.4 A common heating source serving both HVAC and service water heating equipment~~, or~~
2. HVAC systems that provide recovered heat for service water heating
3. HVAC systems not specified ~~included~~ in Table C409.6.1.10.1
4. HVAC systems specified ~~included~~ in Table C409.6.1.10.1 with characteristics or parameters in Table C409.6.1.10.2(1), not identified as applicable to that HVAC system type.
5. HVAC systems with chilled water supplied by absorption chillers, heat recovery chillers, water to water heat pumps, air to water heat pumps, or a combination of air- and water-cooled chillers on the same chilled water loop.
6. HVAC systems served by heating water plants that include air to water or water to water heat pumps.
7. Underfloor air distribution and displacement ventilation HVAC systems.
8. Space conditioning systems that do not include mechanical cooling.
9. HVAC systems serving laundry rooms, elevator rooms, mechanical rooms, electrical rooms, data centers, and computer rooms.
10. *Buildings* or areas of medical office buildings ~~that comply fully with~~ required to use ASHRAE Standard 170 . ~~, including but not limited to surgical centers, or~~
11. *Buildings* or areas that are required by ~~other applicable codes or standards~~ regulation to ~~provide 24/7~~ have continuous air handling unit operation
12. HVAC systems serving laboratories with fume hoods
13. Locker rooms with more than 2 showers
14. Natatoriums and rooms with saunas
15. Restaurants and commercial kitchens with total cooking capacity greater than 100,000 Btu/h (29 kW)
16. Areas of *buildings* with commercial refrigeration equipment exceeding 100 kW of power input.
17. Cafeterias and dining rooms

C409.3 ~~C403.1.3.3~~ HVAC TSPR Compliance ~~Method Partial Prescriptive Requirements~~. HVAC systems permitted to use TSPR shall comply with Section C409.4 and the following:~~HVAC systems using the HVAC Performance Rating Method shall meet relevant prescriptive requirements in Section C403 as follows:~~

1. HVAC systems shall comply with the applicable requiremts of Section C403 as follows:

1.1. Air economizers shall meet the requirements of Section C403.5.3.4 Relief of excess outdoor air and Section C403.5.5 Economizer fault detection and diagnostics.

1.2. Variable-air-volume system systems shall meet requirements of Sections C403.6.5, C403.6.6, and C403.6.9.

1.3. Hydronic systems shall meet the requirements of Section C403.4.4.

1.4. Plants with multiple chillers or boilers shall meet the requirements of Section C403.4.5.

1.5. Hydronic (Water Loop) Heat Pumps and Water-Cooled Unitary Air Conditioners shall meet the requirements of Section C403.4.3.3.

1.6. Cooling tower turndown shall meet requirements of Section C403.11.4.

1.7. Heating of unenclosed spaces shall meet the requirements of Section C403.14.1.

1.8. Hot-gas bypass shall meet the requirements of Section C403.3.3.

1.9. Systems shall meet the operable openings interlock requirements of Section C402.5.11.10 (*staff note Section C402.5.11.10 removed by CECPI-3-21 and CEPI-65-21*). Refrigeration systems shall meet the requirements of Section C403.12.

2. Systems shall comply with the applicable provisions of Sections of Section C403 required by Table C407.2

C409.4 Performance Target ~~HVAC TSPR Compliance~~. For HVAC Systems serving uses or portions of uses listed in Section C409.2 that are not served by systems listed in Section C409.2.1, the ~~allowed to use HVAC TSPR in accordance with Section C403.1.3 shall comply with all of the following:~~

~~1.~~	~~Systems shall meet the applicable provisions of Section C403.1.3.3 and Sections within Section C403 that are listed in Table C407.2~~

~~The~~ HVAC TSPR of the proposed design shall be greater than or equal to the HVAC TSPR of the standard reference design divided by the mechanical performance factor (MPF)using Equation 4-33.

(Equation 4-33)

$$TSPRp > TSPRr / MPF$$

where:

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

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 using Equation 4-34

$$MPF = (A1 \times MPF1 + A2 \times MPF2 + ... + An \times MPFn)/(A1 + A2 + ... + An)$$

(Equation 4-34)

where:

MPF1, MPF2 through MPFn= Mechanical Performance Factors from Table C409.4 based on ~~climate zone and~~ building use types 1,2, through n

A1, A2 through An= Conditioned floor areas for building use types 1, 2, through n

TABLE C409.4 Mechanical Performance Factors

Climate Zone: Building ~~type~~ Use	Occupancy Group	0A	0B	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
~~Office (small and medium)[a]~~	~~B~~	~~0.72~~	~~0.715~~	~~0.70~~	~~0.705~~	~~0.685~~	~~0.65~~	~~0.71~~	~~0.68~~	~~0.645~~	~~0.805~~	~~0.70~~	~~0.78~~	~~0.845~~	~~0.765~~	~~0.805~~	~~0.865~~	~~0.835~~	~~0.875~~	~~0.895~~
Office (Large)[a]	B	0.83	0.83	0.84	0.84	0.79	0.82	0.72	0.81	0.77	0.67	0.76	0.63	0.71	0.72	0.63	0.73	0.71	0.71	0.71
Office (all others)[a]	B	0.72	0.715	0.70	0.705	0.685	0.65	0.71	0.68	0.645	0.805	0.70	0.78	0.845	0.765	0.805	0.865	0.835	0.875	0.895
Retail	M	0.60	0.57	0.50	0.55	0.46	0.46	0.43	0.51	0.40	0.45	0.57	0.68	0.46	0.68	0.67	0.50	0.45	0.44	0.38
Hotel/Motel	R-1	0.62	0.62	0.63	0.63	0.62	0.68	0.61	0.71	0.73	0.45	0.59	0.52	0.38	0.47	0.51	0.35	0.38	0.31	0.26
Multi-family/Dormitory	R-2	0.64	0.63	0.67	0.63	0.65	0.64	0.59	0.72	0.55	0.53	0.50	0.44	0.54	0.47	0.38	0.55	0.50	0.51	0.47
School/Education and Libraries	E (A-3)	0.82	0.81	0.80	0.79	0.75	0.72	0.71	0.72	0.67	0.73	0.72	0.68	0.82	0.73	0.61	0.89	0.80	0.83	0.77

a. Large office ~~gross~~ conditioned floor area ~~>~~ more than 150,000 ft^2 (14,000 m^2) or ~~>~~ more than 5 stories ~~floors; all other offices are small or medium~~

C409.4.1 HVAC TSPR. HVAC TSPR is calculated according to Equation 4-35.

$$\text{HVAC TSPR} = \text{Heating and cooling load/Building HVAC system energy}$$

(Equation 4-35)

where:

Building HVAC system energy = Sum of the annual site energy consumption for heating, cooling, fans, energy recovery, pumps, and heat rejection in thousands of Btus (kWh)

Heating and cooling load = Sum of the annual heating and cooling loads met by the building HVAC system in thousands of Btus (kWh)

C409.5 General. Projects shall ~~comply with the requirements~~ use the procedures of this Section when calculating compliance using HVAC Total System Performance Ratio.

C409.5.1 Simulation Program. Simulation tools used to calculate HVAC TSPR of the Standard Reference Design shall comply with the following:

1. The simulation program shall calculate the HVAC TSPR based only on the input for the proposed design and the requirements of Section 409. The calculation procedure shall not allow the user to directly modify the building component characteristics of the standard reference design.
2. Performance analysis tools shall meet ~~ing~~ the applicable subsections of Section 409 and be tested ~~according to~~ in accordance with ASHRAE Standard 140, except for Sections 7 and 8 of Standard 140~~, shall be permitted to be approved~~. The required tests shall include building thermal envelope and fabric load test (Sections 5.2.1, 5.2.2, and 5.2.3), ground coupled slab-on-grade analytical verification tests (Section 5.2.4), space-cooling equipment performance tests (Section 5.3), space-heating equipment performance tests (Section 5.4), and air-side HVAC equipment analytical verifi-cation test (Section 5.5), along with the associated reporting (Section 6). ~~Tools are permitted to be approved based on meeting a specified threshold for a jurisdiction. The code official shall be permitted to approve tools for a specified application or limited scope.~~
3. The test results and modeler reports shall be ~~posted on a~~ publicly available ~~website~~ and shall include the test re-sults of the simulation programs and input files used for generating the results along with the results of the other simulation programs included in ASHRAE Standard 140 Annexes B8 and B16. The modeler report in Standard 140 Annex A2 Attachment A2.7 shall be completed for results exceeding the maximum or falling below the minimum of the reference values and for omitted results.
4. The simulation program shall have the ability to ~~explicitly~~ model part-load performance curves or other part-load adjustment methods based on manufacturer's part-load performance data for mechanical equipment.
5. The *code official* shall be permitted to approve specific software deemed to meet these requirements in accordance with Section C101.5.1.

C409.5.2 Climatic Data. C409.5.2 The simulation program shall perform the simulation using hourly values of climatic data for a full calendar year

(8,760 hours) and shall reflect approved coincident hourly data for temperature, solar radiation, humidity and wind speed for the building location. ~~, such as temperature and humidity, using TMY3 data for the site as specified here: https://buildingenergyscore.energy.gov/resources~~

C409.5.3 Documentation. Documentation or web links to documentation conforming to the provisions of this section shall be provided to the *code official*.

C409.5.3.1 Compliance Report. Building permit submittals shall include:

1. A report produced by the simulation software that includes the following:

   1.1 Address of the building.

   1.2 Name of individual completing the compliance report.

   1.3 Name and version of the compliance software tool

   1.4 The dimensions, floor heights and number of floors for each block.

   1.5 By block, the U-factor, C-factor, or F-factor for each simulated opaque envelope component and the U-factor and SHGC for each fenestration component.

   1.6 By block or by surface for each block, the fenestration area.

   1.7 By block, a list of the HVAC equipment simulated in the proposed design including the equipment type, fuel type, equipment efficiencies and system controls.

   1.8 Annual site HVAC energy use by end use for the proposed and baseline building.

   1.9 Annual sum of heating and cooling loads for the baseline building.

   1.10 The HVAC ~~total system performance ratio~~ TSPR for both the standard reference design and the proposed design.

2. A mapping of the actual building HVAC component characteristics and those simulated in the proposed design showing how individual pieces of HVAC equipment identified above have been combined into average inputs as required by Section C409.6.1.10 including:

   2.1 Fans

   2.2 Hydronic pumps

   2.3 Air handlers

   2.4 Packaged cooling equipment

   2.5 Furnaces

   2.6 Heat pumps

   2.7 Boilers

   2.8 Chillers

   2.9 Heat rejection equipment (open and closed-circuit cooling towers; dry coolers)

   2.10 Electric resistance coils

   2.11 Condensing units

   2.12 Motors for fans and pumps

   2.13 Energy recovery devices

3. For each piece of equipment identified above include the following as applicable:

   3.1 Equipment name or tag consistent with that found on the design documents.

   3.2 Rated Efficiency level.

   3.3 Rated Capacity.

   3.4 Where not provided by the simulation program report in item a, documention of the calculation of any weighted equipment efficiencies input into the program.

   3.5 Electrical input power for fans and pumps (before any speed or frequency control device) at design condition and calculation of input value (W/cfm(W/Lps) or W/gpm (W/Lps)).

4. Floor plan of the building identifying:

   4.1 How portions of the buildings are assigned to the simulated blocks.

   4.2 Areas of the building that are not covered under the requirements of Section C403.1.1.

C409.6 Calculation Procedures. Except as specified by this Section, the standard reference design and proposed design shall be configured and analyzed using identical methods and techniques

C409.6.1 Simulation of the proposed building design. The proposed design shall be configured and analyzed as specified in this section.

C409.6.1.1 Block Geometry. The geometry of buildings shall be configured using one or more blocks. Each block shall define attributes including block dimensions, number of floors, floor to floor height and floor to ceiling height. Simulation software may allow the use of simplified shapes (such as rectangle, L shape, H Shape, U shape or T shape) to represent blocks. Where actual building shape does not match these pre-defined shapes, simplifications are permitted providing the following requirements are met:

1. The conditioned floor area and volume of each block shall match the proposed design within 10 percent.
2. The area of each exterior envelope component from Table C402.1.4 is accounted for within 10 percent of the actual design.
3. The area of vertical fenestration and skylights is accounted for within 10 percent of the actual design.
4. The orientation of each component in 2 and 3 above is accounted for within 45 degrees of the actual design.

The creation of additional blocks may be necessary to meet these requirements. A more complex zoning of the building shall be allowed where all thermal zones in the reference and proposed model are the same and rules related to block geometry and HVAC system assignment to blocks are met with appropriate assignment to thermal zones.

Exception: Portions of the building that are unconditioned or served by systems not covered by the requirements of Section C403.1.1 shall be omitted.

Revise as follows:

C409.6.1.1.1 Number of Blocks. One or more blocks may be required per building based on the following restrictions:

1. Each *block* ~~can~~ shall have ~~only~~ no more than one building use ~~occupancy type (multifamily *dwelling unit*, multifamily common area, office, library, education, hotel/motel or retail). Therefore, at least one single *block* shall be created for each unique use type.~~
2. Each block ~~can~~ shall be served by ~~only~~ no more than one type of HVAC system. ~~Therefore, a~~ A single block shall be created for each unique HVAC system and building use ~~type~~ combination and ~~. Multiple HVAC units of the same type may be represented in one block. Table D601.10.2 provides directions for combining~~ multiple HVAC units or components of the same type shall be combined in accordance with Section C409.6.1.10.2 . ~~of the same type into a single block~~.
3. Each block ~~can~~ shall have no more than a single defin ed ~~ition of~~ floor~~-to-~~ -to-floor or floor~~-to-~~ -to-ceiling height~~s~~. Where floor heights differ by more than two feet, ~~unique~~ separate blocks ~~should~~ shall be created f~~or the floors with varying heights~~.
4. Each block ~~can~~ shall include either above grade or below grade stories ~~floors~~. For buildings with both above grade and below grade stories ~~floors~~, separate blocks ~~should~~ shall be created for each. Where blocks have exterior walls partially below grade, if greater than 50 percent of the exterior wall surface is below grade, then simulate the block as below grade; otherwise simulate as above grade . ~~For buildings with stories floors partially above grade and partially below grade, if the total wall area of the floor(s) in consideration is greater than or equal to 50 percent above grade, then it should be simulated as a completely above grade block, otherwise it should be simulated as a below grade block.~~
5. ~~Each wall on a façade of a block shall have similar vertical fenestration.~~ Where a block includes multiple stories, separate blocks shall be created, if needed, to comply with both the following fenestration modeling requirements:

   5.1. The product of the proposed design U-factor times the area of windows (U•A) on a given story of each façade ~~of a given~~ shall not ~~floor cannot~~ differ by more than 15 percent of the average U •A for that modeled façade in each block.

   5.2 The product of the proposed design SHGC times the area of windows (SHGC•A) on a given story of each façade ~~of a given~~ shall not ~~floor cannot~~ differ by more than 15 percent of the average SHGC •A for that modeled façade in each block.

   ~~If either of these conditions are not met, additional blocks shall be created consisting of floors with similar fenestration.~~

6. For a building model with multiple blocks, the blocks ~~should~~ shall be configured together to have the same adjacencies as the actual building design.

C409.6.1.2 Thermal Zoning. Each ~~floor~~ story in a block shall be modeled ~~a single thermal zone or as five thermal zones consisting of four perimeter zones and a core zone.~~ as follows:

1. Below grade ~~floor~~ stories shall be modeled as a single thermal zone ~~block~~.
2. Where ~~If~~ any façade in the block is less than 45 feet in length, it shall be modeled as ~~there shall only be~~ a single thermal zone per ~~floor~~ story.
3. Otherwise, each ~~floor~~ story shall be modeled with five thermal zones. A perimeter zone shall be created extending from each façade to a depth of 15 feet. Where facades intersect, the zone boundary shall be formed by a 45 degree angle with the two facades. The remaining area or each ~~floor~~ story shall be modeled as a core zone with no exterior walls.

C409.6.1.2.1 ~~C409.3~~ Core & Shell, ~~/ Initial~~ Build-Out, and Future System Construction Analysis. Where the building permit applies to only a portion of the HVAC system in a *building* and the remaining components will be designed under a future building permit or were previously installed, ~~the future or previously installed~~ such components shall be modeled as follows:

1. ~~Where the HVAC zones that do not include~~ Blocks including existing or future HVAC zones ~~systems in the current permit will be or are~~ served by independent systems and not part of the construction project shall not be modeled~~, then the block including those zones shall not be included in the model~~.
2. Where the HVAC zones that do not include complete HVAC systems in the permit are intended to receive HVAC services from systems that are part of the construction project ~~in the permit~~, their proposed zonal systems shall be modeled with equipment that meets, but does not exceed, the requirements of Section C403.
3. Where existing HVAC systems serve permitted ~~the~~ zone equipment ~~in the permit receives HVAC services from previously installed systems that are not in the permit,~~ the ~~previously installed~~ existing systems shall be modeled with equipment matching the manufacturer's stated efficiency for the ~~certified~~ ~~value of what is~~ installed equipment or equipment that meets, but does not exceed the requirements of complying with Section C403.
4. Where the central plant heating and cooling equipment is completely replaced and HVAC zones with existing systems receive HVAC services from systems in the permit, their proposed zonal systems shall be modeled with equipment that meets, but does not exceed, the requirements of Section C403.

C409.6.1.3 Occupancy. Building occupancies modeled in the standard reference design and the proposed design shall comply with the following requirements.

Revise as follows:

C409.6.1.3.1 Occupancy Type. The occupancy type for each block shall be consistent with the building occupancy and uses specified in Table C409.4 ~~area type as determined in accordance with Section C405.4.2.1.~~ Portions of the building that are building occupancy and uses other than those specified in Table C409.4 ~~area types multifamily dwelling unit, multifamily common area, office, school (education), library, or retail~~ shall not be included in the simulation. Surfaces adjacent to such excluded building portions shall be modeled as adiabatic in the simulation program.

C409.6.1.3.2 Occupancy schedule, density, and heat gain. The occupant density, heat gain, and schedule shall be for multifamily, office, retail, library, hotel/motel or school as specified by ASHRAE Standard 90.1 Normative Appendix C.

C409.6.1.4.1 Roofs. ~~Roofs will be modeled with insulation above a steel roof deck.~~ The roof U-factor and area shall be modeled as in the proposed design. If different roof thermal properties are present in a single block, an area weighted U-factor shall be used. Roofs shall be modeled with insulation above a steel roof deck, with ~~Roof~~ solar absorptance ~~shall be modeled at~~ of 0.70 and emittance ~~at~~ of 0.90.

C409.6.1.4.2 Above grade walls. ~~Walls will be modeled as steel frame construction.~~ The U-factor and area of above grade walls shall be modeled as in the proposed design. If different wall constructions exist on the façade of a block an area-weighted U-factor shall be used. Walls shall be modeled as steel frame construction.

C409.6.1.4.3 Below grade walls. The C-factor and area of below grade walls shall be modeled as in the proposed design. If different ~~slab on grade floor~~ below grade wall constructions exist in a block, an area-weighted C- factor shall be used.

C409.6.1.4.4 Above grade exterior floors. ~~Exterior floors shall be modeled as steel frame.~~ The U-factor and area of floors shall be modeled as in the proposed design. If different ~~wall~~ floor constructions exist in the block an area-weighted U-factor shall be used. Exterior floors shall be modeled as steel frame.

C409.6.1.4.5 Slab on grade floors. The F-factor and ~~area~~ perimeter of slab on grade floors shall be modeled as in the proposed design. If different ~~below grade wall~~ slab on grade floor constructions exist in a *block*, ~~an area~~ perimeter-weighted F- factor shall be used.

C409.6.1.4.6 Vertical Fenestration. The window area and area weighted U-factor and SHGC shall be modeled for each façade based on the proposed design. Each exterior surface in a block must comply with Section C409.6.1.1.1 item 5. Windows ~~will~~ shall be combined into a single window centered on each façade based on the area and sill height input by the user. When different U values, SHGC or sill heights exist on a single facade in a block, the area weighted average for each shall be input by the user.

C409.6.1.4.7 Skylights. The skylight area and area weighted U-factor and SHGC shall be modeled for each roof ~~floor~~ based on the proposed design. Skylights ~~will~~ shall be combined into a single skylight centered on the roof of each zone based on the area input by the user.

C409.6.1.4 Envelope Components. Building envelope components modeled in the standard reference design and the proposed design shall comply with the requirements of this Section.

C409.6.1.4.8 Exterior Shading. Permanent window overhangs shall be modeled. When windows with and without overhangs or windows with different overhang projection factors exist on a façade, window width weighted projection factors shall be input by the user as follows:

$$P_{avg} = (A1 \times L_{o1} + A2 \times L_{o2} ... + An \times L_{on})/(Lw_1 + Lw_2 ... + L_{wn})$$

C409.6.1.5 Lighting. Interior lighting power density shall be equal to the allowance in Table C405.4.2(1) for multifamily, office, retail, library, or school. The lighting schedule shall be for multifamily, office, retail, library, or school as specified by ASHRAE Standard 90.1 Normative Appendix C. The impact of lighting controls is assumed to be captured by the lighting schedule and no explicit controls shall be modeled. Exterior lighting shall not be modeled.

C409.6.1.6 Miscellaneous equipment. The miscellaneous equipment schedule and power shall be for multifamily, office, retail, library, or school as specified by ASHRAE Standard 90.1 Normative Appendix C. The impact of miscellaneous equipment controls is assumed to be captured by the equipment schedule and no explicit controls shall be modeled.
Exceptions:

1. Multifamily dwelling units shall have a miscellaneous load density of 0.42 W/ft^2
2. Multifamily common areas shall have a miscellaneous load density of 0 W/ft^2

C409.6.1.7 Elevators. Elevators shall not be modeled.

C409.6.1.8 Service water heating equipment. Service water heating shall not be modeled.

C409.6.1.9 On-site renewable energy systems. On-site Renewable Energy Systems shall not be modeled.

Revise as follows:

C409.6.1.10 HVAC equipment. <u>Where proposed or reference system parameters are not specified in Section C409,</u> HVAC systems shall <u>be modeled to</u> meet the <u>minimum</u> requirements of Section C403 Mechanical Systems.

C409.6.1.10.1 Supported HVAC systems. At a minimum, the HVAC systems shown in Table <u>C409.6.1.10.1</u> ~~CD105.2.10~~.1 shall be supported by the simulation program.

Reason: The changes here are the result of several SEHPCAC meetings with the CEPI-76 proponents to improve clarity of the new section. There are no changes in intended requirements as a result of these changes.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Proposed changes are clarification and editorial only.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason: This proposal is based on several SEHPCAC meetings with CEPI-76 to clarify the section. There are no changes to the section requirements. The modeling SC unanimously approved the proposal with no comment.

Proposal # 839

CED1-203-22

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

2024 International Energy Conservation Code [CE Project]

Add new definition as follows:

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*. 2. Alteration of a *historic building* where the *alteration* will not affect the designation as a historic building.

Revise as follows:

~~**C406.1.3 Substantial Alterations to Existing Buildings.** The *building envelope*, *equipment*, and *systems* in *alterations* to *buildings* exceeding 5000 square feet (46.5 m^2) of *gross conditioned floor area* shall comply with the requirements of Section C406.1.1 and C406.1.2 where the alteration includes replacementof two or more of the following:~~

1. ~~HVAC unitary systems or HVAC central heating or cooling equipment serving the alteration area, not including ductwork or *piping*.~~
2. ~~80% or more of the lighting fixtures in the *alteration* area.~~
3. ~~Building envelope components in the *alteration* area including new exterior cladding, fenestration, or insulation.~~

C503.6 Additional energy efficiency credits. ~~*Alterations* shall comply with measures from Sections C406.2 and C406.3 to achieve not less than 10 percent 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 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 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 include replacement of no more than one of the following:~~

~~1.1 HVAC unitary systems or HVAC central heating or cooling equipment serving the *work area* of the *alteration*.~~

~~1.2 Water heating equipment serving the *work area* of the alteration.~~

~~1.3 50 percent or more of the lighting fixtures in the *work area* of the alteration.~~

~~1.4 50 percent or more of the area of interior surfaces of the thermal envelope in the *work area* of the alteration.~~

~~1.5 50 percent or more of the building's *exterior wall envelope*, including fenestration.~~

~~1. *Alterations* to *buildings* in Utility and Miscellaneous Group U, Storage Group S, Factory Group F, High-Hazard Group H.~~

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. *Buildings* in Climate Zone 0A.~~

4. *Alterations* that are permitted with an *addition* complying with Section C502.3.7.

~~6. *Alterations* that comply with Section C407.~~

Reason: To ensure that this section of the code is usable and enforceable.
There are several problems which are fixed by this proposed revision:

1. This proposal assumes that compliance is not required unless the specified conditions are met. This limits the risk of unusual project types not being able to comply with the code just because the authors of the code didn't think of them when a list of exceptions was created.

2. This proposal requires that only substantial alterations will be required to achieve efficiency credits. This is important because the vast majority of alterations are truly small-scale projects without sophisticated design teams to wade through the compliance requirements.

3. This proposal specifies that credits are achieved only from work being done as part of the alteration. This allows projects to be completed that upgrade only part of inefficient buildings without adding to the scope of the project, and also requires that alterations of inefficient parts of otherwise efficient buildings will have to do more.

4. This proposal specifies which credits are achievable for each type of alteration. Some credits (for example L04 increase daylight area, or E03 envelop leak reduction) really should not be allowed unless the entire building is being modified.

5. This proposal indicates that the restrictions on credit combinations identified in C406.2.1, C406.2.2, C406.2.3, and C406.2.5 will apply to alterations as well.

6. This proposal deletes C406.1.3, which is redundant.

Cost Impact: The code change proposal will decrease the cost of construction.
This proposal will significantly reduce the burden of cost and complexity for small alterations.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: This proposal clarifies the scope threshold where alteration projects are subject to obtaining C406 credits.

Proposal # 933

CED1-204-22

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

2024 International Energy Conservation Code [CE Project]

Revise as follows:

CC101.1 Purpose. The purpose of this appendix is to supplement the *International Energy Conservation Code* and require renewable energy systems of adequate capacity to achieve net zero operational energy.

GREEN RETAIL PRICING. A program by the retail electricity provider to provide 100-percent renewable energy to the building project owner.

Revise as follows:

OFF-SITE RENEWABLE ENERGY SYSTEM. Renewable energy system which serves the building project and is not an on-site renewable energy system, including contracted purchases of renewable energy and renewable energy certificates.

ON-SITE RENEWABLE ENERGY SYSTEM.
Renewable energy systems located on any of the following:
1. The *building*.
2. The property upon which the *building* is located.
3. A property that shares a boundary with and is under the same ownership or control as the property on which the *building* is located, or
4. A property that is under the same ownership or control as the property on which the *building* is located and is separated only by a public right-of way ~~on which the *building* is located~~ from the building being served by the renewable energy system.

RENEWABLE ENERGY SYSTEM. Photovoltaic, solar thermal, geothermal energy extracted from hot fluid or steam, wind, or other approved ~~renewable energy production~~ systems used to generate renewable energy.

CC103.1 Renewable energy. On-site renewable energy systems shall be installed, or adjusted off-site renewable energy shall be procured to ~~offset the building energy as calculated in Equation CC-1~~ meet the minimum renewable energy requirement in accordance with Section CC103.1.1.

$$RE_{onsite} + RE_{offsite} \geq RE_{min}$$

where: **(Equation CC-1)**
RE_{onsite} = Annual site energy production from on-site renewable energy systems ~~(see Section CC103.2)~~, including installed on-site renewable energy systems used for compliance with C405.13.1 and C406.5.
$RE_{offsite}$ = Adjusted annual energy production from off-site renewable energy systems that ~~may~~ is permitted to be credited against the minimum renewable energy requirement ~~(see Section CC103.3).~~ This includes ~~including~~ off-site renewable energy purchased for compliance with C405.13.2.
RE_{min} = Minimum renewable energy requirement.

When Section C401.2.1(1) is used for compliance with the *International Energy Conservation Code*, the minimum renewable energy requirement shall be determined by multiplying the gross *conditioned floor area* plus the gross semiheated floor area of the proposed building by the prescriptive renewable energy requirement from Table CC103.1. An area weighted average shall be used for mixed-use buildings.
When Section C401.2.1, Item 2 or Section C401.2.2 is used for compliance with the *International Energy Conservation Code*, the minimum renewable energy requirement shall be equal to the building energy as determined from energy simulations.

Add new text as follows:

CC103.2 Procurement Factors for Renewable Energy System Compliance Alternatives

Renewable Energy Systems	**Procurement Factors**
Onsite renewable energy with a capacity of not less than 7.5 W/ft^2	1.0
Offsite renewable energy complying with Section CC103.3.1	0.90
Unbundled renewable energy certificates	0.75
Offsite renewable energy systems used to comply where the building site is located where an unshaded flat plate collector oriented toward the equator and tilted at an angle from horizontal equal to the latitude receives an annual daily average incident solar radiation less than 1.1 $kBtu/ft^2$ - day (3.5 kWh/m^2 - day).	1.0
Offsite renewable energy systems used to comply where more than 80 percent of the roof area is covered by any combination of permanent obstructions such as, but not limited to, mechanical equipment, vegetated space, access, pathways, or occupied roof terrace.	1.0
Offsite renewable energy systems used to comply where more than 50 percent of the roof area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building more than 2500 annual hours between 8:00 a.m. and 4:00 p.m.	1.0

Revise as follows:

CC103.2.1 Renewable energy certificates. ~~r~~ *Renewable energy certificates (RECs)* ~~and other environmental attributes~~ associated with the *on-site renewable energy system* shall be assigned to the initial and subsequent building owner(s) for a cumulative period of not less than 15 years. The building owner(s) ~~may~~ are permitted to transfer ~~*renewable energy certificates*~~ *RECs* to building tenants ~~while they are~~ occupying the building.

CC103.3.1 ~~**Qualifying off-site**~~ **Offsite procurement methods..** ~~The following are considered qualifying off-site~~ Offsite renewable energy systems used to comply with Section CC103.1 shall be one or more of the following ~~procurement methods~~:

1. *Community renewables energy facility*
2. *Renewable energy investment fund*
3. *Financial renewable energy power purchase agreement*
4. *Direct ownership*
5. *Direct access to wholesale market*
6. *Green retail pricing*
7. Unbundled *Renewable Energy Certificates (RECs*)
8. *Physical renewable energy power purchase agreement.*

CC103.3.2 Requirements for all procurement methods. ~~The following requirements shall apply to all *off-site renewable energy* procurement methods:~~ Offsite renewable enregy systems used to comply with Section CC103.1 shall comply with one or more of the following:

~~1. The building owner shall sign a legally binding contract or other approved agreement to procure qualifying off-site renewable energy.~~

~~2~~ 1. The procurement contract shall have duration of not less than 15 years and shall be structured to survive a partial or full transfer of ownership of the property.

~~3~~ 2. RECs ~~and other environmental attributes~~ associated with the procured ~~*off-site*~~ *offsite renewable energy* shall ~~meet all of~~ comply with the following requirements:

   ~~3~~ 2.1 The RECs shall be ~~Are~~ retained or retired by or on behalf of the property owner or tenant for a period of not less than 15 years.

   ~~3~~ 2.2 The RECs shall be ~~Are~~ created within a 12-month period of use of the REC; and

   ~~3~~ 2.3 The RECs shall be ~~Are~~ from a generating asset constructed no more than 5 years before the issuance of the certificate of occupancy.

~~4~~ 3. The generating source shall be a renewable energy system.

~~5~~ 4. The generation source shall be located where the energy can be delivered to the building site by any of the following:

   ~~5~~ 4.1 Direct ~~By direct~~ connection to the *off-site renewable energy facility*.

   ~~5~~ 4.2 The ~~By the~~ local utility or distribution entity.

   ~~5~~ 4.3 An By an interconnected electrical network where energy delivery capacity between the generator and the building site is available.

~~6~~ 5. Records on power sent to or purchased by the building shall be retained by the building owner and made available for inspection by the code official upon request.

CC103.3.3 Adjusted off-site renewable energy. The ~~process for calculating the~~ adjusted *off-site renewable energy* ~~is shown in~~ shall be calculated in accordance with Equation CC-2.

$$RE_{offsite} = \sum_{i=1}^{n} PF_i \times RE_i = PF_1 \times RE_1 + PF_2 \times RE_2 + ... + PF_n \times RE_n$$ **(Equation CC-2)**

where:
$RE_{offsite}$ = Adjusted off-site renewable energy.
PF_i = Procurement factor for the i^{th} renewable energy procurement method per specified by Table CC103.2 ~~Section CC103.3.3.1.~~
RE_i = Annual energy production for the i^{th} renewable energy procurement method .
n = The number of renewable energy procurement methods ~~considered~~ used for compliance with Section CC103.1.

CC103.3.3.1 Procurement factors. ~~When installed on-site renewable energy capacity is 7.5 W/ft² (80.7 W/m²) of roof area or greater, the procurement factor is 1.00, otherwise, the procurement factor is 0.75, except for unbundled *renewable energy certificates* which shall have a procurement factor of 0.20. A procurement factor of 1.0 may also be used when the conditions of exceptions 1, 2, or 3 to Section C405.13.1 are satisfied.~~
The procurement factors for renewable energy system compliance alternatives shall be as specified in Table CC103.2 .

Exception: The procurement factor for R-2 occupancies shall be 1.0.

CC103.2 Calculation of on-site renewable energy. The annual energy production from on-site renewable energy systems shall be determined using approved software approved ~~by the code official~~.

Reason: An exception permitting a procurement factor of 1 for R-2 occupancies is provided. R-2 occupancies need the flexibility provided with procurement of offsite renewable energy generation, including compliance through the purchase of renewable energy certificates, without the ‘location’ penalties. This incentivizes 'more sustainable building locations (urban areas) where renewable onsite options are limited.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
Eliminates the renewable energy location penalty for R-2 occupancies.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: This proposal makes several editorial changes to the Net Zero Appendix, Appendix CC.

Proposal # 744

CED1-208-22

Proponents: Charles Eley, representing Architecture 2030 (charles@eley.com)

2024 International Energy Conservation Code [CE Project]

Update standard(s) as follows:

CD101.4.1 Off-site procurement. The *building owner* shall procure and be credited for the total amount of off-site renewable energy required by Equation CD-4. Procured off-site renewable energy shall comply with the requirements applicable to not less than one of the following:

1. *Community renewables energy facility*.
2. *Financial renewable energy power purchase agreement.*
3. *Physical renewable energy power purchase agreement.*
4. *Direct ownership.*
5. *Renewable Energy Investment Fund.*
6. *Green retail tariff*

Add new definition as follows:

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% *renewable energy resources.*

Reason: A green retail tariff is a special program offered by electric service providers (utilities) whereby they acquire 100% renewable energy to meet the electricity demands of a participating customer. The customer typically pays a premium in the range of one to two cents per kilowatt-hour (similar to participation in a community solar program). The delivered renewable energy is in addition to that required to meet applicable renewable portfolio standards and the RECs associated with the renewable energy are retired on behalf of the participating customer (as required by C405.15.3).
Section C405.15.2.2 would apply to green retail tariffs as it does to all off-site procurement options. A contract is required: (1) with a duration of at least 10 years, (2) that is structured to survive a transfer of ownership, and (3) and that acquires renewable energy in concert with energy consumption.

Retail green pricing is the most common method for procuring off-site renewable energy and the only option available to many building owners/managers. This is the option most widely used in Boston, San Francisco and other cities where the purchase of off-site renewable energy is already required for some building types and sizes.

Off-site renewable energy purchases are recognized in three places in the standard and this code change proposal strives to make the methods more consistent in section C405.15, Appendix CC and Appendix CD.

Not including this option will limit the ability of building owners to purchase off-site renewable energy and undermine the effectiveness of the Glide Path.

Cost Impact: The code change proposal will increase the cost of construction.
Increasing the number of options will create more competition and reduce compliance cost.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Submitted

Commercial Energy Committee Reason:

CED1-209-22

Proponents: Aaron Phillips, representing Asphalt Roofing Manufacturers Association (aphillips@asphaltroofing.org)

2024 International Energy Conservation Code [CE Project]

Revise as follows:

C409.6.1.4.1 Roofs. Roofs will be modeled with insulation above a steel roof deck. The roof U-factor and area shall be modeled as in the proposed design. If different roof thermal properties are present in a single block, an area weighted U-factor shall be used. Roof solar reflectance~~absorptance~~ shall be modeled at 0.25 ~~0.70~~ and emittance at 0.90.

Exception: For Climate Zones 0, 1, 2, and 3, solar reflectance and emittance shall be as specified in Section C402.4 and Table C402.4.

Reason: Roof solar absorptance in section C409.6.1.4.1 is adjusted from 0.70 to 0.75 to align with the roof solar absorptance of the Standard Reference Design in the Simulated Building Performance provisions as shown in Table C407.4.1(1). The exception recognizes new provisions in Table C407.4.1(1) that are specific to Climate Zones 0, 1, 2, and 3. By reference to Section C402.4, those new provisions require solar reflectance of 0.55 (solar absorptance of 0.45) and thermal emittance of 0.75 for Climate Zones 0 to 3. In communications during the initial phase of deliberations, the proponents of CEPI-76 (which added section C409.6.1.4.1) indicated their intention was to have the HVAC Total System Performance Ratio standard design roof solar absorptance match the value in C407. Acceptance of this minor modification will establish equivalent parameters between C407 and C409.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The proposed change creates consistency between different options. It is not expected to increase or decrease the cost of construction because parity between alternatives is the intent.

Workgroup Recommendation

Commercial Energy Committee Committee Action: As Modified

Commercial Energy Committee Reason: The proposed change align the requirements in C409 with changes in C402.

Proposal # 613
