Making your voice heard: Commenting on the Draft Commercial 2024 International Energy Conservation Code (IECC-C)

The public comment draft of the 2024 commercial IECC is now available and proposed recommendations could result in energy savings, a reduction in greenhouse gas emissions, and improved grid reliability benefits. Because of the potential impact of the code, this review period presents a crucial moment to weigh in on the specific language that jurisdictions will depend on for the next three years to meet their climate commitments.

In this resource you will learn how you can help. Included are summaries of the draft code amendments and revisions that were submitted by New Buildings Institute into the ICC process to advance the 2024 IECC. They are categorized by electrification; resilience, renewables and grid integration; new building energy efficiency; and existing building energy efficiency. Each item provides a brief code change title, a proposal number, the section of the code that could be impacted, and a summary.

It's important to weigh in during this critical code cycle for addressing climate change. The International Code Council and commercial consensus committee need to hear your support for building codes that address climate change.

Why this is important right now:

- Building codes and performance policies are one of the most effective ways to reduce the carbon emissions driving the climate crisis.
- The U.S. does not have a national energy code. 96 percent of U.S. states and some cities refer to the model code published by the International Code Council (ICC) when developing local requirements for their building codes. The International Energy Conservation Code (IECC) is updated every three years — often referred to as a "code cycle."
- The provisions adopted into the 2024 IECC are critical for achieving the energy and carbon reductions we need to keep temperature rise below 1.5°-degrees Celsius and avoid the worst impacts of climate change.

- The public comment draft of the 2024 Commercial IECC was released on September 6th, 2022. Anyone is allowed to make comments on that draft, with a deadline for submitting comments of Friday, October 21st.
- The draft of the 2024 Residential IECC is expected to be released in late October or early November 2022.

How to weigh in on the 2024 IECC:

There are four ways in which you can weigh in, listed below in order of level of effort (lowest to highest). Indicate which method you would like to use in this google form and we can help you if needed:

1. **Low: Sign on Letter.** This is the easiest way to provide comment, but is also the lower impact option, as the Committees are likely to weigh formal submissions through cdpACCESS (included in options 2-4 below) with more consideration. NBI has developed a general sign-on letter and a building electrification sign-on letter. Tesla has also developed a sign-on letter for Electric Vehicle Infrastructure requirements. The Smart Surfaces Coalition is encouraging organizations to draft their own letter to support cool roofs. Fill out this form if you want to sign on to one or all of these letters by **Friday October 7th.** We will forward your response to Noelani Derrickson (nderrickson@tesla.com) at Tesla and Emily Morin (emorin@smartsurfacescoalition.org) at the Smart Surface Coalition.

2. **Medium: Co-proponent**. This is more impactful than a sign on letter but not as impactful as submitting a statement from your own organization. If you are interested in being a co-proponent on a proposal, fill out this form by **Friday October 7th** indicating which proposal(s) you would like to support. Follow the directions here and we will send you an email for you to sign on as a co-proponent.

3. **High: Submit supportive statements via energy.cdpaccess.com**. This one of the more time intensive ways to comment on the IECC, but much more impactful than signing on to a letter or being a co-proponent. To submit a comment, refer to sample support statements below indicating why you think a particular measure should be in the 2024 IECC-C then follow the directions here to enter that statement into cdpACCESS. Follow the links for a 10-minute cdpACCESS tutorial or a 30 minute webinar

4. **Very High: Submit code change proposals via energy.cdpaccess.com**. The most time intensive way to comment on the IECC includes submitting reason statements along with a suggested code change proposal. This is only needed for proposals that are missing in the code, such as electrification or cool roof measures, or proposals where there are needed revisions. To submit a code change proposal, view sample code change proposals below and follow the directions here to enter proposed code language and a reason statement into cdpACCESS. Follow the links for 10-minute cdpACCESS tutorial or a 30 minute webinar.

5. **Bonus:** Attend the Commercial Consensus Committee and Subcommittee Meetings: The most impactful thing you can do is attend the Commercial Consensus Committee meetings where these proposals are being discussed. If you would like to be involved in defending any of NBI's or your own proposals at these meetings, fill out this form and we will let you know when those meetings occur. For all levels of supportive above, this bonus action will amplify your base action and may be your only way to truly influence the new IECC-C process.

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Electrification Proposals

Electric-Ready (CEPI-22)

Add new text as follows:

C103.2.2 Electrification system. 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, in compliance with the provisions of this code.

Revise text as follows:

C105.2.5 Electrical system. Inspection shall verify lighting system controls, components, ~~and~~ meters, and additional electric infrastructure as required by the code, approved plans and specifications.

Add new definitions as follows:

ALL-ELECTRIC BUILDING. A *building* that contains no *combustion equipment*, or plumbing for *combustion equipment,* installed within the *building* or *building site.*

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

COMBUSTION EQUIPMENT. Any equipment or *appliance* used for space heating, *service water heating*, cooking, clothes drying and/or lighting that uses *fuel gas* or *fuel oil*.

COMMERCIAL COOKING APPLIANCES. 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. For the purpose of this definition, a food service establishment shall include any building or a portion thereof used for the preparation and serving of food.

FUEL GAS. A natural gas, manufactured gas, liquified petroleum gas or a mixture of these.

FUEL OIL. Kerosene or any hydrocarbon oil having a flash point not less than 100°F (38°C).

Revise text as follows:

C405.5.3 Fuel Gas lighting. *Fuel gas-*fired lighting appliances shall not be ~~equipped with continuously burning pilot ignition systems~~ permitted.

Add new text as follows:

C403.15 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).

Add new text as follows:

C405.17 Additional electric infrastructure. Buildings that contain *combustion equipment* shall be required to install electric infrastructure in accordance with this section.

C405.17.1 Combustion space heating. Spaces containing *combustion equipment* for space heating shall comply with Sections C405.17.1.1, C405.17.1.2 and C405.17.1.3.

C405.17.1.1 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 space heating heat pump equipment.

C405.17.1.2 Dedicated branch circuits for future electric space heating equipment. Spaces containing *combustion equipment* for space heating shall be provided with a dedicated branch circuit rated and sized in accordance with Section C405.17.1.3, in compliance with NFPA70 Section 424.4 and terminating in a junction box within 3 feet (914 mm) of the location the space heating equipment without obstructions. 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 C405.17.1.3
2. Where a branch circuit provides electricity to space cooling equipment and is both in compliance with NFPA70 Sections 440.4(B) and 440.35 and is rated and sized in accordance with Section C405.17.1.3.
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 C405.17.1.3.

C405.17.1.3 Additional space heating electric infrastructure sizing. Electric infrastructure for future electric space heating equipment shall be sized to accommodate at least one of the following:

1. An electrical capacity not less than the space heating *combustion equipment* heating capacity multiplied by the value in Table C405.17.1(1) based on the climate zone and building occupancy group served by the space heating equipment. Where the space heating equipment serves multiple occupancies, the values in Table C405.17.1(1) shall be weighted by the gross floor area of each occupancy served by the space heating equipment and multiplied by the space heating *combustion equipment* heating capacity, or

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 in Table C405.17.1(2) based on the climate zone and building occupancy group served by the space heating equipment. Where the space heating equipment serves multiple occupancies, the values in Table C405.17.1(2) shall be weighted by the gross floor area of each occupancy served by the space heating equipment and multiplied by the peak space heating load of the building areas served by the space heating equipment, or

3. 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 C405.17.1(1) ALTERNATE ELECTRIC SPACE HEATING EQUIPMENT CONVERSION FACTORS (VA/kBtu/h) - CAPACITY BASIS

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																			
I-2																			
R-1																			
B																			

A-2																			
M																			
E																			
S-1 and S-2																			
All Other																			

Table C405.17.1(2) ALTERNATE ELECTRIC SPACE HEATING EQUIPMENT CONVERSION FACTORS (VA/kBtu/h) - LOAD BASIS

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																			
I-2																			
R-1																			
B																			
A-2																			
M																			
E																			
S-1 and S-2																			
All Other																			

C405.17.2 Combustion water heating. Spaces containing *combustion equipment* for water heating shall comply with Sections C405.17.2.1, C405.17.2.2 and C405.17.2.3.

C405.17.2.1 Designated locations for future electric water heating equipment. Spaces containing *combustion equipment* for water heating shall be provided with one of the following:

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.
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.

Spaces containing *combustion equipment* for water heating shall be provided with a condensate drain located within 3 feet (914 mm) of the location of the water heating equipment. The condensate drain shall maintain a minimum horizontal slope in the direction of discharge of not less than one-half unit vertical in 12 units horizontal (4-percent slope) and include a “P” trap or vent “t”.

C405.17.2.2 Dedicated branch circuits for future electric water heating equipment. Spaces containing *combustion equipment* for water heating shall be provided with a dedicated branch circuit rated and sized in accordance with Section C405.17.2.3, in compliance with NFPA70 Section 424.4 and terminating in a junction box within 3 feet (914 mm) of the location the water heating equipment without obstructions. Both ends of the branch circuit shall be labeled “For Future Electric Water Heating Equipment.”

> **Exception:** Where future electric water heating equipment would require three-phase power and the main electrical service panel has a reserved space for a bus bar rated and sized in accordance with Section C405.17.2.3 and labeled “For Future Electric Water Heating Equipment.”

C405.17.2.3 Additional water heating electric infrastructure sizing. Electric infrastructure water heating equipment 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 C405.17.2 based on the climate zone and building occupancy group served by the water heating equipment. Where the water heating equipment serves multiple occupancies, the values in Table C405.17.2 shall be weighted by the

gross floor area of each occupancy served by the water heating equipment and multiplied by the *combustion equipment* water heating capacity, or

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 C405.17.2 ALTERNATE ELECTRIC WATER HEATING EQUIPMENT CONVERSION FACTORS (VA/kBtu/h)

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																			
I-2																			
R-1																			
B																			
A-2																			
M																			
E																			
S-1 and S-2																			
All Other																			

C405.17.3 Combustion cooking. Spaces containing combustion equipment for cooking shall comply with either C405.17.3.1 or C405.17.3.2

C405.17.3.1 Commercial cooking. Spaces containing *commercial cooking appliances* shall be provided with a dedicated branch circuit with a minimum electrical capacity in accordance with Table 405.17.3.1 based on the appliance in the space. The branch circuit shall terminate within 3 feet (914 mm) of the appliance with no obstructions. Both ends of the branch circuit shall be labeled with the words "For Future Electric Cooking Equipment" and be electrically isolated.

Table 405.17.3.1 COMMERCIAL COOKING MINIMUM BRANCH CIRCUIT CAPACITY

Commercial Cooking Appliance	Minimum Branch Circuit Capacity
Range	114 VA/kBtu/h
Steamer	469 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

C405.17.3.2 All other cooking. Spaces containing all other cooking equipment not designated as *commercial cooking appliances* shall be provided with a dedicated branch circuit in compliance with NFPA 70 Section 422.10. The branch circuit shall terminate within 6 feet (1829 mm) of fossil fuel ranges, cooktops and ovens and be accessible with no obstructions. Both ends of the branch circuit shall be labeled with the words “For Future Electric Cooking Equipment” and be electrically isolated.

C405.17.4 Combustion clothes drying. Spaces containing combustion equipment for clothes drying shall comply with either C405.17.4.1 or C405.17.4.2

C405.17.4.1 Commercial drying. Spaces containing clothes drying equipment, and end-uses for commercial laundry applications shall be provided with conduit that is continuous between a junction box located within 3 feet (914 mm) of the equipment and an electrical panel. The junction box, conduit and bus bar in the electrical panel shall be rated and sized to accommodate a branch circuit with sufficient capacity for an equivalent electric equipment with an equivalent equipment capacity. The electrical junction box and electrical panel shall have labels stating, “For Future Electric Clothes Drying Equipment.”

C405.17.4.2 Residential drying. Spaces containing clothes drying equipment, *appliances,* and end-uses serving multiple *dwelling units* or sleeping areas with a capacity less than or equal to 9.2 cubic feet shall be provided with a dedicated 240-volt branch circuit with a minimum capacity of 30 amps shall terminate within 6 feet (1829 mm) of fossil fuel clothes dryers and shall be accessible with no obstructions. Both ends of the branch circuit shall be labeled with the words “For Future Electric Clothes Drying Equipment” and be electrically isolated.

Reason Statement:
In order for the U.S. to reach net zero carbon emissions, the country must not only reduce energy use through energy efficiency and move to utility scale and on-site renewable energy, but also begin to transition away from using combustion equipment in buildings that run on fossil fuels to electric equipment. In 2021, combustion equipment in commercial and residential buildings accounted for 35% of US greenhouse gas emissions.[1] The cost of installing electric-ready infrastructure when a building is under construction, walls are open, and the trades are already on-site, is small in comparison to the cost of retrofitting a building to install the same level of electric equipment. Having electric-ready infrastructure in place gives building owners or occupants the choice to shift to electric appliances at time of replacement or retrofit without incurring the costs and delays of retrofitting panels, opening walls to install conduit, etc. The residential 2024 IECC has included mandatory electric-ready requirements for water heating, cooktops and clothes drying into the public comment review draft #1. The California Building Energy Efficiency Standards 2022 update (Title 24, Part 6) has also moved in this direction, including electric-ready requirements for heat pump space heating, cooktops and clothes drying in both single family homes and multifamily buildings, and for water heating in single family homes. The Chicago Energy Transformation Code has also included electric-ready requirements for residential single family and multifamily buildings in their energy code. Attached is a letter with others stating the support for this proposal from 50 organizations, 16 of which are from local or state governments and universities, 12 of which are from NGOs, and 22 of which are from design and construction industry. In addition to the letter of support, this proposal includes more than 30 co-proponents.

Requiring buildings to be electric-ready will not only reduce costs for building owners who choose to electrify their building at a later date but it will also give building residents the option to improve their own health. Gas appliances release harmful pollutants like nitrogen dioxide (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 be diagnosed with asthma. [3]Therefore, ensuring all-electric appliances can be installed in our buildings in the future is critical to reducing air pollution, protecting public health, reducing utility and construction costs, and meeting climate goals.

NBI, ACEEE, and 2050 Partners on behalf of the California Investor Owned Utilities worked together to address many of the technical concerns raised when NBI's original proposal, CEPI-22, was discussed by the Commercial Consensus Committee in June of 2022. The main revisions to this proposal include:

1. Separating the original CEPI-22 proposal into three pieces, an electric-ready proposal, an all-electric appendix, and a requirement for more energy efficiency credits in buildings that do not primarily use heat pumps for space and water heating. Each piece stands alone with its own independent support, so each proposal can be discussed and voted on separately.
2. Requiring buildings with central water heating or space heating systems to have the electrical capacity but not conduit for a new system to ensure that unnecessary conduit

is not placed in buildings that choose to install distributed and not central systems at a future date.

3. Clear electrical capacity requirements for electric-ready space and water heating based on occupancy type and climate zone to ensure that there is sufficient capacity to install efficient heat pumps for space heating and water heating without requiring full design and sizing of an all-electric alternative to a fuel-based system (though that option remains for flexibility). 2050 Partners is conducting energy modeling to determine capacity requirements. This modeling is not yet complete but will be complete before this proposal is considered by the commercial consensus committee.
4. Clear capacity requirements for commercial cooking appliances based on research conducted by NBI on the minimum branch circuits needed for a variety of commercial cooking appliances.
5. Additional flexibility that allows designers to submit an alternate design for the electrical infrastructure needed for water and space heating that would allow the building to use no energy source other than electricity or on-site renewable energy in the future.
6. Restructuring of the proposal to make it easier to understand and enforce.

Bibliography:

[1] "U.S. Energy Information Administration - EIA - Independent Statistics and Analysis." *Energy and the Environment Explained: Where Greenhouse Gases Come From*, U.S. Energy Information Administration (EIA), https://www.eia.gov/energyexplained/energy-and-the-environment/where-greenhouse-gases-come-from.php#:~:text=In%202021%2C%20petroleum%20accounted%20for,energy%2Drelated%20CO2%20emissions.

[2] *Health Air Quality Impacts of Buildings Emissions*. RMI, 5 May 2021, rmi.org/health-air-quality-impacts-of-buildings-emissions#MI.

[3] *Gas Stoves: Health and Air Quality Impacts and Solutions.* RMI, 1 Feb. 2021, rmi.org/insight/gas-stoves-pollution-health/.

[4]*Cost Study of the Building Decarbonization Code* , New Buildings Institute, Apr. 2022, https://newbuildings.org/wp-content/uploads/2022/04/BuildingDecarbCostStudy.pdf.

[5] *2021 Reach Code Cost-Effectiveness Analysis: Non-Residential Alterations*, California Energy Codes and Standards, 27 Jan. 2022, https://localenergycodes.com/.

Cost Statement:

Recent analysis by NBI and partners using cost data from RSMeans for a medium office indicates that additional electrical infrastructure costs for water-heating and space-heating would cost a typical office building an additional $0.09 per square foot of conditioned floor area. [4] However, if a building owner were to have to retrofit their building from using combustion equipment to natural gas equipment costs without these requirements in place, costs could be exorbitant. California Energy Codes & Standards "2021 Reach Code Cost-Effectiveness Analysis: Non-Residential Alterations" report estimated labor costs for electrification retrofit of mechanical systems as a 25 to 50% increase from new construction labor cost due to building-specific considerations such as tight conditions, prepping surfaces, elevated work, material handling, specialty rigging, and protecting existing finishes that can vary building to building. [5]

All-Electric Appendix (CEPI-22)

Add new Appendix as follows:

APPENDIX CG
ALL-ELECTRIC COMMERCIAL BUILDING PROVISIONS

About this appendix: *Appendix CG requires the installation of all-electric equipment and appliances in new construction and promotes in electrification in existing buildings in order to reduce carbon emissions from buildings and improve the safety and health of commercial building occupants.*

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

ALL-ELECTRIC BUILDING. A *building* that contains no *combustion equipment*, or plumbing for *combustion equipment,* installed within the *building* or *building site.*

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

COMBUSTION EQUIPMENT. Any equipment or *appliance* used for space heating, *service water heating*, cooking, clothes drying, humidification, or lighting that uses *fuel gas* or *fuel oil*.

FUEL GAS. Natural gas, manufactured gas, liquified petroleum gas or a mixture of these.

FUEL OIL. Kerosene or any hydrocarbon oil having a flash point not less than 100°F (38°C).

SUBSTANTIAL ENERGY ALTERATION**.** An *alteration* that includes replacement of two or more of the following:

1. 50 percent or greater of the area of interior wall-covering material of the *building thermal envelope* or *fenestration*.

2. 50 percent or greater of the area of the exterior wall-covering material of the *building thermal envelope* or *fenestration*.
3. Space-conditioning equipment constituting 50 percent or greater of the total input capacity of the space heating or space cooling equipment serving the *building*.
4. Water-heating equipment constituting 50 percent or greater of the total input capacity of all the water heating equipment serving the *building*.
5. 50 percent or greater of the luminaires in the *building.*

SUBSTANTIAL IMPROVEMENT. Any *repair*, reconstruction, rehabilitation, *alteration*, *addition* or other improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the improvement or repair is started. If the structure has sustained *substantial damage*, any repairs are considered substantial improvement regardless of the actual *repair* work performed. The term does not, however, include either:

1. Any project for improvement of a *building* required to correct existing health, sanitary or safety code violations identified by the *building official* and that are the minimum necessary to assure safe living conditions.
2. Any *alteration* of a *historic structure* provided that the *alteration* will not preclude the structure's continued designation as a historic structure.

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.

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. 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 (1.0 watts) per square foot of *conditioned space* are permitted to be heated using electric resistance *appliances* or equipment.

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 by the code official.

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. 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 no higher than 40°F (4.5°C) and intended for freeze protection, including temporary systems in unfinished spaces, are 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 are permitted to utilize electric resistance to preheat outdoor air for defrost or temper supply air to not more than 45°F (7.2°C). Hydronic systems without energy recovery ventilation are permitted to utilize electric resistance to temper supply air 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 the *building service water heating* load at the greater of 15°F (-18°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 Cooling equipment. New unitary air conditioners 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 not be permitted to contain *combustion equipment* and new equipment installed to serve *additions* shall not be *combustion equipment*. Where systems with *combustion equipment* are extended into an addition, the existing *building* and addition together shall use no more fossil fuel energy 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 Additional energy efficiency credits for substantial energy alterations. *Substantial energy alterations* of *all-electric buildings* shall comply with Section C503.6 and *mixed-fuel* buildings shall achieve not less than two times the number of required efficiency credits from Section C503.6.

> **Exceptions:**
> 1. Alterations that are part of an addition complying with section CG104.1.
> 2. Alterations that comply with Section C407.
> 3. Alterations that comply with Section CG104.2.

CG104.4 Cooling equipment. New and replacement unitary 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 CG104.7.

CG104.5 Service water heating equipment. Where service water heating equipment is added or replaced, new service hot water equipment shall not be *combustion equipment*.

CG104.6 Furnace replacement. Newly installed warm air furnaces provided for space heating shall only be permitted as supplementary heat controlled in accordance with Section CG104.7.

CG104.7 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 at least 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 input capacity greater than the heating input capacity of the heat pump equipment.

Add new reference standard as follows:

ASHRAE	**ASHRAE** **180 Technology Parkway NW Peachtree** **Corners, GA 30092**

100—2018: Energy Efficiency in Existing Buildings

Reason Statement:
In order for the U.S. to reach net zero carbon emissions, the country must not only reduce energy use through energy efficiency and move to utility scale and on-site renewable energy, but also begin to transition away from using combustion equipment in buildings that 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 Statement:

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]

Additional Efficiency Credits for Non-Heat Pump Buildings (CEPI-22)

Revise and add text to Section C406 as follows:

C406.1.1.1 Buildings without heat pumps. *Buildings* using any energy source other than electricity or *on-site renewable energy*, with electric storage water heaters that are not heat pumps or 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 1.5 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 1.5 and 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.

Exceptions:

1. *Buildings* complying with all of the following:
   1.1 Peak heating load calculated in accordance with Section C403.1.1 greater than peak cooling load calculated in accordance with Section C403.1.1
   1.2 All cooling systems are electric heat pumps.
   1.3 Total heat pump space heating capacity not less than 50% of the *building*'s space heating load at heating design conditions calculated in accordance with Section C403.1.1.
   1.4 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.
   1.5 Electric resistance heat is used only in accordance with Section C403.4.1.1.
2. Unconditioned parking garages that achieve 75% of the credits required for use groups S-1 and S-2 in Table C406.1.1.
3. Portions of *buildings* devoted to manufacturing or industrial use.
4. Low-energy *buildings* complying with Section C402.1.1.1.

C406.1.1.~~1~~2 Building Core/Shell and Initial Build-Out Construction. Where separate permits are issued for core and shell buildings and build-out construction, compliance shall be in accordance with the following requirements.

1. Core and shell buildings or portions of buildings shall comply with one of the following:
   1.1 Where the permit includes a central HVAC system or service water heating system with chillers, heat pumps, boilers, service water heating equipment, or loop pumping systems with heat rejection, the project shall achieve not less than 50 percent of the energy credits required ~~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 achieved shall be reduced in

proportion to the floor area with final HVAC systems or final service water heating systems installed.

3. Build-out construction shall be deemed to comply with Section C406.1 where either:
   3.1 Where heating and cooling generation are provided by a previously installed central system, the energy credits achieved in accordance with Section C406.2 under the build-out project are not less than 33 percent of the credits required ~~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 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 text to Section C502 as follows:

C502.3.7.1 Additions not served by heat pumps *Additions* using any energy source other than electricity or *on-site renewable energy*, served by electric storage water heaters that are not heat pumps or 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 75 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 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. *Additions* complying with all of the following:
   1.1 Peak heating load calculated in accordance with Section C403.1.1 greater than peak cooling load calculated in accordance with Section C403.1.1.
   1.2 All cooling systems serving the *addition* are electric heat pumps.
   1.3 Total heat pump space heating capacity serving the *addition* not less than 50% of the *addition*'s space heating load at heating design conditions calculated in accordance with Section C403.1.1.
   1.4 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.
   1.5 Electric resistance heat serving the *addition* is used only in accordance with Section C403.4.1.1.
2. *Buildings* in Utility and Miscellaneous Group U, Storage Group S, Factory Group F, High-Hazard Group H.
3. *Additions* less than 1,000 ft2 (92 m2) and less than 50 percent of existing floor area.
4. *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.
5. *Additions* that do not contain conditioned space.
6. Where the *addition* alone or the existing building and *addition* together comply with Section C407.
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. 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.

Cost Statement:

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. 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.

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.

Electric Vehicle Infrastructure (CECPI-1)

If you are interested in getting involved with a coordinated EV infrastructure comment or sign-on letter, contact Noelani Derrickson at nderrickson@tesla.com.

Revise as follows:

C103.2Information on construction documents. Construction documents shall be drawn to scale on suitable material. Electronic media documents are permitted to be submitted where *approved* by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, systems and equipment as herein governed. Details shall include, but are not limited to, the following as applicable:

19. Location of designated EVSE spaces, EV Ready spaces, and EV Capable spaces in parking facilities.

C405.14Electric 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.

C405.14.1Quantity.
The number of required EV spaces, EV capable spaces and EV ready spaces shall be determined in accordance with this Section and Table C405.14.1 based on the total number of automobile parking spaces and shall be rounded up to the nearest whole number. For R-2 buildings, the Table requirements shall be based on the total number of dwelling units or the total number of automobile parking spaces, whichever is less.

1. Where more than one parking facility is provided on a building site, the number of required automobile parking spaces re-quired to have EV power transfer infrastructure shall be calculated separately for each parking facility.
2. Where one shared parking facility serves multiple building occupancies, the required number of spaces shall be determined proportionally based on the floor area of each building occupancy.
3. Installed EVSE spaces that exceed the minimum requirements of this section may be used to meet minimum requirements for EV ready spaces and EV capable spaces.
4. Installed EV ready spaces that exceed the minimum requirements of this section may be used to meet minimum requirements for EV capable spaces.
5. Where the number of EV ready spaces allocated for R-2 occupancies is equal to the number of dwelling units or to the number of automobile parking spaces allocated to R-2 occupancies, whichever is less, requirements for EVSE spaces for R-2 occupancies shall not apply.
6. Requirements for a Group S-2 parking garage shall be determined by the occupancies served by that parking garage. Where new automobile spaces

do not serve specific occupancies, the values for Group S-2 parking garage in Table C405.14.1 shall be used.

Exception: Parking facilities, serving occupancies other than R2 with fewer than 10 automobile parking spaces.

Revise as follows:

C405.14.2EV 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 capacit~~i~~y in accordance with Section C405.14.5
3. The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a 2-pole circuit breaker or set of fuses.
4. The electrical enclosure or outlet and the electrical distribution equipment directory shall be marked: "For future electric vehicle supply equipment (EVSE)."
5. ~~Reserved capacity shall be no less than 4.1 kVA (20A 208/240V) for each EV capable space.~~

C405.14.3EV 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 electrical distribution system and circuit capacity in accordance with Section C405.14.5.
3. The panelboard or other electrical distribution equipment directory shall designate the brach circuit as "For electric vehicle supply equipment (EVSE)" and the outlet or enclosure shall be marked "For electric vehicle supply equipment (EVSE)."

C405.14.4EVSE 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. Be served by an electrical distribution system ~~Have a minimum circuit capacity~~ in accordance with Section C405.14.5.
2. Have a minimum ~~charging rate in accordance with C405.14.4.1~~nameplate charging capacity of 6.2 kVA (or 30A at 208/240V) per *EVSE space* served.

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.

Delete and substitute as follows:

~~**C405.14.4.1EVSE 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.~~

C405.14.4.1*EVSE* Installation.
EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. EVSE shall be accessible in accordance with *International Building Code* Section 1107.

Revise as follows:

C405.14.5~~Circuit~~ Electrical distribution system Capacity.
The ~~capacity of electrical infrastructure~~ electrical distribution system serving each EV capable space, EV ready space, and EVSE space used to comply with Section C405.15.1 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)~~ Sized for a calculated *EV* charging load of not less than 6.2 kVA for each *EV ready space* or *EVSE space* and 3.3 kVA for each *EV capable space* it serves.
2. The requirements of Section C405.14.5.1.

C405.14.5.1 Capacity Management for *EV* loads.
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~~ Be sized for a minimum calculated load of 3.3 kVA per *EVSE, EV ready* or *EV capable* space.
2. ~~Have a minimum capacity of 2.7 kVA 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.~~

   ~~Have a minimum capacity of 2.7 kVA per space when serving EV ready spaces or EVSE spaces for a building site when all (100%) of the automobile parking spaces are designed to be EV ready or EVSE~~

spaces. Where all (100%) of the automobile spaces are *EVSE* or *EV ready spaces,* be sized for a minimum calculated load of 2.1 kVA per *EVSE* or *EV ready space.*

Where an energy management system is used to control *EV* charging loads for the purposes of this section, it shall not be configured to turn off electrical power to *EVSE* or *EV ready spaces* used to comply with Section C405.14.1.

Delete without substitution:

C405.14.6EVSE Installation.
EVSE shall be installed in accordance with NFPA 70 and shall be listed and labeled in accordance with UL 2202 or UL 2594. EVSE shall be accessible in accordance with *International Building Code* Section 1107.

Reason:

This public comment does not meaningfully change the stringency of any of the requirements, but is intended to improve the clarity, usability and enforceability of the EV charging section of the code. The edits do several things:

1. New requirements to note the location and layout of EVSE, EV Ready and EV Capable spaces on construction documents have been added.
2. There are several editorial changes to align the language with standard code language conventions. For example, "in compliance" has been replaced with "in accordance."
3. The capacity requirement has been removed from C405.14.2 and has been addressed more clearly in C405.14.5.
4. The language has been clarified that capacity requirements are not just for branch circuits, but for the whole electrical distribution system.
5. The minimum charging functionality requirements for EVSE (C405.14.4 #2 and C405.14.4.1) has been rewritten. C405.14.4.1 attempted to set requirements for minimum charging rates for EVSE controlled by an EMS. However, it created confusion. Energy management is not the only reason that an EVSE will reduce the power delivery to an EV. EVSE will frequently reduce the power delivered to an EV based on the charging capacity and needs of the EV, or based on demand responsive controls. Therefore, it does not work to set a minimum charging rate for a load managed EVSE. To address this issue, the new language just sets a minimum nameplate charging capacity for the EVSE. Functional requirements for how EV power can be reduced by an EMS is addressed in the EMS section in C405.14.5. This allows C405.14.4.1 EVSE Minimum Charging Rate to be deleted completely. Additionally, the section uses language of the "nameplate charging capacity" rather than "be capable of charging" since this better aligns with how the functional capacity of equipment is generally discussed in the code.
6. C405.14.6 has been moved to C405.14.4.1 since that is a more logical location as those requirements are all specific to the EVSE.
7. C405.14.5, which addresses EV load management, has been significantly revised. The existing language creates some confusion since it includes requirements for both charging rate and available infrastructure capacity. The discussion by both the ELPR sub-committee and the full commercial committee revealed that there was some confusion about how to convert these requirements into electrical distribution system designs, particularly in regard to when the safety factor required by the electrical code was or was not included or how to address power factors. The new language includes a simplified approach.

- The section does not set direct requirements for circuit or system sizing at all. Distribution system sizing is really the purview of the electrical code. Since this section's real purpose is to ensure minimum available power for EV space, the edits focus C405.14.5 instead on the calculated EV loads that the electrical system must be sized to accommodate. This allows this code to set minimum functional requirements for how much power needs to be available for EV charging while leaving the sizing of the actual system to the requirements of the electrical code. Therefore, the 8.3 kVA branch circuit requirement (208/240V branch circuit with a 40A circuit breaker) in C405.14.5 Item #1 is expressed as a requirement for a 6.2 kVA calculate load (which is the load of a 30A charger on a 208/240V circuit). The 4.1 kVA requirement for the distribution system in C405.14.5.1 is expressed instead as a requirement 3.3 kVA calculated load (or a 2.1 kVA calculated load).
- During the development of the committee proposal that led to this language, it was important that EMSs not manage loads by simply turning power off to some EV spaces since that would have a significant impact on user satisfaction. As discussed above, dealing with this at the EVSE level does not quite work. This edit to C405.14.5.1addresses the issue of minimum simultaneous charging in a much simpler way by addressing the EMS rather than the EVSE. It simply states that the EMS cannot turn off power to the EV spaces as part of capacity management. This ensures that EVSE can reduce power to the EVs for other reasons, and leaves the door open for the EMS to cut power to the EVSE for other reasons beside capacity management such as demand response.
- Additionally, C405.14.5.1 item 2 has been removed since it is redundant with #3.

Supportive Reason: Preparing our buildings for safe and convenient EV charging infrastructure is critical to deployment of electric vehicles. The transportation sector is the single largest source of carbon emissions in the nation and near complete electrification of the transportation sector is necessary to achieve the carbon emission reductions needed to avoid the worst effects of climate change.

Electric vehicle sales doubled from 2020 to 2021, and currently make up more than 5% of vehicle sales. [1] EV sales are expected to grow significantly in the future federal policies encouraging vehicle electrification take effect. Recent studies have shown that our nation does not have the Electric Vehicle infrastructure in place to meet the growing number of Electric Vehicles. Of the 100 most populous metro areas, 88 had less than half of the needed charging infrastructure in place for 2025 based on expected EV growth.[2]

We therefore applaud the IECC for joining over 40 cities and states across the country [3] who have adopted EV infrastructure requirements and including EV Infrastructure requirements in the 2024 IECC so that municipalities across the nation can address their climate goals and meet the growing demand for electric vehicle chargers.

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[1] “New Plug-in Electric Vehicle Sales in the United States Nearly Doubled from 2020 to 2021”. U.S. DOE. 1 March 2022. https://www.energy.gov/energysaver/articles/new-plug-electric-vehicle-sales-united-states-nearly-doubled-2020-2021

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Resilience, Renewables and Grid Integration Proposals

Cool Roof Requirements (CEPI-50)

If you are interested in getting involved with a coordinated cool roof comment or sign-on letter, contact Emily Morin at emorin@smartsurfacecoalition.org

C402.4 Roof solar reflectance and thermal emittance. Low-sloped 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/m2) or 23 psf (117 kg/m2) pavers.
4. Roofs where not less than 75 percent of the roof area complies with one or more of the exceptions to this section.
5. Roofs in Climate Zone 6 that are in a jurisdiction with a population of less than 50,000.

TABLE C402.4
MINIMUM ROOF REFLECTANCE AND EMITTANCE OPTIONS[a]

Climate Zone	0-6	7-8
Three-year-aged solar reflectance[b]/3-year aged thermal emittance[c]	~~Three-year-aged solar reflectance index[b] of 55 and 3-year aged thermal emittance[c] of 0.75~~ 0.63/0.75	**NR**
Three-year-aged solar reflectance index[d]	~~Three-year-aged solar reflectance index[d] of 64~~ 75	**NR**

a. The use of area-weighted averages to comply with these requirements shall be permitted. Materials lacking 3-year-aged tested values for either solar reflectance or thermal emittance shall be assigned both a 3-year-aged solar reflectance in accordance with Section C402.3.1 and a 3-year-aged thermal emittance of 0.90.
b. Aged solar reflectance tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 or CRRC-S100.
c. Aged thermal emittance tested in accordance with ASTM C1371 or ASTM E408 or CRRC-S100.
d. Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 Btu/h × ft^2 × °F (12 W/m^2 × K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance.

Reason Statement:
The building code needs to be updated to include reflective roof requirements for Climate Zones 4, 5, and cities in Zone 6. Cities and not rural areas in Climate Zone 6 should incorporate reflective roof requirements because in dense urban environments reflective roofs can provide cooling to both their respective building and the city as a whole. In sum, the cost-benefit value of reflective roofs is greater in cities than in rural areas because of the secondary cooling, energy-cost saving, climate health, and equity benefits that are diffused across a city. For Zone 6, roofs in jurisdictions of at least 50,000 people, qualifying as a small city according to the National League of Cities definition should be subject to reflective requirements [1].

Multiple cities in Climate Zones 4 and 5 have already adopted roof mandates and codes to require the use of cool, green, and/or solar PV roofs on new buildings. For example, New York City (2019) requires solar photovoltaic (PV) systems, a vegetated green roof, or both on all available roof area in "sustainable roofing zones." The policy also increases the prior threshold of solar reflectivity outlined in the Energy Conservation Codes. Another example is Washington, D.C, which implemented a code supplement in 2008 to require 75% of roof area not covered with solar, a green roof, or other roof penetrations to be cool roofs (have an initial Solar Reflectance Index or SRI of at least 78). For other cool roof codes and programs in different climate zones, see the CRRC code resource here.

Across these three climate zones, reflective roofs are superior to their dark counterparts from a financial, climate, health, and environmental justice perspective. For Zones 4 and 5, and cities in Zone 6, reflective roofs offer high returns from their initial costs over the lifetime of the roof [2]. Reflective roofs can pay themselves back so effectively in part because of their longer lifespans [3]. Dark roofs get very hot and experience more diurnal heat-driven expansion and contraction, leading to more rapid cracking and thus shortening the product's lifespan. In contrast, reflective roofs do not get as hot and can last longer due to less wear and cracking. This simple lifespan extension makes reflective roofs the more cost-effective choice.

Reflective roofs can reduce urban heat, smog, heat deaths, and costs, building a strong public health argument for their deployment in Climate Zones 4, 5, and cities in Zone 6. Heat deaths typically occur on the top floor of a building as a direct result of the heating of dark roofs [4]. For example, a Chicago multi-day heat event in 1995 killed 793 people [5]. With the value of a statistical life at about $10 million, the deaths alone quantify this tragedy at $800 million [6]. This is without any attempt to quantify the cost of the larger number of people who suffered from, though survived the heat event. Chicago is in Zone 5, but on the cusp of Zone 6, illustrating that with the increased severity and frequency of heat events across Climate Zones, reflective roofs should be included in updated codes for all of Zone 5, and urban roofs in Zone 6 as well.

More generally, reflective roofs can improve health outcomes with the health benefits that come with reducing indoor and outdoor extreme heat. The impacts of excess urban heat are large and complex including increased risk of chronic diseases, obesity, occupational accidents, and reduced work capacity [7]. Reflective roofs measurably reduce urban temperature, protecting the lives and health of populations.

Another factor that is commonly ignored in setting roof reflectivity standards is that global warming increases cooling needs. Over the last 2 decades, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) has found that heating degree days have dropped 15% while cooling degree days have increased by about 15%. These findings are based on out-of-date data and given accelerated global warming, and the shift from heating to cooling degree days is substantially larger than those estimations indicate [8]. This suggests that the cost-effectiveness of reflective roofs is even greater than conventionally calculated.

Numerous US companies have invested in and developed highly reflective surface options in the last several years, rendering the minimum reflectivity/SRI in the building code out-of-date. The most logical way to set a minimum roof reflectivity/SRI is to set it at the level of the widely commercially available roofing options. The US Cool Roof Rating Council reviews all commercially available and tested products on their site and has at least three dozen commercial roofing products with a three-year SRI of 0.75 or higher. As the use of reflective roofs increases, their costs drop, making reflective roofs, even more, cost effective. A 0.75 SRI should be the current basis for both new and retrofitted roofs. It should be noted that leading roofing firms like GAF are investing in making even more reflective roofs. There will be more highly reflective surfaces emerging on the market, and the 0.75 SRI will become increasingly conservative. California adopted 0.75 SRI as its roof performance standard in the current 2019 version of Title 24 [9]. Other states are expected to follow and adopt this, providing a common national standard will make compliance easier on the national scale.

The case for adopting reflective roofs in zones 4 and 5 and for cities in zone 6 is compelling and will become even more compelling with the above-described industry climate, health, reflective roofing product cost and performance improvements, and health trends.

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.

Bibliography:

[1] National League of Cities “Small: 50K”
[2] Lawrence Berkeley National Laboratory “Economic comparison of white, green, and black roofs in the United States” 2013.
[3] The Atlantic “The Homeowner’s Sunshine Problem” 2022.
[4] The New England Journal of Medicine “Heat-Related Deaths during the July 1995 Heat Wave in Chicago” 1996.
[5] EPA “Chicago, IL Adapts to Improve Extreme Heat Preparedness” 2022.
[6] EPA “Mortality Risk Evaluation” 2022.
[7] Annual Review of Public Health “Heat, Human Performance, and Occupational Health: A Key Issue for the Assessment of Global Climate Change Impacts” 2016.
[8] Building Services Engineering Research and Technology “A method to estimate the heating and cooling degree-days for different climatic zones of Saudi Arabia” 2016
[9] Cool Roof Rating Council “CA Title 24”

Cost Statement:

When examined comprehensively, it is clear that implementing cool roof requirements in Climate Zones 4, 5, and cities in Zone 6 is the cost-effective choice. Cool roofs expected lifespans range from 15-30 years, while conventional roofs are only thought to last around 10 [10]. This product-life extension is significant and critical for decision-making that seeks to be based on financial logic, and not just a first-cost approach. Reflective roof requirements would help remove the cost burden of dark roofs from home and property owners by guiding them to make the more cost-effective choice.

Additionally, rapidly rising market demand and the desire to respond to climate change, have led roofing manufacturers to increasingly invest in more reflective roofing products. It is worth noting that these newer, higher value-added reflective roofs not only reduce unwanted heat and cut pollution, energy bills, smog, and global warming emissions, but they also commonly command larger profit margins for roofing product companies. This dynamic makes cool roofs more desirable for both manufacturers and consumers, including most cities. Reflective roofs are being widely adopted by cities to cut energy bills, excess heat, and pollution and deliver other benefits.

Renewables Proposal (CECPI-2)

Revise as follows:

C405.15.1On-site renewable energy systems.
~~*Buildings* shall install equipment for o~~<u>O</u>n-site renewable electricity generation <u>systems shall be provided</u> 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.

C405.15.2 Off-site renewable energy. *Buildings* that qualify for one or more of the exceptions to Section 405.13.1 and do not meet the requirements of Section 405.13.1 ~~either in part or in full,~~ with an o*n-site renewable energy* <u>system</u>, shall procure off-site renewable electrical energy, in accordance with C405.13.2.1 and C405.13.2.2, that shall not be less than the total off-site renewable electrical energy determined in accordance with Equation 4-12.

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 4-12, 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.

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

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

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 demonstrate that where RECs or EACs are associated with on-site and off-site renewable energy production required by Sections C405.13.1 and C405.13.2 all of the following criteria for RECS and EACS shall be met:

1. <u>The RECS and EACS</u> ~~A~~<u>a</u>re 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 C405.13.2.2 whichever is less;

2. The RECS and EACS ~~A~~are created within a 12-month period of the use of the REC; and
3. The RECS and EACS ~~A~~are from a generating asset constructed 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 4-12.

Revise Appendix CC as follows:

~~**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.~~

~~**FINANCIAL RENEWABLE ENERGY POWER PURCHASE AGREEMENT (FPPA).** A financial arrangement between a renewable electricity generator and a purchaser wherein the purchaser pays or guarantees a price to the generator for the project's renewable generation. Also known as a "financial power purchase agreement" and "virtual power purchase agreement."~~

~~**PHYSICAL RENEWABLE ENERGY POWER PURCHASE AGREEMENT (PPPA).** A contract for the purchase of renewable electricity from a specific renewable electricity generator to a purchaser of renewable electricity.~~

~~**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).~~

Reason (for code changes):

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.

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.

Reason (for general support):

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:

5) Economically benefit individuals and communities as the country transitions towards a low-carbon economy;

6) Increase the resilience of communities during disruptions to centrally supplied power;
7) Reduce the impact of utility-scale renewables on critical wildlife habitat; and
8) 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.

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/.

Biomass Definition (CEPI-12)

Revise text as follows:

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

RENEWABLE ENERGY RESOURCES. Energy derived from solar radiation, wind, waves, tides, ~~biomass waste~~ <u>*renewable fuels*</u> or extracted from hot fluid or steam heated within the earth.

Add new text as follows:

<u>**RENEWABLE FUEL.** Fuels that achieve a 70% greenhouse gas emission reduction from a comparable fossil fuel calculated in accordance with California Air Resources Board's Low Carbon Fuel Standard or Annex V or Annex VI of the European Union Renewable Energy Directive 2018/2001.</u>

Add New Reference Standard:

CARB

California Air Resources Board.
1001 I Street
Sacramento, CA 95814

<u>*Low Carbon Fuel Standard: CA- GREET 3.0 model*</u>

<u>*C202*</u>

EU

European Parliament
2 Pl. de l'Europe
1499 Luxembourg

<u>*Annex V and VI of the European Union Renewable Energy Directive 2018/2001 (RED II)*</u>

<u>C202</u>

Reason: NBI submitted proposal CEPI-12 to revise the definition of renewable energy resource by removing the word "biomass" from the definition and substituting it with "biomass waste" to more accurately address the types of biomass that are likely to reduce and not increase pollutants and greenhouse gas emissions. Several conversations with industry stakeholders raised valid concerns with this approach namely, the revised definition approved in the draft 2024 IECC may be both difficult to enforce and could eliminate certain fuels that reduce greenhouse gas emissions not sourced from biomass waste products.

The ICC should instead model the definition of a renewable fuel on existing policies used to reduce greenhouse gas emissions from fuels. This new proposed definition is based on current policies for transportation fuels in California, Washington and Oregon, Green-e's renewable fuel standard, and requirements for renewable fuels in Europe. Like the Green-e certified renewable fuel standard, the proposed definition relies on a method for calculating the greenhouse gas emission reduction from a renewable fuel product using California Air Resource Board's Low Carbon Fuel Standard. [1], [2] A similar calculation developed by the European Union for their Renewable Energy Directive II is also provided as an optional method for calculating emissions. Both methods include both direct greenhouse gas emission from the production and consumption of the fuel and indirect greenhouse gas emissions from land use changes. [3]

The required greenhouse gas emission reduction target of 70% when compared to fossil fuels is equivalent to the requirements for renewable building fuels in Europe as of 2021. Europe will increase the required percentage to 80% by 2026. [3] NBI believes the IECC should eventually follow Europe's lead and reduce the greenhouse gas emission requirement for renewable fuels as the US transitions to a more renewable grid.

This revised renewable fuel definition proposed is easier to enforce, technology neutral, and will ensure the renewable energy requirement proposed for inclusion in the 2024 IECC will prevent increased localized criteria air pollution while still reducing carbon emissions from the building.

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

This proposal does not affect the cost of construction.

Bibliography:
[1] California Air Resources Board. (2022, July 7). LCFS Pathway Certified Carbon Intensities. Retrieved from https://ww2.arb.ca.gov/resources/documents/lcfs-pathway-certified-carbon-intensities.

[2] Center for Resource Solutions. (2021, September 16). Green-e. Retrieved from Green-e Renewable Fuels Standard, Version 1.0: https://www.green-e.org/docs/rf/Green-e%20Renewable%20Fuels%20Standard.pdf

[3] European Commission. (2022, July 7). Renewable Energy – Recast to 2030 (RED II). Retrieved from EU Science Hub: https://joint-research-centre.ec.europa.eu/welcome-jec-website/reference-regulatory-framework/renewable-energy-recast-2030-red-ii_en

Energy Storage Ready (CEPI-7)

Revise as follows:

C405.16 Electrical energy storage system. Buildings shall comply with C405.16.1 and C405.16.2 or C405.16.3.

C405.15.1 Electrical energy storage energy capacity. Each building shall have an ESS with rated energy capacity as follows:

1. ESS rated energy capacity (kWh) ≥ 1.0 (kWh/kW) x Installed ~~PV System~~ *On-site Renewable Energy* System Rated Power (kW_{DC})
2. ESS rated power capacity (kW) ≥ 0.25 x Installed ~~PV System~~ *On-site Renewable Energy* System Rated Power (kW_{DC})

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

C405.16.3 Electrical energy storage system ready. Each building shall have a reserved ESS-ready area to accommodate future electrical storage meeting the following electrical criteria:

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

Reason: The proposed amendment clarifies that the Energy Storage System rated energy and power capacity are related to the on-site renewable energy system's rated power. The changes also clarify that the size of the system is based on the gross conditioned floor area of the three largest floors. Additional changes were made to fix a typo in the units in Section C405.1.3. The changes were made to reflect the intent of the proposal to tie energy storage readiness provisions to renewable energy requirements in the 2024 IECC.

NBI believes that the energy storage-ready provisions proposed for the 2024 IECC which ensure that either an energy storage system is installed or that there is both sufficient physical space and electrical capacity for that energy storage system, are critical bolstering the economy, presenting a cost savings opportunity for building owners, increasing resilience to power outages, and aiding in the transition to a carbon-free grid. The Inflation Reduction Act of 2022 is estimated to double the deployment of renewable energy technology, ensuring that 67% of our energy will be carbon-free by 2035. As the U.S. rapidly deploys renewables, buildings must be prepared to aid in this transition by storing energy to match grid demands. That is why the Inflation Reduction Act includes tax credits which will reduce the capitol costs of energy storage systems by 30%. Ensuring buildings are energy storage-ready will allow more customers to take advantage of federal incentives, reduce their utility bills, make their buildings more resilient and aid in the transition to a carbon free economy. The proposed changes ensure that the energy storage-ready provisions fully align with the renewable energy provisions in the draft 2024 IECC.

Grid integrated thermostats (CEPI-99)

Section: C403.4.6

Reason: Heating, ventilation, and air conditioning (HVAC) system control allows for dialing back heating and cooling, as well as accepting additional heating or cooling when renewable energy generation is high or energy prices are low. This is often done through thermostats, and has been at the center of demand response (DR) programs for decades. DR programs continue to rely deeply on thermostat control strategies, but the need for such controls is fast growing. As electricity systems transform to include more variable renewable energy, from 20% of electricity supply in 2020 to an estimated 67% by 2035 due to the passage of the Inflation Reduction Act, demand flexibility is increasingly critical to both grid operation and further transformation. [1] Building systems that can use energy when it is abundant, clean, and low-cost not only help decarbonize the entire energy system, they also insulate their owners from future increases in demand charges and peak hour energy rates – a current and accelerating trend. Requiring buildings to have grid integrated HVAC controls is therefore an important requirement in the 2024 IECC.

Bibliography:

[1] Seiple, Chris. "US Inflation Reduction Act set to make climate history." Wood Mackenzie. 19 Aug. 2022, https://www.woodmac.com/news/opinion/us-inflation-reduction-act-set-to-make-climate-history/

Grid integrated water heating (CEPI-125)

Section: C404.10

Reason: Demand responsive water heating controls can signal water heaters to heat water when renewable energy generation is high and energy prices are low. As electricity systems transform to include more variable renewable energy, from 20% of electricity supply in 2020 to an estimated 67% by 2035 due to the passage of the Inflation Reduction Act, demand flexibility is increasingly critical to both grid operation and further transformation. [1] The provisions in the 2024 IECC that require demand responsive controls for electric water heaters are one of the most cost effective methods to deliver substantial reliable energy flexibility. Water heaters that can use energy when it is abundant, clean, and low-cost not only help decarbonize the entire energy system, they also insulate their owners from future increases in demand charges and peak hour energy rates – a current and accelerating trend. Requiring buildings to have demand responsive water heating controls is an important requirement in the 2024 IECC.

Bibliography:

[1] Seiple, Chris. “US Inflation Reduction Act set to make climate history.” Wood Mackenzie. 19 Aug. 2022, https://www.woodmac.com/news/opinion/us-inflation-reduction-act-set-to-make-climate-history/

New Building Energy Efficiency

Propose New Building Envelope Backstop

Modify Section C402 as follows:

C402.1.4 Component performance 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 C402.1.4**, **C402.1.5**, and C402.4 and the maximum allowable fenestration areas in Section C402.4.1. *Fenestration* shall meet the applicable SHGC requirements of Section C402.4.3.

~~$A_P + B_P + C_P + T_P \le A_T + B_T + C_T + T_T - V_F - V_S$~~ (Equation 4-1)

$HTF_P \le HTF_B$

where:

HTF_P is the proposed envelope heat transfer factor, $HTF_P = A_P + B_P + C_P + T_P$

HTF_B is the base envelope heat transfer factor, $HTF_B = A_T + B_T + C_T + T_T - V_F - V_S$

Modify Section C407 as follows:

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.

2. An annual energy cost that is less than or equal to the percentage of the annual energy cost (PAEC) of the *standard reference design* calculated in Equation 4-31. 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.

3. The proposed building's envelope heat transfer factor (HTF_P) shall not exceed the base envelope heat transfer factor (HTF_B) by more than 15% for Type 5 construction and by more than 20% for all other building types, as determined in accordance with Section C402.1.4.

> **Exception:** New buildings exceeding the maximum vertical fenestration area permitted in Section C402.5.1 for which the proposed envelope performance factor does not exceed the base envelope performance factor by more than 15% in multifamily residential, hotel/motel and

dormitory building area types, as determined in accordance with ANSI/ASHRAE/IESNA 90.1 Appendix C. For all other building area types, the limit shall be 7%. For buildings with both residential and nonresidential occupancies, the limit shall be based on the area-weighted average of the gross conditioned floor area of each building area type.

Reason:

The purpose of this code change proposal is to improve the commercial total building performance path by incorporating a mandatory building thermal envelope trade-off backstop (limiting the user's ability to trade off the prescriptive envelope levels) similar to the residential version in Section R405.2 of the 2021 *IECC*. Although the residential provisions of the *IECC* have included mandatory trade-off limits (backstops) for various compliance paths for several editions now, and these trade-off limits were expanded and improved in the 2021 *IECC*, the commercial code compliance paths do not yet have similar trade-off backstops.

Even though the 2021 *IECC* requires a substantially improved level of efficiency in commercial building envelope components, an effective thermal envelope trade-off backstop would provide important additional benefits for the owners and occupants of these buildings by ensuring that all building envelopes exhibit a reasonable level of efficiency:

- The efficiency of the building envelope is the most important factor in a building's long-term performance (unlike equipment, the envelope typically lasts a very long time, even for the life for the building), but is the most costly to retrofit after the building is constructed;
- Occupants will be more comfortable and healthier in a building with a reasonably efficient envelope; and
- Well-insulated buildings are more resilient and will provide better protection for occupants and property in long-term power outages.

An effective thermal envelope backstop is crucial to ensure that the building retains reasonable envelope performance under the performance path, and that the envelope is not unduly traded-off for other measures. Trading off envelope and associated occupant comfort can have direct negative impacts on energy usage. For example, if the occupant responds to discomfort from a "cold" or "hot" room due to an inadequate building envelope by adjusting the thermostat, the additional energy use from the adjusted thermostat can be substantial. As a result, backstops can save significant energy and energy costs in buildings.

Because the commercial performance path provides code users wider latitude than the residential chapters to trade efficiency among envelope, mechanical equipment, renewables and lighting, it is even more important that a backstop be included in the commercial performance path.

A backstop for Section C407 was proposed in the public input phase (CEPI-204-21) and disapproved by the Commercial Consensus Committee. The reason for disapproval was because the restrictions on every envelope component was considered overly restrictive. It also could not be coordinated with a simple UA approach using the C402.1.4 Component Performance Alternative because that method was not constructed in such a way to allow that to be done. However, Section C402.1.4 was revised in the public input phase (CEPI-46-21, as modified) to follow a more traditional UA equation approach with additional considerations for thermal bridging (CECPI-4). This proposal goes one step further to revise the approach and simplify it to comparison of a baseline and proposed heat transfer factor (HTF) which is even more consistent with a traditional total UA method equation format. Thus, the envelope backstop can be characterized as a multiplier on the base envelope heat transfer factor (HTF_B) which allows the U-factors, F-factors, C-factors (and now also psi- and chi-factors for thermal bridging) to vary by more than 15% (for Type V wood frame construction) or 20% (all others) so long as the total HTF_P for the proposed building envelope does not exceed a percentage of the HTF_B. This is consistent with how envelope backstops are applied in other parts of the IECC. The 1.15 x HTF_B also is consistent with backstops for wood frame building in accordance with the IECC-Residential provisions (known as Type V construction in the IBC). The 1.20 x HTF_B is added for the IECC-Commercial provisions because the IECC includes more assembly types for commercial buildings, some of which may include fenestration/spandrel systems where a greater backstop allowance is needed to accommodate available systems without creating significant difficulty or cost impacts (e.g., requiring triple-pane glazing to help offset impact of spandrel U-factors that typically exceed the opaque above-grade wall U-factors by a significant margin).

In addition, an exception is provided that allows even greater flexibility in the backstop to permit larger fenestration areas to be achieved in the C407 Simulated Building Performance path while still retaining a modest backstop against trading off long-term building thermal envelope performance. This exception relies on an approach developed for ASHRAE 90.1 (as already referenced in Section C406.2.1.1 of the IECC public comment draft) and is based on a percentage of the building energy use (performance factor), not a percentage of the "UA" or HTF_B of the envelope. Thus, the 7% and 15% of base envelope "performance factor" provides substantially more flexibility to achieve large window to wall area ratios (WWR) where needed for a proposed building. The exception is only applied to new buildings because flexible provisions for existing building alterations are already addressed separately in Section C503.

Cost Statement:

This proposal does not increase the baseline stringency of the prescriptive requirements of the IECC, but merely limits trade-offs under a voluntarily chosen alternate compliance path. The mandatory minimum values proposed are less stringent than prescriptive values of the IECC and only apply if an alternative compliance path is chosen. The user can be expected to choose an alternate compliance path, with the mandatory measures, when it produces lower costs than prescriptive compliance. As a result, whether costs of construction increase or decrease ultimately depends on choices made by the code user.

This proposal does not increase the stringency of the code or result in increased costs, so a cost-effectiveness analysis does not apply. The ICC Board of Directors set the 2021 IECC as the baseline for future IECC development – and by extension made the 2021 IECC the basis for cost-effectiveness analyses. This means for purposes of analyzing code proposals, the existing provisions of the 2021 IECC are considered cost- effective and reasonable (since they are the starting point for analyses of code changes and no rollbacks are permitted). Establishing trade-off backstops like this code change proposal does not increase the stringency of that baseline or impose any additional costs to meet specific measures. In addition, if the prescriptive values are cost-effective, then the backstop values would be cost-effective. These backstops serve only as a consumer protection against excessive trade-offs, but do not require anything more than what would be required for base code prescriptive compliance.

Multifamily Envelope Alignment (CEPI-53)

Add new definition as follows:

CURTAIN WALL. An external non-bearing wall intended to separate the exterior nonconditioned and interior conditioned spaces consisting of any combination of framing materials, fixed glazing, opaque glazing, operable windows, or other in-fill materials.

Revise text as follows:

Table C402.4 BUILDING ENVELOPE FENESTRATION 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**																
	All other	Group R[a]	All other	Group R[a]	All other	Group R[a]	All other	Group R[a]	All other	Group R[a]	All other	Group R[a]	All other	Group R[a]	All other	Group R[a]
Fixed fenestration	0.50	0.50	0.45	0.40	0.42	0.30	0.36	0.30	0.36	0.28	0.34	0.28	0.29	0.27	0.26	0.27
Operable fenestration	0.62	0.50	0.60	0.40	0.54	0.30	0.45	0.30	0.45	0.28	0.42	0.28	0.36	0.27	0.32	0.27
Entrance doors	0.83	0.83	0.77	0.77	0.68	0.68	0.63	0.63	0.63	0.63	0.63	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	

a. Standard/Specification for an Architectural Window (AW) in Group R occupancies shall be permitted to use the U-factors for All Other.

C402.4.3 Maximum U-factor and SHGC. [no change to text]

> **Exception:** Curtain wall fenestration and fenestration products certified to meet the North American Fenestration Standard/Specification for an Architectural Window (AW) in Group R occupancies shall be permitted to use the U-factors for All Other.

Reason: This proposal seeks to align the window requirements of multifamily dwelling units between the Residential and Commercial codes in order to ensure consistency between substantially similar multifamily buildings. Currently there are large discrepancies in terms of system design, control and stringency between a three-story multifamily building (regulated by the residential code) and a four-story multifamily building (regulated by the commercial code). This leads to market confusion, enforcement inconsistencies, and large potential untapped energy savings. This revision and its companion, which was accepted by the 2024 IECC Residential Consensus Committee, seeks to close these gaps and create a common set of window 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 to not create a new section, this proposal instead works to align the sections that currently exist.

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

Cost: 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.

Multifamily Lighting Alignment (CEPI-53)

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.

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.

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

Cost: 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.

Energy Credits (CEPI-193)

Revise Table C406.1.1 as follows:

Table C406.1.1 Energy 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~~	~~65~~	~~66~~	~~67~~	~~77~~	~~80~~	~~86~~	~~80~~	~~81~~	~~90~~	~~86~~	~~90~~	~~90~~	~~86~~	~~90~~	~~90~~	~~79~~	~~89~~	~~80~~	~~78~~
~~I-2~~	~~43~~	~~42~~	~~38~~	~~37~~	~~36~~	~~38~~	~~32~~	~~32~~	~~30~~	~~36~~	~~36~~	~~35~~	~~43~~	~~43~~	~~44~~	~~46~~	~~47~~	~~50~~	~~53~~
~~R-1~~	~~63~~	~~62~~	~~66~~	~~65~~	~~70~~	~~71~~	~~77~~	~~80~~	~~84~~	~~81~~	~~83~~	~~88~~	~~85~~	~~86~~	~~90~~	~~83~~	~~87~~	~~87~~	~~85~~
~~B~~	~~62~~	~~62~~	~~64~~	~~66~~	~~66~~	~~65~~	~~64~~	~~64~~	~~68~~	~~70~~	~~72~~	~~74~~	~~71~~	~~73~~	~~77~~	~~71~~	~~74~~	~~74~~	~~71~~
~~A-2~~	~~70~~	~~70~~	~~72~~	~~72~~	~~75~~	~~75~~	~~70~~	~~73~~	~~82~~	~~69~~	~~74~~	~~78~~	~~67~~	~~72~~	~~78~~	~~60~~	~~67~~	~~57~~	~~51~~
~~M~~	~~80~~	~~79~~	~~83~~	~~79~~	~~81~~	~~84~~	~~67~~	~~74~~	~~87~~	~~80~~	~~66~~	~~65~~	~~79~~	~~62~~	~~50~~	~~75~~	~~67~~	~~75~~	~~58~~
~~E~~	~~56~~	~~57~~	~~55~~	~~58~~	~~58~~	~~57~~	~~59~~	~~62~~	~~59~~	~~61~~	~~66~~	~~62~~	~~64~~	~~67~~	~~67~~	~~65~~	~~67~~	~~63~~	~~58~~
~~S-1 and S-2~~	~~61~~	~~60~~	~~61~~	~~60~~	~~58~~	~~57~~	~~44~~	~~54~~	~~62~~	~~85~~	~~68~~	~~75~~	~~90~~	~~82~~	~~72~~	~~90~~	~~89~~	~~90~~	~~90~~
~~All Other~~	~~31~~	~~31~~	~~31~~	~~32~~	~~32~~	~~33~~	~~30~~	~~32~~	~~36~~	~~35~~	~~35~~	~~35~~	~~37~~	~~36~~	~~36~~	~~36~~	~~37~~	~~36~~	~~34~~

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	85	85	91	100	100	100	100	100	100	94	100	100	93	100	100	100	100	100	100
I-2	50	49	47	46	46	48	44	44	45	48	48	49	54	55	56	55	56	58	59
R-1	59	57	60	60	62	62	65	67	68	67	70	73	78	75	82	86	82	94	100
B	66	63	65	68	64	63	67	68	68	70	73	74	83	83	84	95	92	94	100
A-2	74	74	75	76	79	79	77	80	87	73	78	82	100	98	100	100	100	100	100
M	95	94	95	93	94	97	87	85	97	82	75	68	79	94	83	100	98	100	87
E	67	68	68	70	72	71	72	76	77	77	83	79	83	86	89	90	89	88	89
S-1 and S-2	90	89	95	92	93	91	66	83	95	38	62	90	100	93	87	100	100	100	98
All Other	37	36	37	38	38	39	37	38	41	34	37	39	42	43	44	47	46	47	47

Reason (code change): The additional energy efficiency credit flexibility is of great value, and the increased requirement for energy savings in this proposal are important. However, he proponent's cost-effectiveness analysis supported higher requirements for energy efficiency credits, as described in a detailed Technical Brief by the Pacific Northwest National Laboratory [1]. The proponent made unexpected changes to the values in Table C406.1.2 after the completion of a working group of the proponent and Modeling, Whole Building Metrics and Zero Energy Subcommittee members. These changes were based on a misreading of the guidance on cost-effectiveness calculations developed by the Construction Cost & LCC Advisory Group and voted on affirmatively by the Commercial Consensus Committee. That guidance stated that cost-effectiveness calculations should consider both 5.33% and 9.33% nominal discount rates (equivalent to 3% and 7% real discount rates with a 2.33% assumed inflation rate). Presumably (and understandably) due to the complexity of the proposal, the energy efficiency credit values in Table C406.1.2 were determined using a single discount rate. The analysis underlying the original proposal used an 8.1% nominal discount rate, itself high in the 5.33%-9.33% range. The credit requirements in the final approved proposal were based on only a 9.33% nominal discount rate; using this discount rate alone in determining cost-effective code criteria is unsupportable. The proposed values in Table C406.1.1 restore the requirements as originally submitted, based on the published cost-effectiveness analysis.

Bibliography:

Technical Brief by the Pacific Northwest National Laboratory
https://www.energycodes.gov/sites/default/files/2021-07/TechBrief_EnergyCredits_July2021.pdf

Reason (support): This proposed revision to section C406 in the 2024 IECC is an important tool for the energy code to continue to drive the energy performance of commercial buildings. The revision to Section C406, which results an additional 5% energy efficiency improvement, incentivizes buildings to take advantage of cost-effective energy efficiency, renewable and grid integration measures that otherwise are not reasonable to be included as prescriptive requirements in the energy code. The optional Appendix is also a crucial component for forward thinking jurisdictions who want to meet their climate goals in the most cost effective and flexible manner possible.

Thermal Bridging (CECPI-4)

Section: C402.7

Reason: The requirements for overall assembly insulation have been well addressed in the 2021 IECC. However, the 2021 IECC does little to address the issue of thermal bridges, which can have an oversized impact on the performance of the thermal envelope and thus a building's energy use. Thermal bridging can reduce the thermal performance of the opaque building envelope by between 20-70%. Non-thermally broken cladding attachments can degrade the thermal performance of opaque panel assemblies by 50%. [1] The proposed addition of thermal bridging requirements to the 2024 IECC is therefore crucial to improving the performance of buildings and ensuring the energy code can eventually achieve net-zero performance to meet climate goals.

Bibliography:

[1] BC Housing, Thermal Bridging Guide, Version 1.5, 2020, https://www.bchousing.org/research-centre/library/residential-design-construction/building-envelope-thermal-bridging-guide

Total System Performance Ratio (CEPI-76)

Section: C409

Reason: This proposed addition of HVAC Total System Performance Ratio (TSPR) in Section C409 to the 2024 IECC is an important tool for the energy code to continue to drive the energy performance of commercial buildings and help communities meet their climate goals. The addition of the TSPR metric, which evaluates overall system efficiency instead of individual component efficiency, allows one to incentivize buildings to install HVAC system types that can cost-effectively reduce the total energy consumption of a building. The additional stretch code option provided in the proposal will allow jurisdictions that want to cost-effectively meet their climate goals to take advantage of TSPR metric to mandate more efficient HVAC system choices in their energy code.

Existing Building Energy Efficiency

Existing Building Credits (CEPI-204)

Section: C506

Add new definition as follows:

SUBSTANTIAL ENERGY ALTERATION. An *alteration* that includes replacement of two or more of the following:

1. 50% or more of the area of interior wall-covering material of the *building thermal envelope*.
2. 50% or more of the area of the exterior wall-covering material of the *building thermal envelope* or fenestration.
3. Space-conditioning equipment constituting 50% or more of the total input capacity of the space heating or space cooling equipment serving the building.
4. Water-heating equipment constituting 50% of more of the total input capacity of all the water heating equipment serving the *building*.
5. 50% or more of the luminaires in the *building*.

Revise as follows:

C503.6Additional energy efficiency credits.
~~*Alterations*~~ *Substantial energy 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. Credits shall be achieved when all of the *alteration* complies with the credit requirements. Portions of the *alteration* that represent less than 50% of the interior or exterior wall covering of the *thermal envelope,* less than 50% of the input capacity of the space heating or cooling equipment, less than 50% of the input capacity of water heating equipment or less than 50% of the lighting power of the *building* shall not be eligible to achieve credits for compliance with 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 *alte*~~

~~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 alter~~

~~1.5 50 percent or more of the building's *exterior wall envelope*, including fenestration.~~

1~~2~~. *Alterations* to *buildings* in Utility and Miscellaneous Group U, Storage Group S, Factory Group F, High-Haz

2~~3~~. *Alterations* that do not contain conditioned space.

3~~4~~. Portions of *buildings* devoted to manufacturing or industrial use.

4~~5~~. *Buildings* in Climate Zone 0A.

5~~6~~. *Alterations* that are permitted with an *addition* complying with Section C502.3.7.

6~~7~~. *Alterations* that comply with Section C407.

Reason: Requiring existing buildings undergoing major renovations or additions to make efficiency improvements when it is cost effective to do so is crucial element towards meeting our climate goals. The new language in the 2024 IECC is a reasonable strategy as the costs for this proposal are the same as the costs for C406 requirements for new construction. However, savings for each package are much higher since the rest of the building will nearly always have specifications that fall short of the latest energy code and each package will deliver greater savings. As a result, any package that is cost effective for new construction is even more cost effective for major alterations.

During the committee hearing process, this new code section received substantial support, but there were two major concerns: the clarity of the language, and the alteration threshold for the requirement.

Clarity of the Language: The original language was structured so that only "substantial" alterations would be subject to the requirements. This was done by creating an exception that effectively defined an alteration that was not substantial and exempted those alterations. During the committee process, concerns were raised about how this was a confusing way to structure the requirement even if the language itself was reasonably clear. In order to increase clarity, the language was reconfigured so that the threshold would not be defined through the exception. This public comment defines a new term: "substantial energy alteration" and only makes this specific kind of alteration subject to the requirements. The definition of the term is largely the same as the exception, except expressed in terms of what it is instead of what it isn't. This is more clear since alterations that are not substantial energy alterations will not even need to look at the section. This term was chosen because it follows an approach to substantial alterations that is already in the code. The IEBC has a definition for "substantial structural alteration" that sets a threshold for alterations to the structure that are considered substantial enough for special requirements. This definition does the same thing, it creates a threshold for alterations to the energy systems that are substantial enough for special requirements.

Threshold: The other concern raises was that the original language defined the substantial alteration as one that impact more that 50% of the systems serving the alteration area. Concerns were raised that the area of an alteration is difficult to define. Concerns were also raised that even if the alteration area is defined, it could be easy for substantial alterations to a limited part of the building to meet the threshold but hard for them to achieve points. To address this issue, this public comment changes the threshold for the alteration from just the alteration area to the entire building. While there is some loss in stringency, this will be much easier to understand, much clearer to enforce, and much easier to comply with.

Energy Monitoring (CEPI-138)

Section: C405.13

Reason: There are currently over 40 benchmarking regulations across the U.S. (38 local jurisdictions and four states) – with size thresholds as low as 10,000 sf. These regulations require the reporting of energy use and are being used as a steppingstone toward regulation of building performance – either through audit and retro-commissioning requirements or building performance standards. The proposed requirement in the 2024 IECC which ensures that buildings are equipped to comply with these policies is a critical function of the code.

EV Energy Monitoring (CEPI-140)

Section: Table C405.13.2

Reason: In 2022, the electric vehicles market grew by over 60%, making up almost 5 percent of vehicle purchases. [1] The passage of the Inflation Reduction Act, which reduces the price of electric vehicles by up to $7,500 and new regulations in California that plan to ban the sale of gas-powered vehicles by 2035, will further transform the auto-industry in the U.S. As electric vehicle charging infrastructure becomes more common place to match the growing demand for electric vehicles, the electricity supplied to these chargers will increase the overall energy use of buildings when compared to similar buildings without charging infrastructure. Combined with new regulations from jurisdictions on benchmarking and building performance, it is important that owners know and understand the energy use of electric vehicle charging infrastructure separate from the base building uses. It is far more cost-effective to submeter these loads during new construction than to try to isolate them and add additional submeters as part of a retrofit. The provisions proposed to require monitoring of electric vehicles in the 2024 IECC will help owners cost effectively manage their building's energy use and meet current or future benchmarking and building performance standards requirements, as well as future-proof buildings for the electric vehicle charging infrastructure needs of the evolving transportation sector.

Bibliography:

[1] Blanco, Sebastian. Electric Cars' Turning Point May Be Happening as U.S. Sales Numbers Start Climb. Car and Driver, 7 Sept. 2022, https://www.caranddriver.com/news/a39998609/electric-car-sales-usa/.

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