# CED1-15-22 (PLR mods are highlighted yellow)

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

## 2024 International Energy Conservation Code [CE Project]

**Add new text as follows:**

**APPENDIX CG**

**ALL-ELECTRIC COMMERCIAL BUILDING PROVISIONS**

*The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.*

**User note:**

***About this chapter:*** *Appendix CG provides cities and states an appendix to the Commercial Provisions of the 2024 International Energy Conservation Code® (IECC®) that would result in all-electric commercial buildings. Jurisdictions have the prerogative to adopt the appendix in support of policy goals related to carbon emission reductions. The provisions contained in this appendix are not mandatory unless specified as such in the jurisdiction’s adopting ordinance.*

*Whether an all-electric buildings is less expensive to construct and operate depends heavily on climatic and market variables. Therefore, before adopting this appendix, jurisdictions should carefully consider the local climate and market conditions such as utility costs, local equipment costs and local workforce and equipment availability.*

**SECTION CG101 GENERAL**

**CG101.1 Intent.** The intent of this Appendix is to amend the *International Energy Conservation Code* to reduce greenhouse gas emissions from buildings and improve the safety and health for commercial building occupants by requiring new *all-electric buildings* and efficient electrification of existing buildings.

**CG101.2 Scope.** The provisions in this appendix are applicable to commercial buildings. New construction shall comply with Section CG103.

*Additions*, *alterations*, *repairs* and *changes of occupancy* to existing buildings shall comply with Chapter 5 and Section CG104.

**SECTION CG102 DEFINITIONS**

**CG102 ALL-ELECTRIC BUILDING.** A *building* using no *purchased energy* other than electricity when utility power is available.~~that contains no~~ *~~combustion equipment~~*~~, or plumbing for~~ *~~combustion equipment,~~* ~~installed within the~~ *~~building~~* ~~or~~ *~~building site~~.*

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

**CG102 COMBUSTION EQUIPMENT.** Any equipment or *appliance* used for space heating, *service water heating*, cooking, clothes drying, humidification, or lighting that uses a *fossil fuel* *~~fuel gas~~* ~~or~~ *~~fuel oil~~*~~.~~

**~~CG102 FUEL GAS.~~** ~~Natural gas, manufactured gas, liquified petroleum gas or a mixture of these.~~

**~~CG102 FUEL OIL.~~** ~~Kerosene or any hydrocarbon oil having a flash point not less than 100°F (38°C).~~

**~~CG102 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 b~~*~~uilding 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.~~*

**CG102 PURCHASED ENERGY.** Energy or power purchased for consumption and delivered to the building site.

**CG102 SUBSTANTIAL IMPROVEMENT**.Any *repair*, reconstruction, rehabilitation, *alteration*, *addition* or other improvement of a building or structure, the cost of which equals or ~~exceeds~~ is more than 50 percent of the market value of the structure before the improvement ~~or repair is started~~. ~~If~~ Where the structure has sustained *substantial damage,* as defined in the International Building Code, any repairs are considered substantial improvement regardless of the actual *repair* work performed. ~~The term~~ Substantial improvement does not~~, however,~~ include ~~either~~ the following:

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

**SECTION CG103**

**NEW COMMERCIAL BUILDINGS**

**CG103.1 Application.** New commercial buildings shall be *all-electric buildings* and comply with Sections C401.2.1 or C401.2.2*.*

**Exceptions:**

1. *Purchased energy* other than electricity shall be permitted where it has been demonstrated to the building official that the building is required by an applicable law or regulation to provide space heating with an emergency power system or a standby power system.
2. *Purchased energy* shall be permitted for an emergency power system or a standby power system.

**CG103.2 Electric resistance heating equipment.** The sole use of electric resistance equipment and appliances for space and water heating shall be prohibited other than for *buildings* or portions of *buildings* that comply with not less than one of Sections CG103.2.1 through CG103.2.8.

**CG103.2.1 Low space heating capacity.** Electric resistance appliances or equipment shall be permitted in buildings or areas of buildings not served by a mechanical cooling system and with a total space heating capacity not greater than 4.0 BTU/h (1.~~0~~2 watts) per square foot of *conditioned space* ~~areshall be 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.** ~~The U~~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~~ not greater than 40°F (4.5°C) and intended for freeze protection, including temporary systems in unfinished spaces, ~~are~~shall be permitted to use electric resistance. The building envelope of any such space shall be insulated in compliance with Section C402.1.

**CG103.2.5.2 Freeze protection systems.** Freeze protection systems shall comply with Section C403.13.3.

**CG103.2.6 Pre-heating of outdoor air.** Systems with energy recovery ventilation ~~are~~shall be permitted to utilize electric resistance to preheat outdoor air for defrost or temper ~~supply~~ air entering the energy recovery device to not more than 45°F (7.2°C). Hydronic systems without energy recovery ventilation ~~are~~shall be permitted to utilize electric resistance to temper ~~supply~~ air entering the energy recovery device to not more than 40°F (4.5°C).

**CG103.2.7 Small buildings.** Buildings with a conditioned floor area of not more than 250 square feet (23.2 m2) and not served by a mechanical space cooling system shall be permitted to use electric resistance *appliances* or equipment for space heating.

**CG103.2.8 Supplemental heat.** Electric resistance heat shall be permitted as supplemental heat when installed with heat pumps sized in accordance with Section CG103.3 and when operated only when a heat pump cannot provide the necessary heating energy to satisfy the thermostat setting.

**CG103.3 Heat pump sizing for space heating.** Heat pump space heating systems shall be sized to meet the *building* heating load at the greater of 0°F (-18°C) or the 99 Percent Annual Heating Dry-Bulb for the nearest weather station provided in the ASHRAE Handbook of Fundamentals. The ~~heat pump~~ space heating system shall not require the use of supplemental electric heat at or above this temperature other than for defrosting. Lower capacity heat pumps that operate in conjunction with thermal storage shall be permitted if the system meets the requirements of this section.

**CG103.4 Heat pump sizing for water heating.** Heat pump *service heating system*s shall be sized to meet not less than the *building service water heating* load at the greater of 15°F (-~~18~~9.5°C) or the 99 Percent Annual Heating Dry-Bulb for the nearest weather station provided in the latest edition of the ASHRAE Fundamentals Handbook. Supplemental electric heat shall not be required at or above this temperature other than for temperature maintenance in recirculating systems and defrosting.

**CG103.5 Heating outside a building.** Systems for heating outside a building shall comply with C403.13.1.

**CG103.6 Low capacity cooling equipment.** ~~New unitary a~~Air conditioners with capacity less than 240,000 Btu/hr (70 kW) shall be electric heat pump equipment sized and configured to provide both space cooling and space heating.

**SECTION CG104 EXISTING COMMERCIAL BUILDINGS**

**CG104.1 Combustion equipment in additions.** *Additions* shall use no *purchased energy* other than electricity ~~not be permitted to contain~~ *~~combustion equipment~~* and new equipment installed to serve *additions* shall use no *purchased energy* other than electricity ~~not be~~ *~~combustion equipment~~*. Where existing systems using *purchased energy* other than electricity ~~with~~ *~~combustion equipment~~* ~~are extended into~~ serve an addition, the existing *building* and addition together shall use no more *purchased energy* other than electricity ~~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-2 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 twiceo 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.~~

**CG104.3 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 CG104.6.

**CG104.4 Service water heating equipment.** Where ~~service water heating equipment is~~ *water heaters* are added or replaced, ~~new service hot water equipment~~ they shall use no purchased energy other than electricity.~~not be~~ *~~combustion equipment~~*.

**CG104.5 Furnace replacement.** Newly installed warm air furnaces provided for space heating shall only be permitted as supplementary heat controlled in accordance with Section CG104.6.

**CG104.6 Heat pump supplementary heat.** Heat pumps having *combustion equipment* or electric resistance equipment for supplementary space or *service water heating* shall have controls that limit supplemental heat operation to only those times when one of the following applies:

1. The heat pump is operating in defrost mode.
2. The vapor compression cycle malfunctions.
3. For space heating systems, the thermostat malfunctions.
4. For space heating systems, the vapor compression cycle cannot provide the necessary heating energy to satisfy the thermostat setting.
5. The outdoor air temperature is less than the design temperature determined in accordance with Section CG103.3.
6. For *service water heating*, the heat pump ~~water heater~~ *water heater* cannot maintain an output water temperature of ~~at least~~ not less than 120°F (49°C) .
7. For temperature maintenance in *service water heating* systems.

New supplementary space and *service water heating* systems for heat pump equipment shall not be permitted to have a heating ~~input~~ output capacity greater than the heating ~~input~~ output capacity of the heat pump equipment.

### Add new standard(s) as follows:

ASHRAE

**ASHRAE**

180 Technology Parkway NW Peachtree Corners, GA 30092

100-2018 Energy Efficiency in Existing Buildings

**Reason:** In order for the U.S. to reach net zero carbon emissions, the country must not only reduce energy use through energy efficiency and move to utility scale and on-site renewable energy, but also begin to transition away from using combustion equipment in buildings that runs on fossil fuels to electric equipment. In 2021, combustion equipment in commercial and residential buildings accounted for 35% of US greenhouse gas emissions.[1] The purpose of a model code is to provide cities and states with a starting point on which each jurisdiction can base their energy code. Growing interest in establishing all-electric building requirements is evidenced by several cities and states passing ordinances banning fossil fuel combustion equipment in buildings including Washington DC, New York City, Ithaca, New York; Brookline, Massachusetts; Berkeley, Los Angeles, Sacramento, San Francisco, Oakland and San Jose, California; and Washington State. Including an appendix in the 2024 IECC that specifies requirements for all-electric commercial construction will streamline adoption and implementation of all-electric construction for policy makers and the building industry. We strongly encourage that the code language in this appendix minimizes the use of inefficient electric resistance heat for space heating in new buildings to avoid an unintended consequence of higher operational costs and carbon emissions for the life of the

building. Attached is a letter with others stating the support for this proposal from 50 organizations, 16 of which f 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 (NO2) and carbon monoxide (CO) either indoors because of gas stoves or outdoors because of space-heating and water heating equipment. A recent study from the Harvard Chang School of Public Health and RMI shows that in Illinois in 2017, air pollution from burning fuels in buildings led to an estimated 1,123 early deaths and $12.574 billion in health impact costs.[2] These emissions can particularly affect children. In a meta-analysis analyzing the connections between gas stoves and childhood asthma, children in homes with gas stoves were 42% more likely to experience asthma symptoms, and 32% more likely to 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:
   1. Does not permit new combustion equipment in additions
   2. 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.
   3. Incentivizes heat pumps in new buildings by requiring buildings undergoing a substantial energy alteration to achieve additional energy efficiency credits.
   4. 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.
   5. Requires new or replacement service hot water equipment to be electric.
   6. Requires new furnaces provided for space heating to only be permitted to be used as supplementary heat.
   7. Reduces the use of electric resistance and combustion equipment for supplementary heat through the use of improved controls.

**Cost Impact:** The code change proposal will decrease the cost of construction.

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

**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-](http://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.

1. *Health Air Quality Impacts of Buildings Emissions*. RMI, 5 May 2021, rmi.org/health-air-quality-impacts-of-buildings-emissions#MI.
2. *Gas Stoves: Health and Air Quality Impacts and Solutions.* RMI, 1 Feb. 2021, rmi.org/insight/gas-stoves-pollution-health/.
3. *Cost Study of the Building Decarbonization Code* , New Buildings Institute, Apr. 2022, https://newbuildings.org/wp- content/uploads/2022/04/BuildingDecarbCostStudy.pdf.
4. "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.](http://www.eia.gov/consumption/commercial/data/2018/pdf/CBECS_2018_Building_Characteristics_Flipbook.pdf)
5. 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/.

### Attached Files

**Commercial Electrification Sign On Letter 2024 IECC.pdf**

https://energy.cdpaccess.com/proposal/810/1704/files/download/384/

## Workgroup Recommendation

Proposal # 810