Building Decarbonization Code:

Commercial Language for ASHRAE Standard 90.1

All-Electric

ASHRAE Standard 90.1 (All-Electric)

Chapter 1 – Purpose

1.1

Revise text as follows:

To reduce ~~building~~ greenhouse gas emissions from buildings by establishing ~~the~~ minimum ~~—~~ *energy efficiency* requirements of *buildings* other than low-rise residential buildings for

a. design, *construction*, and a plan for operation and maintenance; and
b. utilization of *energy efficiency*, energy storage, and on-site, renewable *energy* resources.

Intent has been modified to include consideration of greenhouse gas emissions as well as both production and storage of energy.

Chapter 2 – Scope

2.1

Revise text as follows:

This standard provides minimum requirements that

a. apply to the greenhouse gas performance ~~minimum *energy* efficient requirements~~ for the design and construction, ~~and~~ a plan for operation and maintenance of
   1. new *buildings* and their *systems,*
   2. new portions of *buildings* and their *systems,*
   3. new *systems* and *equipment* in *existing buildings*, and
   4. new *equipment* or *building systems* specifically identified in the standard that are part of industrial or manufacturing processes
b. address the reduction of greenhouse gas emissions and the efficient production, use, and storage of energy

   and

c. criteria for determining compliance with these requirements.

Scope has been modified to include consideration of greenhouse gas emissions as well as both production and storage of energy.

Chapter 3 – Definitions

3.2 DEFINITIONS

Revise and add new definitions as follows:

all-electric building: A *building* that contains no *fossil fuel* using *equipment*, or plumbing for *fossil fuels,* installed within the *building* or *building* site.

automatic load management systems (ALMS): A control system that allows multiple connected *EVSE* to share a circuit or panel and automatically reduce power at each charger, reducing the total connected electrical capacity of all *EVSE*.

***commercial cooking appliances*:** see ANSI/ASHRAE Standard 154

Definition of commercial cooking appliances is referenced to Standard 154 for use in defining requirements for additional electric infrastructure required for cooking under Section 8.4.5.

demand responsive control: An automatic control device that can receive and automatically respond to demand response requests from a utility, electrical system operator, or third-party demand response program provider.

electric vehicle (EV): An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, electric motorcycles, and the like, primarily powered by an electric motor that draws current from a rechargeable storage battery, a fuel cell, a photovoltaic array, or another source of electric current. Plug-in hybrid electric vehicles are electric vehicles having a second source of motive power. Off-road, self-propelled electric mobile equipment, such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, boats and the like, are not considered electric vehicles.

electric vehicle supply equipment (EVSE): The conductors, including the ungrounded, grounded, and equipment grounding conductors and the *electric vehicle* connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the *electric vehicle*.

Definitions for EV and EVSE are mirrored from NEC-2020 to be useful in defining requirements for electric vehicle infrastructure.

equipment: see ANSI/ASHRAE/IES Standard 90.1.

Definition for equipment already exists in Standard 90.1. It is called out specifically here because this definition is relied on in this overlay to deal with electrification-readiness and electrification of identified end-uses and buildings.

EV-capable space: An automotive parking space that is reserved for the future installation of an *EVSE*.

EV-ready space: An automotive parking space that is provided with an electrical circuit capable of supporting an installed *EVSE*.

EVSE space: An automotive parking space that is provided with a dedicated *EVSE*.

The definitions of EV spaces have been updated to be descriptive rather than prescriptive to allow for consistent use of the definitions and deferring requirements to be set in the body of the text. This allows the requirements to match the specific requirements and needs of the adopting jurisdiction and for EV spaces to be tailored for different EV charging scenarios (charging at different building types, parking types, residential types, business types, times of day, etc.) as well as different levels of penetration of EV charging spaces in a parking facility. These definitions build off of the IBC proposal G66-21 as modified by public comment from the 2024 development cycle.

fuel: see ANSI/ASHRAE/IES Standard 90.1.

fossil fuel: see ANSI/ASHRAE/IES Standard 90.1.

Definitions for fuel and fossil fuel already exist in Standard 90.1. They are called out specifically here because these definitions are relied on in this overlay to deal with electrification-readiness and electrification of identified end-uses and buildings.

mixed-fuel building: A *building* that contains *equipment* using *fossil fuels,* or includes piping for *fossil fuels*.

Revise text as follows:

on-site renewable energy: *energy* ~~generated~~ from *renewable energy resources* ~~produced~~ harvested at the *building* site.

~~***site-solar energy:*** thermal, chemical, or electrical *energy* derived from direct conversion of incident solar radiation at the *building* site and used to offset consumption of purchased *fuel* or electrical *energy* supplies. For the purposes of applying this standard, *site-solar energy* shall not include passive heat gain through *fenestration systems*.~~

Revises definitions for renewable energy based on language from ASHRAE addenda by, ck, and cp.[5] *Adds definition for renewable energy certificate to ensure any RECs produced by the renewable energy system are retained by the owner.*

Add new definitions as follows:

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

renewable energy resources: *energy* from solar, wind, biomass or hydro, or extracted from hot fluid or steam heated within the earth.

Revises and adds new definitions for renewable energy based on language from ASHRAE addenda by, ck, and cp. Adds definition for renewable energy certificate to ensure any RECs produced by the renewable energy system are retained by the owner.

5 Addenda by, ck, and cp to ASHRAE 90.1-2019 is posted at https://www.ashrae.org/file%20library/technical%20resources/standards%20and%20guidelines/standards%20addenda/90_1_2019_by_ck_cp_20200731.pdf

Chapter 4 – Administration and Enforcement

4.1 GENERAL

Revise text as follows:

4.1 General

4.1.1 Scope

4.1.1.1 New Buildings

New *buildings* shall be *all-electric buildings* and shall comply with the standard as described in Section 4.2.

Exception to 4.1.1.1

Buildings containing XXXX occupancies are permitted to use the following combustion equipment as approved by the code official:

a. XXX
b. XXX

The change in application requires that new construction be all-electric. Where a jurisdiction does not wish to require electrification of specific end uses but wants to advance electric buildings further than electric-readiness, exception language can be added. Where exception language is added, electric infrastructure language should be brought over from the mixed-fuel version of the overlay to ensure easy accessibility to future electric equipment installation.

Recommended exception language for specific equipment or end uses is: Exception: The following combustion equipment is permitted as approved by the code official (list specific equipment types).

Recommended exception language for specific building types: Exception: Buildings containing (list IBC occupancy types) occupancies are permitted to use the following combustion equipment as approved by the code official (list specific equipment types).

4.2 2 COMPLIANCE

Revise text as follows:

4.2.1.1 New Buildings

New *buildings* shall be *all-electric buildings* and shall comply with Sections 4.2.2 through 4.2.5 and either the provisions of

a. Section 5, "*Building Envelope*"; Section 6, "Heating, Ventilating, and Air Conditioning"; Section 7, "*Service Water Heating*"; Section 8, "Power"; Section 9, "Lighting"; and Section 10, "Other *Equipment*," or
b. Section 11, "*Energy Cost Budget* Method," or
c. Normative Appendix G, "*Performance Rating Method*."

When using Normative Appendix G, the Performance Cost Index (PCI) of new *buildings*, *additions* to *existing buildings*, and/or *alterations* to *existing buildings* shall be less than or equal to the Performance Cost Index target (PCI*t*) when calculated in accordance with the following:

$$PCIt = [BBUEC + (BPF \times BBREC) - PRE]/BBP$$

where

PCI = Performance Cost Index calculated in accordance with Section G1.2.

BBUEC = baseline *building* unregulated *energy* cost, the portion of the annual *energy* cost of a *baseline building design* that is due to *unregulated energy use*.

BBREC = baseline *building* regulated *energy* cost, the portion of the annual *energy* cost of a *baseline building design* that is due to *regulated energy use*.

BPF = *building* performance factor from Table 4.2.1.1. For *building* area types not listed in Table 4.2.1.1 use "All others." Where a *building* has multiple *building* area types, the required BPF shall be equal to the area-weighted average of the *building* area types.

BBP = *baseline building performance*.

PBP = *proposed building performance*, including the reduced, annual purchased energy cost associated with all *on-site renewable energy* generation systems.

PBP*nre* = *proposed building performance* without any credit for reduced annual energy costs from on-site renewable energy generation systems.

PBP*pre* = *proposed building performance*, excluding any renewable energy system in the proposed design and including an *on-site renewable energy system* that meets but does not exceed the requirements of Section 10.5.1.1 modeled following the requirements for a *budget building design* in Table 11.5.1.

PRE = PBP*nre* – PBP*pre*.

When (PBP*pre* – PBP)/BBP > 0.05, new *buildings*, *additions* to *existing buildings*, and/or *alterations* to *existing buildings* shall comply with the following:

$$PCI + [(PBP_{pre} - PBP)/BBP] - 0.05 < PCI_t$$

Informative Notes:

1.PBP*nre* = *proposed building performance*, no renewable energy
2.PBP*pre* = *proposed building performance*, prescriptive renewable energy
3. PRE = prescriptive renewable energy

Provides a method to ensure renewable energy is appropriately accounted for when calculating the Performance Cost Index target from ASHRAE addenda by, ck, and cp.

The performance compliance pathway specified in Appendix G of ASHRAE 90.1 requires the calculation of a Performance Cost Index (PCI) target that uses energy cost as the primary metric for determining compliance. This methodology fails to account for the carbon emissions associated with building energy consumption and usually benefits buildings that include natural gas due to the low cost of this energy source (compared to electricity). Alternate language has been proposed in other jurisdictions to encourage electrification by providing either site-energy and/or carbon emissions-based calculation methods for determining code compliance. Additional analysis is being undertaken by the authors to publish alternate compliance targets for national use in future versions. Specific local versions may be available.

4.2.4 Inspections

All *building construction*, additions, or *alterations* work subject to the provisions of this standard shall remain accessible and exposed for inspection purposes until approved in accordance with the procedures specified by the *building official*. Items for inspection include at least the following:

a.additional electric infrastructure for *fossil fuel* equipment

b.energy storage ready space and pathways to electrical service

c. electric vehicle infrastructure

Current 90.1 language does not include specific requirements for inspections. This language is revised based on a previous addition of 90.1 to highlight the necessity of inspections of electrical infrastructure systems to support decarbonization.

Chapter 6 – Heating, Ventilating, and Air Conditioning

6.4 MANDATORY PROVISIONS

Add text as follows:

6.4.3.1.3**Demand Response.**
All *thermostatic controls* shall be capable of the following base on a command from a demand responsive control:

a.The controls shall be programmed to automatically adjust upward the zone operating cooling set points by a minimum of 4°F (2.2°C)

b.The controls shall be programmed to automatically adjust downward the zone operating heating set points by a minimum of 4°F (2.2°C)

c.The controls shall be programmed to automatically adjust downward the zone operating cooling set points by a minimum of 2°F (1.1°C).

d.The automated DR strategy shall include both ramp-up and ramp-down logic to prevent the building peak demand from exceeding that expected without the DR implementation.

Exception to 6.4.3.1.3
Special occupancy or special applications where wide temperature ranges are not acceptable (such as retirement homes, process applications, museums, some areas of hospitals) and are approved by the authority having jurisdiction.

Demand responsive controls for thermostats are added based on language modified from California Title 24 and ASHRAE Standard 189.1. The controls allow for dialing back heating and cooling, as well as to accept additional cooling when renewable energy generation is high, and both ramp up and down requirements in relationship to the DR signal to prevent rebound issues on the grid after the signal is released.

In some applications, thermostat setpoints can impact more than just thermal comfort. To ensure that this requirement cannot have an adverse impact on those services, exception language has been included mirroring that used for 6.4.3.1.2 Dead Band, Exception #2.

6.5 PRESCRIPTIVE COMPLIANCE PATH

Revise text as follows:

Exceptions to 6.5.2.1

4. Zones where at least 75% of the *energy* for *reheating* or for providing warm air in mixing *systems* is provided from *site-recovered energy* (including condenser heat) or ~~*site-solar energy*~~ *on-site renewable energy*.

Exceptions to 6.5.2.3

4. *Systems* serving *spaces* where specific humidity levels are required to satisfy process needs, such as a vivarium; museum; surgical suite; pharmacy; and *buildings* with refrigerating *systems*, such as supermarkets, refrigerated warehouses, and ice arenas, and where the *building* includes *site-recovered energy* or ~~*site-solar energy*~~ *on-site renewable energy* that provide *energy* equal to at least 75% of the annual *energy* for *reheating* or for providing warm air in mixing *systems*. This exception does not apply to *computer rooms*.

5. At least 90% of the annual *energy* for *reheating* or for providing warm air in mixing *systems* is provided from *site-recovered energy* (including condenser heat) or ~~*sitesolar energy*~~ *on-site renewable energy.*

Exceptions to 6.5.3.5

5. *Systems* in which at least 75% of the *energy* for *reheating* (on an annual basis) is from *site recovered energy* or ~~*site-solar energy*~~ *on-site renewable energy*.

Exceptions to 6.5.6.1.2

3. Heating energy recovery where more than 60% of the *outdoor air* heating *energy* is provided from *site-recovered energy* or ~~*site-solar energy*~~ *on-site renewable energy*.

Exceptions to 6.5.6.2.2

2. Facilities that provide 60% of their *service water heating* from ~~*site-solar energy*~~ *onsite renewable energy* or *site-recovered energy* or from other sources

Addresses the definition of on-site renewable energy so that terms are consistent. Code language is consistent with ASHRAE addenda by, ck, and cp.

6.7 SUBMITTALS

Revise text as follows:

6.7.3.2 Manuals

Construction documents shall require that an operating manual and a maintenance manual be provided to the building owner or the designated representative of the building owner within 90 days after the date of system acceptance. These manuals shall be in accordance with industry accepted standards (see Informative Appendix E) and shall include, at a minimum, the following:

a. Submittal data stating equipment size and fuel type, and selected options for each piece of *equipment* requiring maintenance.

Fuel sources are a critical piece of code compliance enforcement for the full implementation of this code overlay. Clear identification in project manuals will allow for easier identification of potential replacement strategies in the future by the owner.

d. HVAC *controls system* maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field- determined *set points* and demand response *set points* shall be permanently recorded on *control* drawings at *control devices* or, for digital *control systems*, in programming comments.

e. A complete narrative of how each system is intended to operate, including suggested *set points* and demand response *set points*.

Requirements for demand response infrastructure may be overlooked if not presented clearly to owner or owners' representative in project manuals. Clear identification of this ability will make participation in a DR program more likely. By including the set points, building operators will understand potential changes in the system during DR signals.

Chapter 7 – Service Water Heating

7.4 MANDATORY PROVISIONS

Add new text as follows:

7.4.4.5 Demand Responsive Controls.

Electric storage water heaters with a storage tank capacity greater than 20 gallons (76 L) shall be provided with *demand responsive controls* that comply with ANSI/CTA-2045-B or another *approved demand responsive control*

Exception to 7.4.4.5

Special occupancy or special applications where water temperature ranges are not acceptable (such as retirement homes, process applications, some areas of hospitals or other health care facilities) and are approved by the authority having jurisdiction.

ANSI/CTA-2045-B standardizes the socket, and communications protocol, for heat pump water heaters so they can communicate with the grid, and with demand response signal providers. In addition, 2045-B adds control and communications requirements for mixing valves in HPWH to enable them to provide greater storage capacity to support increased load shifting. Versions of this standard are included in codes or other requirements in California, Oregon, and Washington.

In health care facilities, such as hospitals, nursing facilities, and other process or special applications hot water can be critical to support a specific end use. To ensure that this requirement cannot have an adverse impact on those services, exemptions have been tailored to this requirement based on similar language in 90.1 around thermostatic controls.

Revise text as follows:

Exception to 7.4.5.2

Pools that do not use *fossil fuels* for heat and ~~deriving~~ derive over 60% of the *energy* for heating from *site-recovered energy* or ~~*site- solar energy*~~ *on-site renewable energy*.

Code language is updated to be consistent with ASHRAE addenda by, ck, and cp.

7.7 SUBMITTALS

Revise text as follows:

7.7.3.2 Manuals

Construction documents shall require that an operating manual and a maintenance manual be provided to the building owner or the designated representative of the building owner within 90 days after the date of system acceptance. These manuals shall be in accordance with industry accepted standards and shall include, at a minimum, information on water heating fuel type, operation manuals and maintenance manual for each component of the system requiring maintenance, except components not furnished as part of the project. Required routine maintenance actions shall be clearly identified. Automated demand response sequences and controls shall be clearly identified.

Fuel sources are a critical piece of code compliance enforcement for the full implementation of this code overlay. Clear identification in project manuals will allow for easier identification of potential replacement strategies in the future by the owner.

Requirements for demand response infrastructure may be overlooked if not presented clearly to owner or owners' representative in project manuals. Clear identification of this ability will make participation in a DR program more likely. By including the set points, building operators will understand potential changes in the system during DR signals.

7.9 VERIFICATION, TESTING, AND COMMISSIONING

Revise text as follows:

7.9.1 Verification and Testing

Service hot-water controls shall be verified and tested in accordance with this section and provisions of Section 4.2.5.1. Testing shall verify that systems and controls are configured and operating in accordance with applicable requirements of

a. service water heating system temperature controls (Sections 7.4.4.1, ~~and~~ 7.4.4.3, and 7.4.4.5)

Adds requirement for verification and testing of DR control on water heaters.

Chapter 8 – Power

8.4 MANDATORY PROVISIONS

Revise text as follows:

8.4.3.1 Monitoring

Measurement devices shall be installed in new buildings to monitor the electrical energy use for each of the following separately:

f. *Electric vehicle* charging

Electric Vehicle charging is a transportation load, not a building load, but is often provided through a building electrical service connection. Adding a category for monitoring EV charging separately allows the building load to be measured independently from this non-building load. This will be critical with the wider adoption of Building Performance Standards or other existing building energy use policies as it will allow EV charging to be easily excluded from the building loads for the purposes of regulating actual energy use in buildings.

Add new text as follows:

8.4.5 Additional electric infrastructure.

Buildings that contain *combustion equipment* and end-uses shall be required to install electric infrastructure in accordance with this section.

The following sections ensure that gas equipment can be more easily and cost-effectively retrofit with electric equipment in the future. This language is adapted from the approach adopted in the electrification reach codes adopted by various California cities. It combines the best elements from those reach codes, breaks out the necessary electric differences between smaller unitized or residential scale equipment and larger central and commercial equipment, and adapts them to the I-Code format.

8.4.5.1 Combustion space heating.

Space heating *equipment* that uses *fossil fuels* shall comply with either 8.4.5.1.1 or 8.4.5.1.2

8.4.5.1.1 Low-capacity heating.

Warm-air furnaces with a capacity less than 225,000 Btu/h and gas- and oil-fired boilers with a capacity less than 400,000 Btu/h shall be provided with a designated exterior location(s) in accordance with the following:

1. Natural drainage for condensate from cooling equipment operation or a condensate drain located within 3 feet (914 mm) of the location of the space heating equipment.

2. A dedicated branch circuit in compliance with NFPA70 Section 424.4 based on heat pump space heating equipment sized in accordance with the requirements of Section 6.4.2.1 and terminating within 3 feet (914 mm) of the location of the space heating equipment with no obstructions. Both ends of the branch circuit shall be labeled “For Future Heat Pump Space Heater.”

   Exception: Where an electrical circuit in compliance with NFPA70 Sections 440.4(B) and 440.35 exists for space cooling equipment.

8.4.5.1.2 High-capacity heating.

All other space heating *equipment* 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 Space Heating Equipment”.

This section includes two size thresholds, applying different criteria to smaller, unitary heating systems, distinct from larger central systems. For low-capacity heating the requirement for sizing a branch circuit serving a heat pump relies on the size of the actual equipment to be installed. Since there is not an actual equipment size to reference and equipment size can vary depending on the size of the zone served and the climate, the section references Section 6.4.2.1 to establish the size of the heat pump equipment that would be required for the specific building.

8.4.5.2 Combustion water heating.

Water heating *equipment* that uses *fossil fuels* shall comply with either 8.4.5.2.1 or 8.4.5.2.2

8.4.5.2.1 Low-capacity water heating.

Water heaters with a capacity less than 300,000 Btu/h (88 kW) shall be installed in accordance with the following:

1. A dedicated 208/240-volt branch circuit with a minimum capacity of 30 amps shall terminate within 3 feet (914 mm) from the water heater and be accessible to the water heater with no obstructions. Both ends of the branch circuit shall be labeled with the words "For Future Heat Pump Water Heater" and be electrically isolated.

2. A condensate drain that is no more than 2 inches (51 mm) higher than the base of the installed water heater and allows natural draining without pump assistance shall be installed within 3 feet (914 mm) of the water heater.

3. The water heater shall be installed in a space with minimum dimensions of 3 feet (914 mm) by 3 feet (914 mm) by 7 feet (2134 mm) high.

4. The water heater shall be installed in a space with a minimum volume of 700 cubic feet (20,000 L) or the equivalent of 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.

8.4.5.2.2 High-capacity water heating.

Water heaters with a capacity greater than or equal to 300,000 Btu/h (88 kW) shall be provided with the following:

1. 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 Water Heating Equipment".

2. A condensate drain that is no more than 2 inches (51 mm) higher than the base of the installed water heater and allows natural draining without pump assistance shall be installed within 3 feet (914 mm) of the water heater.

This section includes two size thresholds, applying different criteria to smaller, unitary water heaters distinct from larger central water heaters. For low-capacity water heating, a series of requirements are provided that ensure that the building can accommodate a HPWH in the future. Requirement 1 ensures that there is a branch circuit ready to support the future installation of a HPWH. Requirement 2 ensures that the condensate generated by a HPWH compressor can be easily drained away. Requirement 3 ensures that the water heater location is physically large enough to accommodate HPWHs that are frequently wider and/or taller than code-minimum gas water heaters. Requirement 4 ensures that a future HPWH has access to sufficient air volume to effectively operate.

For high-capacity systems the language is structured to ensure electric-capability and improve the feasibility of future electrification retrofits. The requirements ensure that adding future electric branch circuits is relatively simple. The section does not include any requirements for branch circuits or electrical panel capacity since it addresses equipment that may be quite large or for which the electric infrastructure needs of future electric equivalent may be uncertain. To support the potential for installation of central HPWH, requirement 2 ensures that the condensate generated by a HPWH compressor can be easily drained away.

8.4.5.3 Combustion cooking.

Cooking *equipment* that use *fossil fuel* shall comply with either 8.4.5.3.1 or 8.4.5.3.2.

8.4.5.3.1 Commercial cooking.

Commercial cooking appliances shall be provided with a dedicated branch circuit with a minimum capacity of 12 kVA per 1 kBtu of appliance input capacity. 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.

8.4.5.3.2 Light and medium duty cooking.

Light- and medium duty 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.

This section includes two size thresholds, applying different criteria to commercial cooking equipment distinct from residential scale cooking equipment. For commercial equipment, a sizing equivalency based on the input of standard commercial range gas burners and electric hobs is used to determine future need.

Residential scale cooking equipment and appliances requires a 240V/40A branch circuit for a standard 8.75 kVA or larger electric residential range and has been used as the basis for the sizing of the branch circuit. Six feet is cited per requirements from IRC Section E3901.5 requiring appliance receptacles to be within 6 feet of the intended appliance.

If the requirements of this provision would be too difficult for a jurisdiction's particular market, the elimination of this section would put gas cooking equipment under 8.4.5.5 Other combustion equipment (which would need to be re-numbered), which does not include full circuits or panel capacity for that equipment.

8.4.5.4 Combustion clothes drying.

Clothes drying *equipment* that use *fossil fuels* shall comply with either 8.4.5.4.1 or 8.4.5.4.2

8.4.5.4.1 Commercial drying.

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".

8.4.5.4.2 Residential drying.

Clothes drying *equipment, appliances,* and end-uses serving *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.

This section includes two size thresholds, applying different criteria to commercial drying equipment distinct from residential scale drying equipment. For commercial equipment, the language is structured to ensure electric-capability and improve the feasibility of future electrification retrofits. The requirements ensure that adding future electric branch circuits is relatively simple. The section does not include any requirements for branch circuits or electrical panel capacity since it addresses equipment that may be quite large or for which the electric infrastructure needs of future electric equivalent may be uncertain.

Residential scale drying equipment and appliances are provided with language that mirrors the Residential Provisions of the IECC section of this overlay.

8.4.5.5 Other combustion equipment.

Combustion equipment not covered by Sections 8.4.5.1-4 shall be provided with conduit that is continuous between a junction box located within 3 feet (914 mm) of the *appliance* or *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 appliance, equipment or end use with an equivalent equipment capacity. The electrical junction box and electrical panel shall have labels stating, "For future electric equipment".

The addition of this section includes requirements to improve the feasibility of future electrification retrofits. The requirements ensure that adding future electric branch circuits is relatively simple. The section does not include any requirements for branch circuits or electrical panel capacity since it addresses equipment that may be quite large or for which the electric infrastructure needs of future electric equivalent may be uncertain, including heating systems and loads.

8.7 GENERAL

Add text as follows:

8.7.3.1 Record Documents

Construction documents shall require that within 90 days after the date of system acceptance, record documents shall be provided to the building owner, including

b. location of additional electric infrastructure for heating, water heating, cooking and clothes drying equipment.

To ensure the work to support electric infrastructure is documented for the owner, building operator, and future owners, record documents have been updated to require explicit information for electric infrastructure for equipment and appliances.

Chapter 9 – Lighting

9.1 1 GENERAL

Revise text as follows:

9.1.1 Scope

This section shall apply to the following:

a. Interior *spaces* of *buildings*.

b. Exterior lighting that is powered through the *building*'s electrical *service*.

Exception to 9.1.1

1. Emergency lighting that is *automatically* off during normal *building* operation.
2. Lighting, including exit signs, that is specifically designated as required by a health or life safety statute, ordinance, or regulation.

3. ~~Decorative gas *lighting systems*.~~

All electric buildings will not need language that relates to fossil fuel systems. Vestigial language around fossil fuels has been removed to avoid confusion in implementation of this overlay.

9.4 MANDATORY PROVISIONS

Revise text as follows:

9.4.1 Lighting Control

Building lighting *controls* shall be installed to meet the provisions of Sections 9.4.1.1, 9.4.1.2, 9.4.1.3, ~~and~~ 9.4.1.4, and 9.4.1.5.

Add new text as follows:

9.4.1.5 Demand Responsive Lighting Controls

Building lighting *controls* shall be programmed to allow automated DR. The programming shall be capable of reducing the total connected lighting power in a uniform manner by no less than 15 percent but no more than 50% of the baseline power level when signaled by a *demand responsive control*. The baseline lighting power shall be determined in accordance with either Section 9.5 or 9.6.

Lighting DR language is modified from ASHRAE Standard 189.1. The built-in exception for lighting that is not connected to a central control point has been removed. To fully integrate lighting into the grid responsive infrastructure needed, lighting will need to be designed to meet these controls, which may require all systems be connected at a central control point.

Add new text as follows:

9.4.4 Gas lighting

Gas-fired lighting appliances shall not be permitted.

While the use of gas lighting is nearly extinct for both indoor and outdoor new construction uses, gas lamps remain a nostalgic feature in historic neighborhoods. Since other codes commonly adopted in jurisdictions, such as the IBC and IFGC, do not prohibit the installation of fuel gas lighting, it is critical to ensure that the adoption of this overlay does prohibit these installations.

Chapter 10 – Other Equipment

10.2 COMPLIANCE PATHS

Revise text as follows:

10.2.1 Requirements for All Compliance Paths

Other equipment shall comply with Section 10.1, "General"; Section 10.4, "Mandatory Provisions"; Section 10.5, "Prescriptive Path" and Section 10.8, "Product Information."

Adds the on-site solar requirements to the prescriptive compliance path as required in ASHRAE Addenda by, ck, and cp.

10.4 MANDATORY PROVISIONS

Add new text as follows:

10.4.8 Electric Vehicle Charging Infrastructure

Parking facilities shall be provided with electric vehicle charging infrastructure in accordance with this section and Table 10.4.8 based on the total number of parking spaces and rounded up to the nearest whole number. EVSE, EV ready spaces and EV capable spaces may be counted toward meeting minimum parking requirements. EVSE spaces may be used to meet requirements for EV ready spaces and EV capable spaces. EV ready spaces may be used to meet requirements for EV capable spaces. Where more than one parking facility is provided on a building site, the number of parking spaces required shall be calculated separately for each parking facility. EV spaces shall be uniformly distributed in the parking facility.

Exception to 10.4.8

In parking garages, the conduit required for *EV capable spaces* may be omitted provided the parking garage electrical service has no less than 1.8 kVA of additional reserved capacity per *EV capable space.*

The EV charging infrastructure requirements have been tailored to different charging scenarios. EV Ready spaces are utilized in residential occupancies where EV owners are more likely to choose specific EVSEs with features that meet their personal, long-term needs. The minimum capacity of those EV Ready spaces has been set at Level 1 charging in order to maximize access to EV charging:

1. *Residential park times are generally much longer which makes Level 1 charging more feasible.*
2. *All EVs come with at least a Level 1 charger, eliminating the need for EV owners to invest in additional equipment to charge at their homes.*
3. *Level 1 charging minimizes the cost of enabling EV charging at a parking space, allowing for the maximization of the number of EV spaces, which maximizes access to charging.*

EVSE spaces are required for commercial parking lots where shorter parking times are typical and Level 2 or 3 parking is more appropriate. Additionally, while the car connection side of Level 2 EVSE are standard, the grid connection side is not, so utilizing EVSE rather than EV Ready spaces maximizes the utility of parking spaces in commercial lots that have more transient parking.

This EVCI language is based on the approach used in the electrification reach codes adopted by various California cities. It captures recent developments in the national conversation about the best way to bring EVCI requirements to code in a way that is consistent, understandable, feasible and ensures the societal benefit of the widest penetration of EV charging possible.

The exception is added to allow capacity to be substituted for conduit in parking garages. EVCI retrofits have different cost considerations in parking garages compared to surface parking lots. Parking garage retrofits do not require retrenching, so the conduit in EV capable spaces does not come with the same future avoided costs.

Add new table as follows:

Table 10.4.8 Electric Vehicle Charging Infrastructure Requirements

Occupancy	*EVSE Spaces*	*EV Ready Spaces*	*EV Capable Spaces*
Group B Occupancies	15%	NA	40%
Group M Occupancies	25%	NA	40%
R-2 Occupancy	NA	100%[a]	NA
All other Occupancies	10%	NA	40%

a. Or one *EV ready space* per *dwelling unit*.

The percentages in Table 10.4.8 can be adjusted to tailor the requirements for the specific market needs of a jurisdiction. However, the EV Capable space requirements included for all commercial lots

recognizes that future needs for EV charging will be much greater than they are now. EV capable spaces avoid the significant cost of parking lot re-trenching, which is one of the largest single costs of EVCI retrofits but only a minor investment in new construction.

Add new text as follows:

10.4.8.1**EV Capable Spaces.** *EV Capable Spaces* shall be provided with electrical infrastructure that meets the following requirements:

1. Conduit that is continuous between a junction box or outlet located within 3 feet (914 mm) of the parking space and an electrical panel serving the area of the parking space.
2. The electrical panel to which the conduit connects shall have sufficient dedicated physical space for a dedicated dual-pole, 40-amp breaker.
3. The conduit shall be sized and rated to accommodate a 40-amp, 208/240-volt branch circuit and have a minimum nominal trade size of 1 inch.
4. The electrical junction box and the electrical panel directory entry for the dedicated space in the electrical panel shall have labels stating "For future *electric vehicle* charging".

The requirements for EV Capable spaces ensure a low-cost path to retrofitting the spaces with EVSE in the future. One of the most significant costs to upgrading parking lots for EVCI is the retrenching of the lot for electrical wiring runs. These requirements ensure that the wiring can be easily run through conduit to spaces without retrenching.

Add new text as follows:

10.4.8.2**EV Ready Spaces.** The branch circuit serving *EV Ready Spaces* shall meet the following requirements:

1. Wiring capable of supporting a 40-amp, 208/240-volt circuit.
2. Terminates at an outlet or junction box located within 3 feet (914 mm) of the parking space.
3. A minimum capacity of 1.8 kVA.
4. The electrical panel directory shall designate the branch circuit as "For electric vehicle charging" and the junction box or receptacle shall be labelled "For electric vehicle charging."

The approach for multifamily can be characterized as "upgradeable Level 1 charging." This approach balances objectives for equity, controlling first costs and future upgradeability. The wiring requirement ensures that the wiring is capable of supporting Level 2 charging, but the circuit capacity requirements can be met by a branch circuit that supports only Level 1 charging. All EVs come with at least a Level 1 charger, so this approach maximizes the number of EV spaces for which charging is immediately available without incurring the higher upfront costs of full Level 2 EVSE at every space. This is an important equity consideration since access to charging is one of the larger barriers to EV use for multifamily tenants. The oversized wiring ensures that these spaces can be upgraded to load managed Level 2 charging in the future and that the building has sufficient capacity for a reasonable minimum level of simultaneous charging.

This upgradable Level 1 approach becomes less appropriate if the required number of EV spaces is reduced from 100%. If a lower percentage is chosen for R-2 occupancies in Table 10.4.8, then the EV

Ready spaces should be specified for Level 2 capacity instead of Level 1. In that case, 10.4.8.2 should read as follows:

Alternate text as follows:

10.4.8.2**EV Ready Spaces.** The branch circuit serving *EV Ready Spaces* shall meet the following requirements:

1. Terminates at an outlet or junction box located within 3 feet (914 mm) of the parking space.
2. A minimum capacity of 8.3 kVA.
3. The electrical panel directory shall designate the branch circuit as "For electric vehicle charging" and the junction box or receptacle shall be labelled "For electric vehicle charging."

This alternate language specifies that the branch circuit must be capable of supporting a Level 2 EVSE capable of meeting the requirements for EVSE spaces in this overlay. 8.3 kVA is equivalent to a 208V @ 40A branch circuit. At lower levels of EV Ready spaces for R-2 occupancies, jurisdictions should also consider adding requirements for minimum percentages of EVSE and EV Capable spaces to ensure both immediate access to charging and future upgradeability.

Add new text as follows:

C405.14.2 EVSE Spaces. The *EVSE* serving *EVSE spaces* shall meet the following requirements:

1. Capable of supplying not less than 6.2 kW to an electric vehicle.

   Exception: An ALMS may be used to reduce the total electrical capacity required by EVSE spaces provided that all EVSE spaces are capable of simultaneously charging at a minimum rate of 1.4 kW.

2. Located within 3 feet (914 mm) of the *EVSE space*.

The charging rate for an EVSE space is set at 6.2 kW. This is equivalent to a 30A/208V EVSE. 30 and 32A chargers are the most common Level 2 chargers and the highest capacity chargers that can be installed on a 40A branch circuit. kW is used as the metric to indicate total power delivered rather than the specific combination of Volts and Amps.

Add new text as follows:

10.4.9 Electric infrastructure for energy storage

Each building site shall have space for on-site energy storage not less than 2 feet (610 mm) in one dimension and 4 feet (1219 mm) in another dimension and located in accordance with Section 1206.2.8 of the International Fire Code and Section110.26 of the NFPA 70.

Exception to 10.4.9

Where an onsite electrical energy system storage system is installed.

10.4.9.1 Electrical service reserved space

The main electrical service panel shall have a reserved space to allow installation of a two-pole circuit breaker for future electrical energy storage system installation This space shall be labeled "For Future Electric Storage." The reserved spaces shall be positioned at the end of the panel that is opposite from the panel supply conductor connection.

Infrastructure for energy storage has been taken from Appendix CB Solar-Ready Zone in the 2021 IECC. This language includes revisions from the 2019 Group B Public Comment that were not incorporated into the final text of the 2021 IECC but modify the language to ensure needed correlation with the IFC and NFPA.

10.5 5 PRESCRIPTIVE COMPLIANCE PATH

Add new text as follows:

10.5.1 **Renewable energy resources**

Buildings shall be served by *renewable energy resources* complying with Section 10.5.1.1 and 10.5.1.2.

10.5.1.1 **Onsite Renewable Energy**

The *building* site shall have *equipment* for *on-site renewable energy* with a rated capacity of not less than 0.25 W/ft² or 0.85 Btu/ft2 (2.7W/m2) multiplied by the sum of the *gross conditioned floor area* for all floors up to the three (3) largest floors.

Exception to 10.5.1.1

1. Any *building* located where an unshaded flat plate collector oriented toward the equator and tilted at an angle from horizontal equal to the latitude receives an annual daily average incident solar radiation less than 3.5 kWh/m2·day (1.1 kBtu/ft2·day).
2. Any *building* where more than 80% of the *roof* area is covered by any combination of *equipment* other than for *on-site renewable energy systems*, planters, vegetated space, *skylights*, or occupied *roof* deck.
3. Any *building* where more than 50% of *roof* area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the *building* for more than 2500 annual hours between 8:00 a.m. and 4:00 p.m.
4. New construction or *additions* in which the sum of the *gross conditioned floor area* of the three largest floors of the new construction or *addition* is less than 10,000 ft2.
5. *Alterations* that do not include *additions*.

A version of this requirement has been approved for ASHRAE 90.1-2019 as Addendum by, and will be published in ASHRAE 90.1-2022. The exceptions are written to ensure that the requirement is not being applied to buildings without adequate space on the roof, to buildings that are in areas of the country where unblocked insolation levels do not provide enough energy to make the equipment cost-effective (according to ASHRAE cost-effective criteria), and to buildings where solar access is wholly or partially blocked

10.7 SUBMITTALS

Add text as follows:

10.7.3.1 Record Documents

Construction documents shall require that within 90 days after the date of system acceptance, record documents shall be provided to the building owner. Record documents shall include, as a minimum, the location of pathways for routing of raceways or cable from the renewable energy system to the electrical service panel and electrical energy storage system area, location and layout of a designated area for electrical energy storage system, and location of designated *EVSE spaces*, *EV-Ready spaces*, and *EV-Capable spaces* in parking facilities.

To ensure the work to support electric infrastructure is documented for the owner, building operator, and future owners, record documents have been updated to require explicit information for renewable energy, energy storage, and electric vehicles.

Chapter 11 – Energy Cost Budget Method

11.4 SIMULATION GENERAL REQUIREMENTS

Add text as follows:

11.4.1 Simulation Program

The *simulation program* shall be a computer-based program for the analysis of *energy* consumption in *buildings*. For components that cannot be modeled by the *simulation program*, the exceptional calculation methods requirements in Section 11.4.5 shall be used.

Exception to 11.4.1

When approved by the *adopting authority*, a separate computer-based program shall be permitted to be used to calculate *on-site renewable energy*.

Revise text as follows:

11.4.3.1 On-Site Renewable Energy and Site-Recovered Energy.

Site-recovered energy shall not be considered *purchased energy* and shall be subtracted from the *proposed design energy* consumption prior to calculating the *design energy cost*. *On-site renewable energy* shall be subtracted from the *proposed design energy* consumption prior to calculating the *design energy cost* provided that the building owner

a. owns the *on-site renewable energy system*,
b. has signed a lease agreement for the *on-site renewable energy system* for at least 15 years or

c. has signed a contractual agreement to purchase *energy* generated by the *on-site renewable energy system* for at least 15 years.

The reduction in *design energy cost* associated with *on-site renewable energy* that exceeds the *on-site renewable energy* required by Section 10.5.1.1 shall be no more than 5% of the calculated *energy cost budget.*

On-site renewable energy included in the *budget building design* shall be subtracted from the *budget building design* energy consumption prior to calculating the *energy cost budget.*

11.4.3.2 Annual Energy Costs.

The *design energy cost* and *energy cost budget* shall be determined using rates for *purchased energy* (such as electricity, gas, oil, propane, steam, and chilled water) that are approved by the *adopting authority*. Where *on-site renewable energy* or *site-recovered energy* is ~~used~~ in excess of what is required in the *budget building design* by Table 11.5.1, the *budget building design* shall be based on the *energy* source used as the backup *energy* source, or electricity if no backup *energy* source has been specified. Where the proposed design includes *on-site electricity generation systems* other than *on-site renewable energy systems*, the baseline design shall include the same generation systems excluding its *site-recovered energy*.

Revise table as follows:

Table 11.5.1 Modeling Requirements for Calculating Design Energy Cost and Energy Budget

Proposed Design **(Column A)** ***Design Energy Cost*** **(DEC)**	***Budget Building Design*** **(Column B)** ***Energy Cost Budget*** **(ECB)**
15. On-Site Renewable Energy	
On-site renewable energy in the *proposed design* shall be determined as follows: a. Where a complete *system* providing on-site *renewable energy* exists, the model shall reflect the actual *system* type using actual component capacities and efficiencies. b. Where a *system* providing on-site *renewable energy* has been designed, the *system* model shall be consistent with design documents. c. Where no *system* exists or is specified to provide *on-site renewable energy*, no *system* shall be modeled.	*On-site renewable energy* shall be included in the *budget building design* when required by Section 10.5.1, and shall be determined as follows: a. Where a *system* providing *on-site renewable energy* has been modeled in the *proposed design*, the same *system* shall be modeled identically in the *budget building design*, except the rated capacity shall meet the requirements of Section 10.5.1.1. Where more than one type of *on-site renewable* energy system is modeled, the total capacities shall be allocated in the same proportion as in the *proposed design*. b. Where no *system* exists or is specified to provide *on-site renewable energy* in the *proposed design*, *on-site renewable energy* shall be modeled as an unshaded photovoltaic system with the following physical characteristics: • Size: Rated capacity per Section 10.5.1.1 • Module Type: Crystalline silicon panel with a glass cover, 19.1% nominal efficiency and temperature coefficient of –

	temperature of 77°F (25°C) and irradiance of 317 Btu/ft2·h (1000 W/m2). • Array Type: Rack-mounted array with installed nominal operating cell temperature (INOCT) of 103°F (45°C) • Total system losses (DC output to AC output): 11.3% • Tilt: 0-degrees (mounted horizontally) • Azimuth:180 degrees If the *on-site renewable energy system* cannot be modeled in the *simulation program,* Section 11.4.5 shall be used.

Includes guidelines for modeling renewable energy systems as required in ASHRAE Addenda by, ck, and cp.

Chapter 12 – Normative References

Revise table as follows:

Reference	Title
American National Standards Institute (ANSI) 1899 L Street, NW, 11th Floor, Washington, DC 20036	
ANSI/CTA-2045-B	Modular Communications Interface for Energy Management

Normative Appendix G – Performance Rating Method

G2 SIMULATION GENERAL REQUIREMENTS

Add text as follows:

G2.2 Simulation Program.

The *simulation program* shall be a computer-based program for the analysis of *energy* consumption in *buildings* (a program such as, but not limited to, DOE-2, BLAST, or EnergyPlus). The *simulation program* shall include calculation methodologies for the *building* components being modeled. For components that cannot be modeled by the *simulation program*, the exceptional calculation methods requirements in Section shall be used.

Exception to G2.2

When approved by the *adopting authority*, a separate computer-based program shall be permitted to be used to calculate *on-site renewable energy*.

G3 CALCULATION OF THE PROPOSED DESIGN AND BASELINE PERFORMANCE

Revise table as follows:

Table G3.1 Modeling Requirements for Calculating Proposed and Baseline Performance

No.	*Proposed Building Performance*	*Baseline Building Performance*	
18. *On-Site Renewable Energy*			
	On-site renewable energy in the *proposed building performance* shall be determined as follows: a. Where a complete *system* providing on-site *renewable energy* exists, the model shall reflect the actual *system* type using actual component capacities and efficiencies. b. Where a *system* providing on-site *renewable energy* has been designed, the *system* model shall be consistent with design documents. c. Where no *system* exists or is specified to provide *on-site renewable energy*, no *system* shall be modeled.	*On-site renewable energy* shall not be included in the *baseline building performance*.	

Includes guidelines for modeling renewable energy systems as required in ASHRAE Addenda by, ck, and cp.