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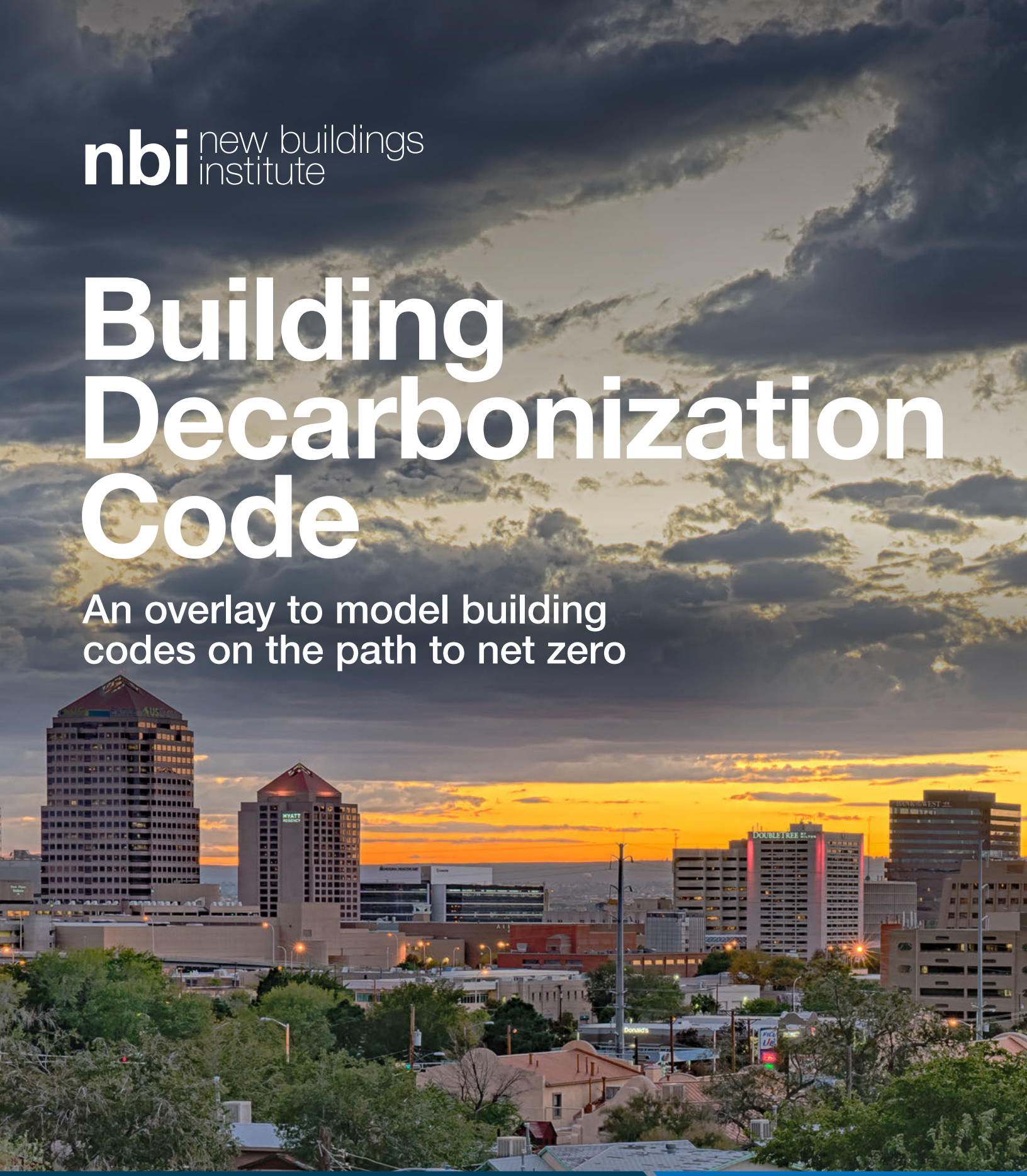
Building Decarbonization Code

An overlay to model building codes on the path to net zero



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Codes for Climate™

Albuquerque, NM

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Introduction and Background

Building electrification and decarbonization policies are being discussed by states and cities across the country. These policies address the transition away from onsite fossil fuel combustion in buildings, as the electricity grid (including renewable energy sources) move towards 100 percent carbon-free. That is, decarbonization in these policies is the process of moving new and existing buildings towards the highly efficient use of 100 percent carbon-free sources of energy.

Many jurisdictions have aggressive climate-related goals, and over 200 cities have made pledges to achieve 100 percent clean energy or "net zero" emissions. Ensuring that new buildings emit little – or no – carbon is an important component of meeting these goals. Cities in California are leading the way, with around 30 cities that have already adopted or are in the process of adopting electrification reach codes for new buildings. Outside of California, cities and states are very interested in decarbonization-focused model code language. Local governments and the advocates that work with them are searching for code tools that can help them easily replicate the wave of local action that has swept California in the last year.

200+
CITIES
have made pledges to achieve 100 percent clean energy or "net zero" emissions.

The efficiency gains in the International Code Council's (ICC) 2021 International Energy Conservation Code (IECC), and its subsequent publication spurring state and local code update conversations and processes creates ideal timing to look at a "decarbonization overlay" to the model code. The code language covers both residential and commercial construction, and is structured such that it is compatible with the IECC and ASHRAE Standard 90.1. Recognizing that not every jurisdiction is looking to require all-electric construction in their next code cycle, and many jurisdictions are looking for electric-ready and electric-preferred options for new construction, both options are presented here. The current overlay focuses on codes for new construction only, and NBI is exploring the potential of adding code language for existing buildings in a future version.

LEADING THE WAY
Cities in California are leading the way, with around **30 cities** that have already adopted or are in the process of adopting electrification reach codes for new buildings.

The overlay incorporates code solutions to the inclusion of key electrification technologies including solar energy production, electric vehicles, battery storage, and demand response. The inclusion of these code measures may seem additive, but in fact as the building stock increases its reliance on the electric grid, buildings built with these grid integration technologies will be relied upon as grid assets, able to help shift, shape, and shave the peaks of the electric load, rather than bringing new generation resources online, making them critical components of the new era of all-electric buildings.

Key Electrification Technologies for Future-Proofing Buildings

SOLAR ENERGY PRODUCTION

Solar energy is a critical component of construction to achieve climate goals. Even with a cleaning electricity supply and clear targets from cities and states moving to 100% clean energy,[1] distributed solar will continue to play a role both in meeting those goals, but also in allowing for the futureproofing of new construction. Buildings with solar generation will have lower monthly utility bills through production and use of on-site energy and have a dedicated source of energy to use and store as needed during grid outages. Requirements for solar ready infrastructure in residential construction create the opportunity for consumer choice and remove the high potential costs of retrofit installation after construction.

1 https://www.nrdc.org/resources/race-100-clean

BATTERY STORAGE

As efficient buildings and clean or renewable energy generation are cited as key components of goals of many jurisdictions targeting carbon neutrality, a missing piece of the puzzle is how to handle energy needs during hours where the renewable generation is not appropriately matched to the demand. Including storage in the design and development of buildings is the next step. Storage solutions will not only benefit building owners and residents in helping to decrease demand charges, but also contribute to the vision of grid-interactive buildings and vehicles, where all pieces of the energy system are working in coordination. Energy storage also provides resilience benefits, allowing continued operation amidst power outages caused by disaster events or to preempt potential disasters like wildfires.

ELECTRIC VEHICLES

The widescale adoption of electric vehicles (EVs) is a key climate strategy to reduce GHG emissions from the U.S. transportation sector. In the United States, EV sales increased by 80 percent from 2017 to 2018.[2] The number of EVs on U.S. roads is projected to grow from 1 million vehicles at the end of 2018, to 18.7 million by 2030. To recharge these new EVs, the U.S. will need 9.6 million charge ports, a substantial portion of which will be installed in single and multi-family residential buildings.[3] The lack of access to EV charging stations continues to be a critical barrier to EV adoption, with the most significant logistical barriers for residents of multi-family dwellings. By installing required infrastructure for EV charging at construction, the impact of cost for installation of charging stations becomes minor, reducing the barriers to the adoption of EVs.

DEMAND RESPONSE

It is also critical that buildings be able to support grid operation more directly by responding to fluctuations in grid load and contributing to efforts to manage more diverse grid resources. This overlay itself adds to the growing increase of distributed energy resources by requiring solar, electric vehicle, and energy storage infrastructure. All new buildings must incorporate demand management controls that allow short term load response to grid peak to support a changing electric grid scenario.

2 "Monthly Plug-In EV Sales Scorecard." Inside EVs: Monthly U.S. Plug-in EV Sales Report Card. Accessed January 2019. https://insideevs.com/monthly-plug-in-sales-scorecard/.

3 Edison Electric Institute. Electric Vehicle Sales Forecast and the Charging Infrastructure Required Through 2030. Report. November 2018. Accessed January 2019.

How to Use This Document

Potential amendments are presented for Commercial and Residential construction covering two jurisdiction options:

1

ALL-ELECTRIC

2

MIXED-FUEL

Mixed-Fuel provisions provide electric-ready construction that allows for simple, low-cost all-electric technology installation at some point in the future.

Each section of commercial and residential covers both fuel scenarios. Commercial options are presented for both IECC and ASHRAE 90.1.

The code amendments are presented in strikethrough and underline formatting that is commonly used in amendment process.

The ~~strikethrough~~ markup indicates the deletion of portions of code text.

The underline markup indicates the addition of portions of code text.

Amendments are followed by narrative text where needed to explain why a change was made, how the code relates to other I-Code language, and/or why certain exceptions were carved out in the new language to be more permissive. Narrative text should be removed for any formal adoption process or repurposed as background information or a reason statement.

Jurisdictions may use any section of the overlay in its entirety or use portions of these sections to amend the 2021 IECC and/or ASHRAE 90.1 to a code that is right for adoption to meet the needs of their communities and supports their climate goals.

To access word documents of both the residential and commerical language, visit **newbuildings.org/resource/building-decarbonization-code**

Building Decarbonization Code:

Commercial Language for IECC

All-Electric

IECC - Commercial Provisions (All-Electric)

Chapter 1 – Scope and Application

C101 SCOPE AND GENERAL REQUIREMENTS

Revise as follows:

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

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

C103 CONSTRUCTION DOCUMENTS

Revise as follows:

> **C103.2 Information on construction documents.** Construction documents shall be drawn to scale upon suitable material. Electronic media documented are permitted to be submitted when *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 herein governed. Details shall include the following as applicable:
>
> > 6. Mechanical and service water heating systems and equipment types, sizes, fuel source and efficiencies.

Fuel sources are a critical piece of code compliance enforcement for the full implementation of this code overlay. Clear identification on the construction documents will allow for easier code compliance review and inspections. Inclusion of fuel sources is most critical in areas where there are multiple fuels available such as fuel oil, propane, and natural gas, as the equipment type alone may not provide this information.

> > 14. 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.
>
> > 15. Location and layout of a designated area for electrical energy storage system.

For ease of enforcement, information for both renewable energy and electrical energy storage have been included as part of construction documents. Language has been migrated from Appendix CB Solar-Ready Zone to the applicable location in the base code and modified to fit into current structure.

> > 16. Location of designated *EVSE spaces*, *EV-Ready spaces*, and *EV-Capable spaces* in parking facilities.

To assist in enforcement of electric vehicle infrastructure requirements, and to serve as a plan for full installation of EVSE equipment in EV-ready and EV-capable spaces in the future, plans should clearly indicate the intended locations of EV infrastructure.

Chapter 2 – Definitions

R202 GENERAL DEFINITIONS

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.

Definition of appliance is mirrored from 2021 IMC to be useful in defining combustion equipment.

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*.

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.

Definition of commercial cooking appliances is mirrored from the 2021 International Fire Code for use in defining requirements for additional electric infrastructure required for cooking under Section C405.14.3.

DEMAND RESPONSIVE CONTROL. An automatic control 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. Piping, ducts, vents, control devices and other components of systems other than appliances that are permanently installed and integrated to provide control of environmental conditions for buildings. This definition shall also include other systems specifically regulated in this code.

Definition of equipment is mirrored from 2021 IMC to be useful in defining combustion equipment.

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

Definition of fuel gas is mirrored from 2021 IMC to be useful in defining combustion equipment.

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

Definition of fuel oil is mirrored from 2021 IMC to be useful in defining combustion equipment.

MIXED-FUEL BUILDING. A *building* that contains *combustion equipment* or includes piping for such *equipment*.

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).

Chapter 4 – Commercial Energy Efficiency

C401 GENERAL

Revise text as follows:

C401.2 Application. Commercial buildings shall be *all-electric buildings* and shall comply with Section C401.2.1 or C401.2.2.

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).

C402 BUILDING ENVELOPE REQUIREMENTS

Revise text as follows:

C402.1.1 Low energy buildings and greenhouses. The following low-energy buildings, or portions thereof separated from the remainder of the *building*-by-*building thermal envelope assemblies* complying with this section shall be exempt from the building thermal envelope provisions of Section C402.

1. Those containing no *combustion equipment* with a peak design rate of energy usage less than 3.4 Btu/h·ft2 (10.7 W/m2) or 1.0 watt/ft2 of floor area for space conditioning purposes.

C402.1.1.1 Greenhouses. Greenhouse structures or areas containing no *combustion equipment* that are mechanically heated or cooled and that comply with all of the following shall be exempt from the building envelope requirements of this code:

C402.1.2 Equipment buildings. Buildings that comply with the following shall be exempt from the *building thermal envelope* provisions of this code:

6. Contain no *combustion equipment*.

Low energy buildings are currently exempt from thermal envelope requirements. This revision applies the same intention of low greenhouse gas impact that was given to low energy use impact when these building types were exempted.

C403 BUILDING MECHANICAL SYSTEMS

Add new text as follows:

C403.4.1.6 Demand responsive controls. All thermostatic controls shall be provided with *demand responsive controls* capable of the following:

1. Automatically increasing the zone operating cooling set points by a minimum of 4°F (2.2°C)
2. Automatically decreasing the zone operating heating set points by a minimum of 4°F (2.2°C)
3. Automatically decreasing the zone operating cooling set points by a minimum of 2°F (1.1°C).
4. Both ramp-up and ramp-down logic to prevent the building peak demand from exceeding that expected without the DR implementation.

The thermostatic controls shall be capable of performing all other functions provided by the control when the *demand responsive controls* are not available. Systems with direct digital control of individual zones reporting to a central control panel shall be capable of remotely complying

Exception: Health care and assisted living facilities.

Demand responsive controls for thermostats are added based on language from California Title 24 and ASHRAE Standard 189.1. Any thermostat listed as "Title 24 compliant" would meet this requirement. 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 health care and assisted living facilities, thermostat setpoints can impact more than just thermal comfort, and temperature can be part of the health care being provided. To ensure that this requirement cannot have an adverse impact on those services, these facilities have been exempted from this requirement.

C404 SERVICE WATER HEATING

Revise text as follows:

C404.9.1 Heaters. The electric power to all heaters shall be controlled by an on-off switch that is an integral part of the heater, mounted on the exterior of the heater, or external to and within 3 feet (914 mm) of the heater in a location with ready access. Operation of such switch shall not change the setting of the heater thermostat. Such switches shall be in addition to a circuit breaker for the power to the heater. Gas-fired heaters shall not be ~~equipped with continuously burning ignition pilots~~ permitted.

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

Add new text as follows:

C404.11 Demand responsive water heating. All electric storage water heaters, or a group of water heaters, in a building with a total storage tank capacity greater than 37 gallons (140 L) shall be provided with *demand responsive controls* that comply with ANSI/CTA-2045-B or another *approved demand responsive control*.

Exception: Health care facilities.

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.

The requirement is limited to electric storage water heaters, excluding small, point-of-use water heaters; these water heaters also have very limited capacity for demand response. Additionally, it only applies to water heaters, or a group of water heaters, over 37 gallons. Research has indicated that 37 gallons is the optimum size for this measure to have a meaningful contribution to DR signals in commercial buildings.

In health care facilities, such as hospitals, nursing facilities, and outpatient facilities, hot water can be critical to support the care being provided. To ensure that this requirement cannot have an adverse impact on those services, health care facilities have been exempted from this requirement.

C405 ELECTRICAL POWER AND LIGHTING SYSTEMS

Add new text as follows:

C405.2 Lighting controls. Lighting systems shall be provided with controls that comply with one of the following.

2. Luminaire level lighting controls (LLLC) and lighting controls as specified in Sections C405.2.1, C405.2.4 and C405.2.5. The LLLC luminaire shall be independently capable of:
   2.4 Reducing lighting power in a uniform manner by no less than 10 percent when signaled by a *demand responsive control*.

This approach to DR controls for lighting limits the requirement to LLLC lighting, which uses control technology that generally already includes DR functionality or for which DR functionality comes at a minimal additional cost. The threshold for lighting power reduction is drawn from California's T24 DR requirements.

Revise text as follows:

C405.4.3 Gas lighting. Gas-fired lighting appliances shall not be ~~equipped with continuously burning pilot ignition systems~~ 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 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.

Revise table as follows:

TABLE C405.12.2 ENERGY USE CATEGORIES

LOAD CATEGORY	DESCRIPTION OF ENERGY CUSE
Total HVAC system	Heating, cooling and ventilation, including but not limited to fans, pumps, boilers, chillers, and water heating. Energy used by 120-volt equipment, or by 208/120-volt equipment that is located in a building where the main service is 480/277-volt power, is permitted to be excluded from total HVAC system energy use.
Interior lighting	Lighting systems located within the building.
Exterior lighting	Lighting systems located on the building site but not within the building.
Plug loads	Devices, appliances and equipment connected to convenience receptacle outlets.
Process load	Any single load that is not included in HVAC, lighting or plug load category and that exceeds 5 percent of the peak connected load of the whole building, including but not limited to data centers, manufacturing equipment, and commercial kitchens.
Electric vehicle charging	*Electric vehicle* charging loads.
Building operations and other miscellaneous	The remaining loads not included in this table, including but not limited to vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains, ornamental fireplaces, swimming pools, in-ground spas and snow-melt systems.

Electric 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:

C405.13 On site renewable energy. Each building site shall have equipment for on-site renewable energy with a rated capacity of not less than 0.25 W/ft² (2.7 W/m²) multiplied by the sum of the gross conditioned floor area of the three largest floors.

Exceptions:

1. Any building located where an unshaded flat plate collector oriented towards 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 percent 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 percent 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 2,500 annual hours between 8:00 AM and 4:00 PM.

C405.13.1 Renewable energy certificate documentation. Documentation shall be provided to the code official that indicates that renewable energy certificates (RECs) associated with the on-site renewable energy will be retained and retired by or on behalf of the owner or tenant.

A version of this requirement has been approved for ASHRAE 90.1-2019 as Addendum by,[4] and will be published in ASHRAE 90.1-2022. The three 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.

Add new text as follows:

C405.14 Electric vehicle charging infrastructure. Parking facilities shall be provided with electric vehicle charging infrastructure in accordance with this section and Table C405.14 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: 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

[4] Addendum by 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

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.

TABLE C405.14
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 C405.14 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.

C405.14.1 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.

C405.14.2 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 C405.14, then the EV Ready spaces should be specified for Level 2 capacity instead of Level 1. In that case, alternate text is provided here.

Alternate add new text as follows:

C405.14.2 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.

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:

C405.15 Energy storage infrastructure. Each building site shall have equipment 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: Where an onsite electrical energy system storage system is installed.

C405.15.1 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 migrated up from Appendix CB Solar-Ready Zone into the main body of the code. 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.

C406 ADDITIONAL EFFICIENCY REQUIREMENTS

Revise text as follows:

> **C406.5 Onsite renewable energy.** The total minimum ratings of on-site renewable energy systems, <u>not including onsite renewable energy system capacity used for compliance with Section C405.13,</u> shall be one of the following:

With the addition of C405.13 for mandatory inclusion of onsite renewable energy this section is revised to allow only additional renewable energy to be counted toward compliance with the additional efficiency requirements.

Chapter 6 – Referenced Standards

(Both) Add new standard as follows:

CTA Consumer Technology Association
1919 S. Eads Street
Arlington, VA 22202

Standard reference number	Title	Referenced in code section number
ANSI/CTA-2045-B	Modular Communications Interface for Energy Management	C404.11

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 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.

2.2

Revise text as follows:

The provisions of this standard do not apply to

b. *buildings* that do not use ~~neither~~ electricity ~~nor *fossil fuel*~~.

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

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.

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 COMPLIANCE

Revise text as follows:

4.2.1.1 New Buildings

New *buildings* 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:

$$PCI_t = [BBUEC + (BPF \times BBREC) \underline{- PRE}]/BBP$$

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.

Revise text as follows:

6.4.3.6.1 Humidification.
Humidistatic controls shall not use ~~*fossil fuel* or~~ electricity to produce relative humidity above 30% in the warmest zone served by the *system*.

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.

Revise text as follows:

Exceptions to 6.4.4.1.3

3. *Piping* that conveys fluids that have not been heated or cooled through the use of ~~fossil fuels or~~ electricity (such as roof and condensate drains, <u>and</u> domestic cold-water supply~~, and natural gas *piping*~~).

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.

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*~~ <u>*on-site renewable energy*</u>.

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*~~ <u>*on-site renewable energy*</u> 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*~~ <u>*on-site renewable energy.*</u>

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*~~ <u>*on-site renewable energy*</u>.

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:

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:

7.4.5.1 Pool Heaters

Pool heaters shall be equipped with a *readily accessible* on/off switch to allow shutting off the heater without adjusting the *thermostat* setting. ~~*Pool* heaters fired by natural gas shall not have continuously burning pilot lights~~.

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

Exception to 7.4.5.2

Pools deriving 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, 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.

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.

Chapter 9 – Lighting

9.1 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

Revise text as follows:

10.4.6.1 Monitoring

Measurement devices shall be installed to monitor the *building* use of the following types of *energy* supplied by a utility, *energy* provider, or plant that is not within the *building*:

~~a. Natural gas~~

~~b. Fuel oil~~

~~c. Propane~~

a~~d~~. Steam

b~~e~~. Chiller water

c~~f~~. Hot water

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.

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 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*.

10.5.1.2 Renewable energy certificate documentation

Documentation shall be provided to the code official that indicates that renewable energy certificates (RECs) associated with the on-site renewable energy will be retained and retired by or on behalf of the owner or tenant.

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 – 0.47%/°C; performance shall be based on a reference

	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.

Building Decarbonization Code:

Commercial Language for IECC

Mixed-Fuel

IECC - Commercial Provisions (Mixed-Fuel)

Chapter 1 – Scope and Application

C101 SCOPE AND GENERAL REQUIREMENTS

Revise as follows:

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

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

C103 CONSTRUCTION DOCUMENTS

Revise as follows:

> **C103.2 Information on construction documents.** Construction documents shall be drawn to scale upon suitable material. Electronic media documented are permitted to be submitted when *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 herein governed. Details shall include the following as applicable:
>
> > 6. Mechanical and service water heating systems and equipment types, sizes, fuel source and efficiencies.

Fuel sources are a critical piece of code compliance enforcement for the full implementation of this code overlay. Clear identification on the construction documents will allow for easier code compliance review and inspections. Inclusion of fuel sources is most critical in areas where there are multiple fuels available such as fuel oil, propane, and natural gas, as the equipment type alone may not provide this information.

> > 14. 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.
>
> > 15. Location and layout of a designated area for electrical energy storage system.

For ease of enforcement, information for both renewable energy and electrical energy storage have been included as part of construction documents. Language has been migrated from Appendix CB Solar-Ready Zone to the applicable location in the base code and modified to fit into current structure.

> > 16. Location of designated *EVSE spaces*, *EV-Ready spaces*, and *EV-Capable spaces* in parking facilities.

To assist in enforcement of electric vehicle infrastructure requirements, and to serve as a plan for full installation of EVSE equipment in EV-ready and EV-capable spaces in the future, plans should clearly indicate the intended locations of EV infrastructure.

Add new text as follows:

> **C103.2.2 Electrification system.** The construction documents shall provide details for additional electric infrastructure, including branch circuits, conduit, or pre-wiring, and panel capacity in compliance with the provisions of this code.

Current 2021 IECC language does not include specific requirements for electrical systems on construction documents for commercial construction. Given the importance of the electrical system in a mixed-fuel building, including an explicit requirement in the construction documents will allow for easier implementation and enforcement of the requirements on code compliance plan review staff.

C105 INSPECTIONS

Revise 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. Where a storage-ready zone is required, inspections shall verify space availability and pathways to electrical service.

Chapter 2 – Definitions

R202 GENERAL DEFINITIONS

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.

Definition of appliance is mirrored from 2021 IMC to be useful in defining combustion equipment.

> **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*.
>
> **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.

Definition of commercial cooking appliances is mirrored from the 2021 International Fire Code for use in defining requirements for additional electric infrastructure required for cooking under Section C405.14.3.

DEMAND RESPONSIVE CONTROL. An automatic control 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. Piping, ducts, vents, control devices and other components of systems other than appliances that are permanently installed and integrated to provide control of environmental conditions for buildings. This definition shall also include other systems specifically regulated in this code.

Definition of equipment is mirrored from 2021 IMC to be useful in defining combustion equipment.

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

Definition of fuel gas is mirrored from 2021 IMC to be useful in defining combustion equipment.

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

Definition of fuel oil is mirrored from 2021 IMC to be useful in defining combustion equipment.

MIXED-FUEL BUILDING. A *building* that contains *combustion equipment* or includes piping for such *equipment*.

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).

Chapter 4 – Commercial Energy Efficiency

C402 BUILDING ENVELOPE REQUIREMENTS

Revise text as follows:

C402.1.1 Low energy buildings and greenhouses. The following low-energy buildings, or portions thereof separated from the remainder of the *building*-by-*building thermal envelope assemblies* complying with this section shall be exempt from the building thermal envelope provisions of Section C402.

1. Those containing no *combustion equipment* with a peak design rate of energy usage less than 3.4 Btu/h·ft2 (10.7 W/m2) or 1.0 watt/ft2 of floor area for space conditioning purposes.

C402.1.1.1 Greenhouses. Greenhouse structures or areas containing no *combustion equipment* that are mechanically heated or cooled and that comply with all of the following shall be exempt from the building envelope requirements of this code:

C402.1.2 Equipment buildings. Buildings that comply with the following shall be exempt from the *building thermal envelope* provisions of this code:

6. Contain no *combustion equipment*.

Low energy buildings are currently exempt from thermal envelope requirements. This revision applies the same intention of low greenhouse gas impact that was given to low energy use impact when these building types were exempted.

C403 BUILDING MECHANICAL SYSTEMS

Add new text as follows:

C403.4.1.6 Demand responsive controls. All thermostatic controls shall be provided with *demand responsive controls* capable of the following:

1. Automatically increasing the zone operating cooling set points by a minimum of 4°F (2.2°C)

2. Automatically decreasing the zone operating heating set points by a minimum of 4°F (2.2°C)

3. Automatically decreasing the zone operating cooling set points by a minimum of 2°F (1.1°C).

4. Both ramp-up and ramp-down logic to prevent the building peak demand from exceeding that expected without the DR implementation.

The thermostatic controls shall be capable of performing all other functions provided by the control when the *demand responsive controls* are not available. Systems with direct digital control of individual zones reporting to a central control panel shall be capable of remotely complying

Exception: Health care and assisted living facilities.

Demand responsive controls for thermostats are added based on language from California Title 24 and ASHRAE Standard 189.1. Any thermostat listed as "Title 24 compliant" would meet this requirement. 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 health care and assisted living facilities, thermostat setpoints can impact more than just thermal comfort, and temperature can be part of the health care being provided. To ensure that this requirement cannot have an adverse impact on those services, these facilities have been exempted from this requirement.

C404 SERVICE WATER HEATING

Revise text as follows:

C404.2.1 High input service water-heating systems. Gas-fired water-heating equipment installed in new buildings shall be in compliance with this section. Where a singular piece of water-heating equipment serves the entire building and the input rating of the equipment is 1,000,000 Btu/h (293 kW) or greater, such equipment shall have a thermal efficiency, Et, of not less than 92 percent or a UEF of not less than 0.92 UEF. Where multiple pieces of water-heating equipment serve the building and the combined input rating of the water-heating equipment is 1,000,000 Btu/h (293 kW) or greater, the combined input-capacity-weighted-average thermal efficiency, Et, of not less than ~~90~~92 percent or a UEF of not less than 0.92 UEF.

Exceptions:

1. Where not less than ~~25~~50 percent of the annual *service water heating* requirement is provided by *on-site renewable energy* or site-recovered energy not including any capacity used for compliance with Section C405.13 or C406 of this code, the minimum thermal efficiency requirements of this section shall not apply.

2. The input rating of water heaters installed in individual dwelling units shall not be required to be included in the total input rating of *service water-heating* equipment for a building.

3. ~~The input rating of water heaters with an input rating of not greater than 100,000 Btu/h (29.3 kW) shall not be required to be included in the total input rating of *service water-heating* equipment for a building.~~

Revisions to Section C404.2 in 2021 IECC raised the high-capacity service hot water efficiency requirement from 0.90 Et to 0.92 but did not add specifications for measurement with UEF as was done in the IgCC. This section adds UEF. While some combinations of boilers with a combined capacity above 1,000,000 Btu/h always triggered the requirement, this modification removes the exemption for multiple smaller water heaters or boilers unless they are located in individual dwelling units.

Add new text as follows:

C404.11 Demand responsive water heating. All electric storage water heaters, or a group of water heaters, in a building with a total storage tank capacity greater than 37 gallons (140 L) shall be provided with *demand responsive controls* that comply with ANSI/CTA-2045-B or another *approved demand responsive control*.

Exception: Health care facilities.

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.

The requirement is limited to electric storage water heaters, excluding small, point-of-use water heaters; these water heaters also have very limited capacity for demand response. Additionally, it only applies to water heaters, or a group of water heaters, over 37 gallons. Research has indicated that 37 gallons is the optimum size for this measure to have a meaningful contribution to DR signals in commercial buildings.

In health care facilities, such as hospitals, nursing facilities, and outpatient facilities, hot water can be critical to support the care being provided. To ensure that this requirement cannot have an adverse impact on those services, health care facilities have been exempted from this requirement.

C405 ELECTRICAL POWER AND LIGHTING SYSTEMS

Add new text as follows:

C405.2 Lighting controls. Lighting systems shall be provided with controls that comply with one of the following.

2. Luminaire level lighting controls (LLLC) and lighting controls as specified in Sections C405.2.1, C405.2.4 and C405.2.5. The LLLC luminaire shall be independently capable of:

2.4 Reducing lighting power in a uniform manner by no less than 10 percent when signaled by a *demand responsive control*.

This approach to DR controls for lighting limits the requirement to LLLC lighting, which uses control technology that generally already includes DR functionality or for which DR functionality comes at a minimal additional cost. The threshold for lighting power reduction is drawn from California's T24 DR requirements.

Revise table as follows:

TABLE C405.12.2 ENERGY USE CATEGORIES

LOAD CATEGORY	DESCRIPTION OF ENERGY CUSE
Total HVAC system	Heating, cooling and ventilation, including but not limited to fans, pumps, boilers, chillers, and water heating. Energy used by 120-volt equipment, or by 208/120-volt equipment that is located in a building where the main service is 480/277-volt power, is permitted to be excluded from total HVAC system energy use.
Interior lighting	Lighting systems located within the building.
Exterior lighting	Lighting systems located on the building site but not within the building.
Plug loads	Devices, appliances and equipment connected to convenience receptacle outlets.
Process load	Any single load that is not included in HVAC, lighting or plug load category and that exceeds 5 percent of the peak connected load of the whole building, including but not limited to data centers, manufacturing equipment, and commercial kitchens.
Electric vehicle charging	*Electric vehicle* charging loads.
Building operations and other miscellaneous	The remaining loads not included in this table, including but not limited to vertical transportation systems, automatic doors, motorized shading systems, ornamental fountains, ornamental fireplaces, swimming pools, in-ground spas and snow-melt systems.

Electric 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:

C405.13 On site renewable energy. Each building site shall have equipment for on-site renewable energy with a rated capacity of not less than 0.25 W/ft² (2.7 W/m²) multiplied by the sum of the gross conditioned floor area of the three largest floors.

Exceptions:

1. Any building located where an unshaded flat plate collector oriented towards 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 percent 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 percent 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 2,500 annual hours between 8:00 AM and 4:00 PM.

C405.13.1 Renewable energy certificate documentation. Documentation shall be provided to the code official that indicates that renewable energy certificates (RECs) associated with the on-site renewable energy will be retained and retired by or on behalf of the owner or tenant.

A version of this requirement has been approved for ASHRAE 90.1-2019 as Addendum by,[6] and will be published in ASHRAE 90.1-2022. The three 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.

Add new text as follows:

C405.14 Electric vehicle charging infrastructure. Parking facilities shall be provided with electric vehicle charging infrastructure in accordance with this section and Table C405.14 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.

6 Addendum by 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

Exception: 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.

TABLE C405.14
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 C405.14 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.

C405.14.1 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.

C405.14.2 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 C405.14, then the EV Ready spaces should be specified for Level 2 capacity instead of Level 1. In that case, alternate text is provided here.

Alternate add new text as follows:

C405.14.2 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.

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:

C405.15 Energy storage infrastructure. Each building site shall have equipment 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: Where an onsite electrical energy system storage system is installed.

C405.15.1 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 migrated up from Appendix CB Solar-Ready Zone into the main body of the code. 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.

Add new text as follows:

C405.16 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.

C405.16.1 Electric infrastructure for dwelling and sleeping units. *Combustion equipment* and end-uses serving individual *dwelling units* or *sleeping units* shall comply with Section R404.6.

C405.16.2 Combustion space heating. Space heating *equipment* that uses *fossil fuels* shall comply with either C405.16.2.1 or C405.16.2.2

C405.16.2.1 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:

a. 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.

b. 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 C403.1.1 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.

C405.16.2.2 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".

Section C405.16.2 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 C403.1.1 to establish the size of the heat pump equipment that would be required for the specific building.

C405.16.3 Combustion water heating. Water heating *equipment* that uses *fossil fuels* shall comply with either C405.16.3.1 or C405.16.3.2

C405.16.3.1 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.

C405.16.3.2 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.

Section C405.16.3 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.

C405.16.4 Combustion cooking. Cooking *equipment* that use *fossil fuel* shall comply with either C405.16.4.1 or C405.16.4.2.

C405.16.4.1 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.

C405.16.4.2 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.

Section C405.16.4 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 C405.16.6 Other combustion equipment (which would need to be re-numbered), which does not include full circuits or panel capacity for that equipment.

C405.16.5 Combustion clothes drying. Clothes drying *equipment* that use *fossil fuels* shall comply with either C405.16.5.1 or C405.16.5.2

C405.16.5.1 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".

C405.16.5.2 Residential drying. 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.

Section C405.16.5 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.

C405.16.6 Other combustion equipment. *Combustion equipment* not covered by Sections C405.16.2-3 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 C405.16.6 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.

C406 ADDITIONAL EFFICIENCY REQUIREMENTS

Revise text as follows:

C406.1 Additional energy efficiency credit requirements. New *all-electric buildings* shall achieve a total of 10 credits and new *mixed-fuel buildings* shall achieve a total of 15 credits from Tables C406.1(1) through C406.1(5) where the table is selected based on the use group of the building and from credit calculations as specified in relevant subsections of C406. Where a building contains multiple use groups, credits from each use group shall be weighted by floor area of each group to determine the weighted average building credit. Credits from the tables or calculation shall be achieved where a building complies with one or more of the following:

To encourage electrification of buildings while allowing for mixed-fuel construction, mixed fuel buildings are required to achieve more efficiency credits. Where a mixed fuel building is constructed under this overlay, these provisions will decrease its carbon impact.

Revise text as follows:

> **C406.5 Onsite renewable energy.** The total minimum ratings of on-site renewable energy systems, <u>not including onsite renewable energy system capacity used for compliance with Section C405.13,</u> shall be one of the following:

With the addition of C405.13 for mandatory inclusion of onsite renewable energy this section is revised to allow only additional renewable energy to be counted toward compliance with the additional efficiency requirements.

Chapter 6 – Referenced Standards

(Both) Add new standard as follows:

CTA Consumer Technology Association
1919 S. Eads Street
Arlington, VA 22202

Standard reference number	Title	Referenced in code section number
ANSI/CTA-2045-B	Modular Communications Interface for Energy Management	. . . . . C404.11

Building Decarbonization Code:

Commercial Language for ASHRAE Standard 90.1

Mixed-Fuel

ASHRAE Standard 90.1 (Mixed-Fuel)

Chapter 1 – Purpose

1.1

Revise text as follows:

To reduce building greenhouse gas emissions 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.[7] *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.

7 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

4.2 COMPLIANCE

Revise text as follows:

4.2.1.1 New Buildings

New *buildings* 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:

$$PCI_t = [BBUEC + (BPF \times BBREC) \underline{- PRE}]/BBP$$

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.

<u>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.</u>

<u>PRE = PBP*nre* – PBP*pre*.</u>

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 and further refined to disincentivize the use of gas pool heaters.

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

9.4 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.

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 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

6. 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).
7. 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.
8. 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.

2. 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.

3. *Alterations* that do not include *additions*.

10.5.1.2 Renewable energy certificate documentation

Documentation shall be provided to the code official that indicates that renewable energy certificates (RECs) associated with the on-site renewable energy will be retained and retired by or on behalf of the owner or tenant.

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 – 0.47%/°C; performance shall be based on a reference 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.

Building Decarbonization Code: Residential Language

All-Electric

IECC - Residential Provisions (All-Electric)

Chapter 1 – Scope and Application

R101 SCOPE AND GENERAL REQUIREMENTS

Revise text as follows:

> **R101.3 Intent.** This code shall regulate the design, and construction of buildings for the ~~effective use and conservation~~ reduction of greenhouse gas emissions and for the efficient production, use and storage of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

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

R103 CONSTRUCTION DOCUMENTS

Add new text as follows:

> **R103.2.3 Solar-ready system**. The construction documents shall provide details for dedicated roof area, structural design for roof dead and live load, and routing of conduit or pre-wiring from *solar-ready zone* to electrical service panel or plumbing from *solar-ready zone* to *service water heating* system.

Revisions to this section incorporate critical elements of solar readiness to be clearly identified on the construction documents to allow for easier code compliance review and inspections. This code language has been migrated and amended from the 2021 IECC Appendix RB Solar-Ready Provisions to the most appropriate place in the base code.

> **R103.2.4 Energy storage-ready system.** The construction documents shall provide the location of pathways for routing of raceways or cable from the electrical service panel and energy storage system area and the location and layout of a designated area for electrical energy storage system.

Revisions to this section incorporate critical elements of storage readiness to be clearly identified on the construction documents to allow for easier code compliance review and inspections. This code language is similar to that used for solar readiness, applied to the necessary components of the energy storage system.

R105 INSPECTIONS

Revise text as follows:

> **R105.2.3 Plumbing rough-in inspection.** Inspections at plumbing rough-in shall verify compliance as required by the code and approved plans and specifications as to types of insulation and corresponding R-values and protection and required controls. Where the solar-ready zone is installed for solar water heating, inspections shall verify pathways for routing of plumbing from solar-ready zone to service water heating system.

Revisions to this section incorporate critical elements of solar readiness used for service water heating to allow for inspection enforcement of this provision. This code language is not in the current version of the 2021 IECC Appendix RB Solar-Ready Provisions but is derived from the that language to fully incorporate all aspects of that appendix throughout the base code for enforceability by adopting jurisdictions.

Add new text as follows:

> **R105.2.5 Electrical rough-in inspection.** Inspections at electrical rough-in shall verify compliance as required by the code and the approved plans and specifications as to the locations, distribution, and capacity of the electrical system. Where the solar-ready zone is installed for electricity generation, inspections shall verify conduit or pre-wiring from solar-ready zone to electrical panel. Where the energy storage system area is not in the same space as the electrical panel, inspections shall verify conduit or pre-wiring from the energy storage ready zone to the electrical panel.

Current 2021 IECC inspections do not require dedicated electrical inspections. Additional electrical inspection code language that is not in the current version of the 2021 IECC Appendix RB Solar-Ready Provisions but is derived from the that language to fully incorporate all aspects of that appendix throughout the base code for enforceability by adopting jurisdictions. Similar language has been added to account for inspections of energy storage ready infrastructure.

Revise numbering as follows:

> **~~R105.2.5~~ R105.2.6 Final inspection.**

Chapter 2 – Definitions

R202 GENERAL DEFINITIONS

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.

Definition for appliance is mirrored from 2021 IMC to be useful in defining combustion equipment.

> **COMBUSTION EQUIPMENT.** Any *equipment* or *appliance* used for space heating, *service water heating*, cooking, clothes drying, or lighting that uses *fuel gas* or *fuel oil*.
>
> **DEMAND RESPONSIVE CONTROL.** An automatic control 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. Piping, ducts, vents, control devices and other components of systems other than appliances that are permanently installed and integrated to provide control of environmental conditions for buildings. This definition shall also include other systems specifically regulated in this code.

Definition for equipment is mirrored from 2021 IMC to be useful in defining combustion equipment.

EV-READY SPACE. A parking space that is provided with an electrical circuit capable of supporting an installed *EVSE*.

The definition of EV Ready space has been updated to be descriptive rather than prescriptive and serves as a single definition replacing previous definitions of EVSE, EV-capable, and EV-ready spaces to allow for consistent use of the definitions and deferring requirements to be set in the body of the text. This allows the requirements match the specific requirements and needs of the adopting jurisdiction for EV Ready 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. This definition is aligned with proposal G66-21 as modified by public comment from the 2024 IBC development cycle.

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

Definition for fuel gas is mirrored from 2021 IMC to be useful in defining combustion equipment.

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

Definition for fuel oil is mirrored from 2021 IMC to be useful in defining combustion equipment.

MIXED-FUEL BUILDING. A *building* that contains *combustion equipment* or includes piping for *combustion equipment*.

SOLAR-READY ZONE. A section or sections of the roof or building overhang designated and reserved for the future installation of a solar photovoltaic or solar thermal system.

Definition for solar-ready zone has been migrated from the 2021 IECC Appendix RB Solar-Ready Provisions to the base code.

Chapter 4 – Residential Energy Efficiency

R401 GENERAL

Revise text as follows:

R401.2 Application. Residential buildings shall be *all-electric buildings* and shall comply with Section R401.2.~~5~~4 and either Sections R401.2.1, R401.2.2, or R401.2.3 ~~or R401.2.4~~.

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 is: Exception: The following combustion equipment is permitted as approved by the code official (list specific equipment types).

Delete section without substitution:

~~**R401.2.2 Total Building Performance Option.** The Total Building Performance Option requires compliance with Section R405.~~

Revise numbering as follows:

R401.2.~~3~~2 Energy Rating Index Option.

R401.2.4~~3~~ Tropical Climate Zone Option.

R401.2.~~5~~4 Additional energy efficiency.

The total building performance option has been removed from the residential compliance path options. See additional reasoning under R405. All other sections have been renumbered to reflect the removal of this compliance option.

Revise text as follows:

R401.3 Certificate. A permanent certificate shall be completed by the builder or other approved party and posted on a wall in the space where the furnace is located, a utility room or an approved location inside the building. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certification shall indicate the following:

4. The types, sizes, and efficiencies of heating, cooling and service water heating equipment. Where a ~~gas-fired unvented room heater,~~ electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate ~~"gas-fired unvented room heater,"~~ "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be indicated for ~~gas-fired unvented room heaters,~~ electric furnaces and electric baseboard heaters.

8. Where a *solar-ready zone* is provided, the certificate shall indicate the location, dimensions, and capacity reserved on the electrical service panel.

Revisions to this section remove vestigial language around "gas-fired" equipment that will not be necessary in an all-electric code and incorporate critical elements of solar readiness to be clearly identified to the original homeowner/building owner and any subsequent owners to allow for easier installation of solar panels. This code language has been migrated from the 2021 IECC Appendix RB Solar-Ready Provisions to the most appropriate place in the base code. By including on the certificate, the information is more likely to remain in the building for future owners.

R402 BUILDING THERMAL ENVELOPE

Delete section without substitution:

~~R402.4.4 Rooms containing fuel burning appliances.~~

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

R403 SYSTEMS

Revise text as follows:

R403.1.1 Thermostat ~~Programmable thermostat~~. The thermostat controlling the primary heating or cooling system of the dwelling unit shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature setpoints at different times of the day. This thermostat shall include the capability to set back or temporarily operate the system to maintain zone temperatures of not less than 55°F (13°C) to not greater than 85°F (29°C). The thermostat shall be programmed initially by the manufacturer with a heating temperature setpoint of not greater than 70°F (21°C) and a cooling temperature setpoint of not less than 78°F (26°C). The thermostat shall be provided with a d*emand responsive control* capable of increasing the cooling setpoint by no less than 4°F (2.2°C) and decreasing the heating setpoint by no less than 4°F (2.2°C) in response to a demand response request.

Demand responsive controls for thermostats are added based on language from California Title 24 and integrated into the current requirement for thermostats. Any thermostat listed as "Title 24 compliant" would meet this requirement, and are available directly through major retailers.

Add new text as follows:

R403.5.4 Demand responsive water heating. All 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*.

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.

R404 ELECTRICAL POWER AND LIGHTING SYSTEMS

Revise text as follows:

R404.1.1 Fuel gas lighting equipment. Fuel gas lighting systems shall not ~~have continuously burning pilot lights~~ be installed.

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 the IRC Chapter 24 Fuel Gas does not prohibit the installation of fuel gas lighting, it is critical to ensure that the adoption of this overlay does prohibit these installations.

Add new text as follows:

R404.4 Renewable energy infrastructure. The building shall comply with the requirements of R404.4.1 or R404.4.2

This code language has been migrated from the 2021 IECC Appendix RB Solar-Ready Provisions to the most appropriate place in the base code. By ensuring solar-ready zones, all-electric buildings will have the potential for an even greater impact on building decarbonization by contributing to the continued cleaning of the electricity supply.

R404.4.1 One- and two- family dwellings and townhouses. One- and two-family dwellings and townhouses shall comply with Sections R404.4.1.1 through R404.4.1.4.

Exceptions:

1. A *building* with a permanently installed on-site renewable energy system.

2. A *building* with less than 600 square feet (55 m^2) of roof area oriented between 110 degrees and 270 degrees of true north.

3. A *building* where all areas of the roof that would otherwise meet the requirements for a *solar-ready zone* are in full or partial shade for more than 70 percent of daylight hours annually.

R404.4.1.1 Solar-ready zone area. The total area of the *solar-ready zone* shall not be less than 300 square feet (28 m^2) and shall be composed of areas not less than 5.5 feet (1676 mm) in width and not less than 80 square feet (7.4 m^2) exclusive of access or set back areas as required by the International Fire Code.

Exception: Townhouses three stories or less in height above grade plane and with a total floor area less than or equal to 2,000 square feet (186 m^2) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m^2).

Language for size of solar ready zone has been updated based on stakeholder and industry feedback. Appendix RB uses 5' as the minimum dimension for the solar ready zone. Typical residential scale solar panels are most commonly 65". By increasing the solar ready zone from 5' to 5.5' the language now better accommodates the flat installation of panels on roofs in the future.

R404.4.1.2 Obstructions. Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.

R404.4.1.3 Electrical service reserved space. The main electrical service panel shall have a reserved space to allow installation of a dual pole circuit breaker for future solar electric installation and shall be labeled "For Future Solar Electric." The reserved space shall be positioned at the opposite (load) end from the input feeder location or main circuit location.

R404.4.1.4 Electrical interconnection. An electrical junction box shall be installed within 24 inches (610 mm) of the main electrical service panel and shall be connected to a capped roof penetration sleeve or a location in the attic that is within 3 feet (914 mm) of the *solar ready zone* by one of the following:

1. Minimum ¾-inch nonflexible conduit

2. Minimum #10 Metal copper 3-wire

Where the interconnection terminates in the attic, location shall be no less than 12" (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled "For Future Solar Electric".

As it is currently written, Appendix RB only requires that the construction documents indicate pathways for routing of conduit from the solar-ready zone to the service panel. This update requires the installation and verification of either conduit or wire from the roof or attic to the panel. This language has been adapted from the solar-ready language proposed for the residential Oregon Reach Code.

R404.4.2 Group R occupancies. Buildings in Group R-2, R-3 and R-4 shall comply with Section C405.13.

The 2021 IECC Appendix RB Solar-Ready Provisions address single and two-family dwellings only. Additional language is added to apply the approach for commercial buildings to multifamily residential construction.

Add new text as follows:

R404.5 Electric vehicle charging infrastructure. Electric infrastructure for the current and future charging of *electric vehicles* shall be installed in accordance with this section. *EV ready spaces* are permitted to be counted toward meeting minimum parking requirements.

R404.5.1 One- and two- family dwellings and townhouses. One- and two-family dwellings and townhouses with a dedicated attached or detached garage or on-site parking spaces and new detached garages shall be provided with one *EV-ready space* per *dwelling unit.* The branch circuit shall meet the following requirements:

1. A minimum capacity of 9.6 kVA
2. Terminates at a junction box or receptacle located within 3 feet (914 mm) of the parking space and labelled "For electric vehicle charging", and
3. The electrical panel directory shall designate the branch circuit as "For electric vehicle charging".

R404.5.2 Group R occupancies. Parking facilities serving Group R-2, R-3 and R-4 occupancies shall comply with Section C405.14.

Tailored requirements for single-family and multifamily housing have been included. Single-family homes, where the occupants will choose the specific EVSE that meets their EV charging needs, are required to have one parking space with an EV Ready space that is sized to accommodate the most common EVSE on the market The required capacity for the branch circuit for the EV Ready space is the equivalent of a 240V, 40A circuit and is expressed in kVA as that is the standard metric for capacity or "apparent power" in electrical infrastructure. The wiring requirement ensures that the space can be upgraded to a load-managed Level 2 EVSE in the future.

The requirements for EV charging infrastructure for multifamily buildings are referenced to the commercial requirements as those are more appropriate for EV charging in parking lots.

Add new text as follows:

R404.6 Energy storage infrastructure. Each *building site* shall have a dedicated location for the installation of future on-site energy storage in accordance with this section.

Exception: Where an onsite electrical energy system storage system is installed.

R404.6.1 One- and two- family dwellings and townhouses. One- and two-family dwellings and townhouses shall be provided with an energy storage ready area in accordance with the following:

1. Floor area not less than 2 feet (610 mm) in one dimension and 4 feet (1219 mm) in another dimension and located in accordance with Section 1207 of the International Fire Code and Section 110.26 of the NFPA 70.
2. 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.

R404.6.2 Group R occupancies. Buildings with Group R-2, R-3 and R-4 occupancies shall comply with Section C405.15.

Infrastructure for energy storage has been adapted from Appendix CB Solar-Ready Zone into the main body of the residential code. This language includes revisions from the 2019 Group B Public Comment that were not incorporated into the final text of the 2021 IECC but modified the language to ensure needed correlation with the IFC and NFPA. Single and two family dwellings are subject to a prescriptive based sizing requirement, while low-rise multifamily buildings will be asked to refer to commercial guidelines.

SECTION 405 TOTAL BUILDING PERFORMANCE

Delete without substitution:

~~**R405 Total Building Performance**~~

Compliance with the performance path for consideration of greenhouse gas emissions and the needed increased stringency for mixed-fuel buildings requires manipulation of the standard reference design for space heating, water heating, and any other potential combustion end use. Given the limited application of Section R405 in new residential construction, for the purposes of this overlay, compliance via prescriptive path or ERI path create simpler enforcement options for jurisdictions. Additionally, the reliance on cost in the performance path creates a "natural" advantage for fossil fuels, as gas is less expensive on a utility bill in many parts of the country. "Hidden" costs of gas like the impact on indoor air quality and health are not accounted for in this analysis.

For jurisdictions that see the inclusion of R405 as absolutely necessary within their jurisdiction, the following language is recommended to pick up mandatory requirements of demand responsive technology, solar and storage readiness and EV infrastructure:

Alternate revision table as follows:

TABLE R405.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

SECTION	TITLE
Mechanical	
R403.5 except Section R403.5.2	Service hot water systems
~~R403.5.1~~	~~Heated water circulation and temperature maintenance systems~~
~~R403.5.3~~	~~Drain water heat recovery units~~

The mandatory requirements table has been modified to include the new requirement for demand responsive hot water control. Based on the structure of the table currently, combining R403.5 and creating a single in line exception is the most straightforward approach to this revision.

Alternate revision table as follows:

TABLE R405.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

SECTION	TITLE
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
R404.4	Renewable energy infrastructure
R404.5	Electric vehicle charging infrastructure
R404.6	Energy storage infrastructure

The mandatory requirements table has been modified to include the new requirements for renewable energy and electric vehicle charging as mandatory elements of the code amendments.

SECTION 406 ENERGY RATING INDEX COMPLIANCE ALTERNATIVE

Revise table as follows:

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

SECTION	TITLE
Mechanical	
R403.5 except Section R403.5.2	Service hot water systems
~~R403.5.1~~	~~Heated water circulation and temperature maintenance systems~~
~~R403.5.3~~	~~Drain water heat recovery units~~

The ERI mandatory requirements table has been modified to include the new requirement for demand responsive hot water control. Based on the structure of the table currently, combining R403.5 and creating a single in line exception is the most straightforward approach to this revision.

Revise table as follows:

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

SECTION	TITLE
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
R404.4	Renewable energy infrastructure
R404.5	Electric vehicle charging infrastructure
R404.6	Energy storage infrastructure
R406.3	Building thermal envelope

The ERI mandatory requirements table has been modified to include the new requirements for renewable energy and electric vehicle charging as mandatory elements of the code amendments.

R407 TROPICAL CLIMATE REGION COMPLIANCE PATH

Revise text as follows:

R407.2 Tropical climate region. Compliance with this section requires the following:

1. Not more than one-half of the *occupied* space is air conditioned and is controlled by a thermostat in accordance with Section R403.1.1.

3. Solar, wind or other renewable energy source supplies not less than 80 percent of the energy for service water heating controlled in accordance with Section R403.5.4.

12. Parking is in accordance with Section R404.6.

Modifications to the Tropical Climate Region Path are minimal. This pathway in the 2021 IECC already does not allow any space heating and requires 80% of hot water be supplied by renewable energy. To ensure the inclusion of demand response controls, electric vehicles, and all other combustion equipment is addressed additional requirements are added to the tropical compliance list under R407.2.

R408 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

Revise text as follows:

R408.2.2 More efficient HVAC equipment. Heating and cooling *equipment* shall meet one of the following efficiencies:

~~1. Greater than or equal to 95 AFUE natural gas furnace and 16 SEER air conditioner.~~

~~2~~1. Greater than or equal to 10 HSPF/16 SEER air source heat pump.

~~3~~2. Greater than or equal to 3.5 COP ground source heat pump.

R408.2.3 Reduced energy use in service water-heating option. The hot water system shall meet one of the following efficiencies:

~~1. Greater than or equal to 82 EF fossil fuel service water-heating system.~~

~~2~~1. Greater than or equal to 2.0 EF electric service water-heating system.

~~3~~2. Greater than or equal to 0.4 solar fraction solar water-heating system.

All electric buildings will not need language that relates to fossil fuel systems. This vestigial language has been removed to avoid confusion in implementation of this overlay and the sections have been renumbered.

Chapter 6 – Referenced Standards

Add new standard as follows:

CTA	Consumer Technology Association 1919 S. Eads Street Arlington, VA 22202	
Standard reference number	Title	Referenced in code section number
ANSI/CTA-2045-B	Modular Communications Interface for Energy Management	R403.5.4

Building Decarbonization Code:

Residential Language

Mixed-Fuel

IECC - Residential Provisions (Mixed-Fuel)

Chapter 1 – Scope and Application

R101 SCOPE AND GENERAL REQUIREMENTS

Revise text as follows:

> **R101.3 Intent.** This code shall regulate the design, and construction of buildings for the ~~effective use and conservation~~ reduction of greenhouse gas emissions and for the efficient production, use and storage of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

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

R103 CONSTRUCTION DOCUMENTS

Revise text as follows:

> **R103.2 Information on construction documents.** Construction documents shall be drawn to scale upon suitable material. Electronic media documented are permitted to be submitted when 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 herein governed. Details shall include the following as applicable:
>
> > 6. Mechanical and service water heating systems and equipment types, sizes, fuel sources and efficiencies.

Fuel sources are a critical piece of code compliance enforcement for the full implementation of this code overlay. Clear identification on the construction documents will allow for easier code compliance review and inspections. Inclusion of fuel sources is most critical in areas where there are multiple fuels available such as fuel oil, propane, and natural gas, as the equipment type alone may not provide this information.

Add new text as follows:

> **R103.2.3 Solar-ready system**. The construction documents shall provide details for dedicated roof area, structural design for roof dead and live load, and routing of conduit or pre-wiring from *solar-ready zone* to electrical service panel or plumbing from *solar-ready zone* to *service water heating* system.

Revisions to this section incorporate critical elements of solar readiness to be clearly identified on the construction documents to allow for easier code compliance review and inspections. This code language has been migrated and amended from the 2021 IECC Appendix RB Solar-Ready Provisions to the most appropriate place in the base code.

R103.2.4 Energy storage-ready system. The construction documents shall provide the location of pathways for routing of raceways or cable from the electrical service panel and energy storage system area and the location and layout of a designated area for electrical energy storage system.

Revisions to this section incorporate critical elements of storage readiness to be clearly identified on the construction documents to allow for easier code compliance review and inspections. This code language is similar to that used for solar readiness, applied to the necessary components of the energy storage system.

Add new text as follows:

R103.2.5 Electrification system. The construction documents shall provide details for additional electric infrastructure, including branch circuits, conduit, or pre-wiring, and panel capacity in compliance with the provisions of this code.

Current 2021 IECC language does not include specific requirements for electrical systems on construction documents for residential construction. Given the importance of the electrical system in a mixed-fuel building, including an explicit requirement in the construction documents will allow for easier implementation and enforcement of the requirements on code compliance plan review staff.

R105 INSPECTIONS

Revise text as follows:

R105.2.3 Plumbing rough-in inspection. Inspections at plumbing rough-in shall verify compliance as required by the code and approved plans and specifications as to types of insulation and corresponding R-values and protection and required controls. Where the solar-ready zone is installed for solar water heating, inspections shall verify pathways for routing of plumbing from solar-ready zone to service water heating system.

Revisions to this section incorporate critical elements of solar readiness used for service water heating to allow for inspection enforcement of this provision. This code language is not in the current version of the 2021 IECC Appendix RB Solar-Ready Provisions but is derived from the that language to fully incorporate all aspects of that appendix throughout the base code for enforceability by adopting jurisdictions.

Add new text as follows:

R105.2.5 Electrical rough-in inspection. Inspections at electrical rough-in shall verify compliance as required by the code and the approved plans and specifications as to the locations, distribution, and capacity of the electrical system. Where the solar-ready zone is installed for electricity generation, inspections shall verify conduit or pre-wiring from solar-ready zone to electrical panel. Where the energy storage system area is not in the same space as the electrical panel, inspections shall verify conduit or pre-wiring from the energy storage ready zone to the electrical panel.

Current 2021 IECC inspections do not require dedicated electrical inspections. Additional electrical inspection code language that is not in the current version of the 2021 IECC Appendix RB Solar-Ready Provisions but is derived from the that language to fully incorporate all aspects of that appendix throughout the base code for enforceability by adopting jurisdictions. Similar language has been added to account for inspections of energy storage ready infrastructure.

Revise numbering as follows:

~~R105.2.5~~ R105.2.6 Final inspection.

Chapter 2 – Definitions

R202 GENERAL DEFINITIONS

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.

Definition for appliance is mirrored from 2021 IMC to be useful in defining combustion equipment.

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

DEMAND RESPONSIVE CONTROL. An automatic control 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. Piping, ducts, vents, control devices and other components of systems other than appliances that are permanently installed and integrated to provide control of environmental conditions for buildings. This definition shall also include other systems specifically regulated in this code.

Definition for equipment is mirrored from 2021 IMC to be useful in defining combustion equipment.

EV-READY SPACE. A parking space that is provided with an electrical circuit capable of supporting an installed *EVSE*.

The definition of EV Ready space has been updated to be descriptive rather than prescriptive and serves as a single definition replacing previous definitions of EVSE, EV-capable, and EV-ready spaces to allow for consistent use of the definitions and deferring requirements to be set in the body of the text. This allows the requirements match the specific requirements and needs of the adopting jurisdiction for EV Ready 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. This definition is aligned with proposal G66-21 as modified by public comment from the 2024 IBC development cycle.

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

Definition for fuel gas is mirrored from 2021 IMC to be useful in defining combustion equipment.

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

Definition for fuel oil is mirrored from 2021 IMC to be useful in defining combustion equipment.

MIXED-FUEL BUILDING. A *building* that contains *combustion equipment* or includes piping for *combustion equipment*.

SOLAR-READY ZONE. A section or sections of the roof or building overhang designated and reserved for the future installation of a solar photovoltaic or solar thermal system.

Definition for solar-ready zone has been migrated from the 2021 IECC Appendix RB Solar-Ready Provisions to the base code.

Chapter 4 – Residential Energy Efficiency

R401 GENERAL

Revise text as follows:

R401.2 Application. Residential buildings shall comply with Section R401.2.~~5~~4 and either Sections R401.2.1, R401.2.2, or R401.2.3 ~~or R401.2.4~~.

Delete section without substitution:

~~**R401.2.2 Total Building Performance Option.** The Total Building Performance Option requires compliance with Section R405.~~

Revise numbering as follows:

R401.2.~~3~~2 Energy Rating Index Option.

R401.2.4~~3~~ Tropical Climate Zone Option.

R401.2.~~5~~4 Additional energy efficiency.

The total building performance option has been removed from the residential compliance path options. See additional reasoning under R405. All other sections have been renumbered to reflect the removal of this compliance option.

Revise text as follows:

R401.2.5 Additional energy efficiency. This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.

1. For *all-electric buildings* ~~buildings~~ complying with Section R401.2.1, one of the additional efficiency package options shall be installed according to Section R408.2.

2. For mixed-fuel buildings complying with Section R401.2.1, the building shall be required to install either R408.2.1 or R408.2.5 of the additional efficiency package options, and any two of R408.2.2, R408.2.3, or R408.2.4 of the additional efficiency package options. ~~For buildings complying with Section R401.2.2, the building shall meet one of the following:~~

~~2.1. One of the additional efficiency package Options in Section R408.2 shall installed without including such measures in the proposed design under Section R405; or~~

~~2.2. The proposed design of the building under Section R405.3 shall have an annual energy cost that is less than or equal to the 95 percent of the annual energy cost of the standard reference design.~~

3. For buildings complying with the Energy Rating Index alternative Section R401.2.3, the Energy Rating Index value shall be at least 5 percent less than the Energy Rating Index target specified in Table R406.5.

The options selected for compliance shall be identified in the certificate required by Section R401.3.

All-electric newly constructed homes typically use less energy when compared to newly constructed mixed-fuel homes. An Ecotope study[8] of the 2017 Oregon Residential code found that homes heated by electric heat pumps use 40 percent less energy than homes heated with gas (including water heating). This change seeks to encourage electrification and more evenly weigh the impact of the additional efficiency credits by requiring the mixed-fuel home to select a total of three packages from the options while the all-electric home is required to select one package. Of the three packages required for the mixed-fuel home, one must address the envelope (improved envelope or reduced

8 *Oregon Residential Specialty Code: 2005 Baseline and Code Roadmap to Achieve the 2030 Goal;* Ecotope (2020)

infiltration plus better ventilation) while the remaining two impact HVAC (better equipment or more efficient ducts) and water-heating (better equipment) requirements.

Revise text as follows:

R401.3 Certificate. A permanent certificate shall be completed by the builder or other approved party and posted on a wall in the space where the furnace is located, a utility room or an approved location inside the building. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certification shall indicate the following:

4. The types, sizes, fuel sources, and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters.

8. The fuel sources for cooking and clothes drying equipment.

9. Where combustion equipment is installed, the certificate shall indicate information on the installation of additional electric infrastructure including which *equipment* and/or *appliances* include additional electric infrastructure, capacity reserved on the electrical service panel for replacement of each piece of combustion *equipment* and/or *appliance*

10. Where a *solar-ready zone* is provided, the certificate shall indicate the location, dimensions, and capacity reserved on the electrical service panel.

Revisions to this section incorporate critical elements of electrification and solar readiness to be clearly identified to the original homeowner/building owner and any subsequent owners to allow for easier mechanical swaps to electrical equipment and the installation of solar panels. By including on the certificate, the information is more likely to remain in the building for future owners.

R402 BUILDING THERMAL ENVELOPE

Revise text as follows:

R402.1 General. The building thermal envelope shall comply with the requirements of Sections R402.1.1 through R402.1.5.

Exceptions:

1. The following low-energy buildings, or portions thereof, separated from the remainder of the building by *building thermal envelope assemblies* complying with this section shall be exempt from the building thermal envelope provisions of Section R402.
   1.1 Those containing no *combustion equipment* with a peak design rate of energy usage less than 3.4 Btu/h·ft2 (10.7 W/m2) or 1.0 watt/ft2 of floor area for space conditioning purposes.

1.2 Those containing no *combustion equipment* that do not contain *conditioned space*.

Low energy buildings are currently exempt from thermal envelope requirements. This revision applies the same intention of low greenhouse gas impact that was given to low energy use impact when these building types were exempted.

R403 SYSTEMS

Revise text as follows:

R403.1.1 Thermostat ~~Programmable thermostat~~. The thermostat controlling the primary heating or cooling system of the dwelling unit shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature setpoints at different times of the day. This thermostat shall include the capability to set back or temporarily operate the system to maintain zone temperatures of not less than 55°F (13°C) to not greater than 85°F (29°C). The thermostat shall be programmed initially by the manufacturer with a heating temperature setpoint of not greater than 70°F (21°C) and a cooling temperature setpoint of not less than 78°F (26°C). The thermostat shall be provided with a d*emand responsive control* capable of increasing the cooling setpoint by no less than 4°F (2.2°C) and decreasing the heating setpoint by no less than 4°F (2.2°C) in response to a demand response request.

Demand responsive controls for thermostats are added based on language from California Title 24 and integrated into the current requirement for thermostats. Any thermostat listed as "Title 24 compliant" would meet this requirement, and are available directly through major retailers.

Add new text as follows:

R403.5.4 Demand responsive water heating. All 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*.

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.

R404 ELECTRICAL POWER AND LIGHTING SYSTEMS

Add new text as follows:

R404.4 Renewable energy infrastructure. The building shall comply with the requirements of R404.4.1 or R404.4.2

This code language has been migrated from the 2021 IECC Appendix RB Solar-Ready Provisions to the most appropriate place in the base code. By ensuring solar-ready zones, all-electric buildings will have the potential for an even greater impact on building decarbonization by contributing to the continued cleaning of the electricity supply.

R404.4.1 One- and two- family dwellings and townhouses. One- and two-family dwellings and townhouses shall comply with Sections R404.4.1.1 through R404.4.1.4.

Exceptions:

1. A *building* with a permanently installed on-site renewable energy system.

2. A *building* with less than 600 square feet (55 m^2) of roof area oriented between 110 degrees and 270 degrees of true north.

3. A *building* where all areas of the roof that would otherwise meet the requirements for a *solar-ready zone* are in full or partial shade for more than 70 percent of daylight hours annually.

R404.4.1.1 Solar-ready zone area. The total area of the *solar-ready zone* shall not be less than 300 square feet (28 m^2) and shall be composed of areas not less than 5.5 feet (1676 mm) in width and not less than 80 square feet (7.4 m^2) exclusive of access or set back areas as required by the International Fire Code.

Exception: Townhouses three stories or less in height above grade plane and with a total floor area less than or equal to 2,000 square feet (186 m^2) per dwelling shall be permitted to have a solar-ready zone area of not less than 150 square feet (14 m^2).

Language for size of solar ready zone has been updated based on stakeholder and industry feedback. Appendix RB uses 5' as the minimum dimension for the solar ready zone. Typical residential scale solar panels are most commonly 65". By increasing the solar ready zone from 5' to 5.5' the language now better accommodates the flat installation of panels on roofs in the future.

R404.4.1.2 Obstructions. Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.

R404.4.1.3 Electrical service reserved space. The main electrical service panel shall have a reserved space to allow installation of a dual pole circuit breaker for future solar electric installation and shall be labeled "For Future Solar Electric." The reserved space shall be positioned at the opposite (load) end from the input feeder location or main circuit location.

R404.4.1.4 Electrical interconnection. An electrical junction box shall be installed within 24 inches (610 mm) of the main electrical service panel and shall be connected to a capped roof penetration sleeve or a location in the attic that is within 3 feet (914 mm) of the *solar ready zone* by one of the following:

1. Minimum ¾-inch nonflexible conduit

2. Minimum #10 Metal copper 3-wire

Where the interconnection terminates in the attic, location shall be no less than 12" (35 mm) above ceiling insulation. Both ends of the interconnection shall be labeled "For Future Solar Electric".

As it is currently written, Appendix RB only requires that the construction documents indicate pathways for routing of conduit from the solar-ready zone to the service panel. This update requires the installation and verification of either conduit or wire from the roof or attic to the panel. This language has been adapted from the solar-ready language proposed for the residential Oregon Reach Code.

R404.4.2 Group R occupancies. Buildings in Group R-2, R-3 and R-4 shall comply with Section C405.13.

The 2021 IECC Appendix RB Solar-Ready Provisions address single and two-family dwellings only. Additional language is added to apply the approach for commercial buildings to multifamily residential construction.

Add new text as follows:

R404.5 Electric vehicle charging infrastructure. Electric infrastructure for the current and future charging of *electric vehicles* shall be installed in accordance with this section. *EV ready spaces* are permitted to be counted toward meeting minimum parking requirements.

R404.5.1 One- and two- family dwellings and townhouses. One- and two-family dwellings and townhouses with a dedicated attached or detached garage or on-site parking spaces and new detached garages shall be provided with one *EV-ready space* per *dwelling unit.* The branch circuit shall meet the following requirements:

1. A minimum capacity of 9.6 kVA
2. Terminates at a junction box or receptacle located within 3 feet (914 mm) of the parking space and labelled "For electric vehicle charging", and
3. The electrical panel directory shall designate the branch circuit as "For electric vehicle charging".

R404.5.2 Group R occupancies. Parking facilities serving Group R-2, R-3 and R-4 occupancies shall comply with Section C405.14.

Tailored requirements for single-family and multifamily housing have been included. Single-family homes, where the occupants will choose the specific EVSE that meets their EV charging needs, are required to have one parking space with an EV Ready space that is sized to accommodate the most common EVSE on the market The required capacity for the branch circuit for the EV Ready space is the equivalent of a 240V, 40A circuit and is expressed in kVA as that is the standard metric for capacity or "apparent power" in electrical infrastructure. The wiring requirement ensures that the space can be upgraded to a load-managed Level 2 EVSE in the future.

The requirements for EV charging infrastructure for multifamily buildings are referenced to the commercial requirements as those are more appropriate for EV charging in parking lots.

Add new text as follows:

R404.6 Energy storage infrastructure. Each *building site* shall have a dedicated location for the installation of future on-site energy storage in accordance with this section.

Exception: Where an onsite electrical energy system storage system is installed.

R404.6.1 One- and two- family dwellings and townhouses. One- and two-family dwellings and townhouses shall be provided with an energy storage ready area in accordance with the following:

1. Floor area not less than 2 feet (610 mm) in one dimension and 4 feet (1219 mm) in another dimension and located in accordance with Section 1207 of the International Fire Code and Section 110.26 of the NFPA 70.
2. 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.

R404.6.2 Group R occupancies. Buildings with Group R-2, R-3 and R-4 occupancies shall comply with Section C405.15.

Infrastructure for energy storage has been adapted from Appendix CB Solar-Ready Zone into the main body of the residential code. This language includes revisions from the 2019 Group B Public Comment that were not incorporated into the final text of the 2021 IECC but modified the language to ensure needed correlation with the IFC and NFPA. Single and two family dwellings are subject to a prescriptive based sizing requirement, while low-rise multifamily buildings will be asked to refer to commercial guidelines.

Add new text as follows:

R404.7 Additional electric infrastructure. *Combustion equipment* shall be installed 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 based on the approach adopted in the electrification reach codes adopted by various California cities. It combines the best elements from those reach codes and adapts them to the I-Code format.

R404.7.1 Equipment serving multiple units. *Combustion equipment* that serves multiple *dwelling units* shall comply with Section C405.13.

R404.7.2 Combustion water heating. Water heaters shall be installed in accordance with the following:

1. A dedicated 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.

The addition of this section provides a series of requirements 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.

R404.7.3 Combustion space heating. Where a building has combustion equipment for space heating, the building 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), and
2. A dedicated branch circuit in compliance with IRC Section E3702.11 based on heat pump space heating equipment sized in accordance with R403.7 and terminating within 3 feet (914 mm) of the location 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 IRC Section E3702.11 exists for space cooling equipment.

IRC Section E3702.11 sets the requirement for sizing a branch circuit serving a heat pump and 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 home and the climate, the section references Section R403.7 to establish the size of the heat pump equipment that would be required for the specific home.

R404.7.4 Combustion clothes drying. A dedicated 240-volt branch circuit with a minimum capacity of 30 amps shall terminate within 6 feet (1829 mm) of natural gas 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" and be electrically isolated.

R404.7.5 Combustion cooking. A dedicated 240-Volt, 40A branch circuit shall terminate within 6 feet (1829 mm) of natural gas 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 Range" and be electrically isolated.

For jurisdictions concerned about impacts and stakeholder feedback on cooking appliances, language in R404.5 can be amended and combined with the requirements of an all-electric version of this code to

allow for continued installation of combustion cooking, provided that the appliances be electric ready for future homeowner choice. IRC Section E3702.9.1 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.

R404.7.6 Other combustion equipment. *Combustion equipment* and end-uses not covered by Sections R404.6.2-5 shall be provided with a branch circuit sized for an electric *appliance*, *equipment* or end use with an equivalent capacity that terminates within 6 feet (1829 mm) of the *appliance* or *equipment*.

SECTION 405 TOTAL BUILDING PERFORMANCE

Delete without substitution:

~~R405 Total Building Performance~~

Compliance with the performance path for consideration of greenhouse gas emissions and the needed increased stringency for mixed-fuel buildings requires manipulation of the standard reference design for space heating, water heating, and any other potential combustion end use. Given the limited application of Section R405 in new residential construction, for the purposes of this overlay, compliance via prescriptive path or ERI path create simpler enforcement options for jurisdictions. Additionally, the reliance on cost in the performance path creates a "natural" advantage for fossil fuels, as gas is less expensive on a utility bill in many parts of the country. "Hidden" costs of gas like the impact on indoor air quality and health are not accounted for in this analysis.

For jurisdictions that see the inclusion of R405 as absolutely necessary within their jurisdiction, the following language is recommended in scoping to push the performance path towards meeting the efficiency gains of the prescriptive path:

Alternate revision text as follows:

R401.2.5 Additional energy efficiency. This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.

1. For *all-electric buildings* ~~buildings~~ complying with Section R401.2.1, one of the additional efficiency package options shall be installed according to Section R408.2.

2. For mixed-fuel buildings complying with Section R401.2.1, the building shall be required to install either R408.2.1 or R408.2.5 of the additional efficiency package options, and any two of R408.2.2, R408.2.3, or R408.2.4 of the additional efficiency package options.

~~2~~3. For buildings complying with Section R401.2.2, the building shall meet one of the following:

~~2~~3.1. *All-electric buildings* shall have ~~O~~one of the additional efficiency package options in Section R408.2 ~~shall~~ be installed without including such measures in the proposed design under Section R405; or

~~2~~3.2. The proposed design of the *all-electric building* ~~building~~ under Section R405.3 shall have an annual energy cost that is less than or equal to the 95 percent of the annual energy cost of the standard reference design~~.~~; or

3.3 Mixed-fuel buildings shall have either R408.2.1 or R408.2.5 of the additional efficiency package options, and any two of R408.2.2, R408.2.3, or R408.2.4 of the additional efficiency package options installed without including such measures in the proposed design under Section R405; or

3.4 The proposed design of the mixed-fuel building under Section R405.3 shall have an annual energy cost that is less than or equal to 85 percent of the annual energy cost of the standard reference design.

~~3~~4. For buildings complying with the Energy Rating Index alternative Section R401.2.3, the Energy Rating Index value shall be at least 5 percent less than the Energy Rating Index target specified in Table R406.5.

The options selected for compliance shall be identified in the certificate required by Section R401.3.

Alternate revision table as follows:

TABLE R405.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

SECTION	TITLE
Mechanical	
R403.5 except Section R403.5.2	Service hot water systems
~~R403.5.1~~	~~Heated water circulation and temperature maintenance systems~~
~~R403.5.3~~	~~Drain water heat recovery units~~

The mandatory requirements table has been modified to include the new requirement for demand responsive hot water control. Based on the structure of the table currently, combining R403.5 and creating a single in line exception is the most straightforward approach to this revision.

Alternate revision table as follows:

TABLE R405.2 REQUIREMENTS FOR TOTAL BUILDING PERFORMANCE

SECTION [a]	TITLE
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
R404.4	Renewable energy infrastructure
R404.5	Electric vehicle charging infrastructure
R404.6	Energy storage infrastructure
R404.7	Additional electric infrastructure

The mandatory requirements table has been modified to include the new requirements for renewable energy, electric vehicle charging, and electric infrastructure as mandatory elements of the code amendments.

SECTION 406 ENERGY RATING INDEX COMPLIANCE ALTERNATIVE

Revise table as follows:

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

SECTION	TITLE
Mechanical	
R403.5 except Section R403.5.2	Service hot water systems
~~R403.5.1~~	~~Heated water circulation and temperature maintenance systems~~
~~R403.5.3~~	~~Drain water heat recovery units~~

The ERI mandatory requirements table has been modified to include the new requirement for demand responsive hot water control. Based on the structure of the table currently, combining R403.5 and creating a single in line exception is the most straightforward approach to this revision.

Revise table as follows:

TABLE R406.2 REQUIREMENTS FOR ENERGY RATING INDEX

SECTION [a]	TITLE
Electrical Power and Lighting Systems	
R404.1	Lighting equipment
R404.2	Interior lighting controls
R404.4	Renewable energy infrastructure
R404.5	Electric vehicle charging infrastructure
R404.6	Energy storage infrastructure
R404.7	Additional electric infrastructure
R406.3	Building thermal envelope

The ERI mandatory requirements table has been modified to include the new requirements for renewable energy, electric vehicle charging, and electric infrastructure as mandatory elements of the code amendments.

Revise text as follows:

R406.5 ERI-based compliance. Compliance based on an ERI analysis requires that the rated *proposed* design and confirmed built dwelling be shown to have an ERI less than or equal to the appropriate value for the proposed *mixed-fuel building* or the proposed *all-electric building* as indicated in Table R406.4 when compared to the *ERI reference design*.

TABLE R406.4 MAXIMUM ENERGY RATING INDEX

Climate Zone	~~Energy Rating Index~~ All-Electric Building	Mixed Fuel Building
0-1	52	43
2	52	45
3	51	47
4	54	47
5	55	47
6	54	46
7	53	46
8	53	45

This modification encourages homes following the ERI performance path to be all-electric by setting more stringent ERI values for mixed-fuel homes. This is needed as Standard 301, which sets the calculation methodology for calculating ERI, claims to be fuel agnostic. This means that there is no way to require that a home be all-electric without making significant modifications to Standard 301.

The ERI values for mixed-fuel homes match those from ASHRAE 90.2 and Appendix RC Zero Energy Residential Building Provisions as published in the 2021 IECC. The ERI values for all-electric homes are the same as the values published in Table R406.5 of the 2021 IECC.

R407 TROPICAL CLIMATE REGION COMPLIANCE PATH

Revise text as follows:

R407.2 Tropical climate region. Compliance with this section requires the following:

1. Not more than one-half of the *occupied* space is air conditioned and is controlled by a thermostat in accordance with Section R403.1.1.

3. Solar, wind or other renewable energy source supplies not less than 80 percent of the energy for service water heating controlled in accordance with Section R403.5.4.

12. Parking is in accordance with Section R404.6.

13. All *combustion equipment* is in accordance with Section R404.5.

Modifications to the Tropical Climate Region Path are minimal. This pathway in the 2021 IECC already does not allow any space heating and requires 80% of hot water be supplied by renewable energy. To ensure the inclusion of demand response controls, electric vehicles, and all other combustion equipment is addressed additional requirements are added to the tropical compliance list under R407.2.

R408 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

Add new text as follows:

R408.2.3 Reduced energy use in service water-heating option. The hot water system shall meet one of the following efficiencies:

1. Greater than or equal to 82 EF fossil fuel service water-heating system.
2. Greater than or equal to 2.0 EF electric service water-heating system.
3. Greater than or equal to 0.4 solar fraction solar water-heating system.
4. Greater than or equal to 82 EF instantaneous fossil fuel service water-heating system and drain water heat recovery unit meeting the requirements of Section R403.5.3 installed on at least one shower.

This new additional efficiency option provides builders with a fourth service hot water package that combines the efficiency benefits of an instantaneous gas water heater with a drain water heat recovery unit). Since mixed fuel buildings will be required to select more package options, the addition of this option provides additional flexibility for builders selecting to construct mixed fuel buildings, while continuing to encourage efficiency in combustion systems. This package reflects the requirements proposed in the Oregon Reach Code which was calibrated to other hot water package options based on analysis conducted by the Northwest Energy Efficiency Alliance[9] (NEEA).

Chapter 6 – Referenced Standards

(Both) Add new standard as follows:

CTA Consumer Technology Association
1919 S. Eads Street
Arlington, VA 22202

Standard reference number	Title	Referenced in code section number
ANSI/CTA-2045-B	Modular Communications Interface for Energy Management	R403.5.4

9 Heny Odum; Paul Kinter; *Oregon Residential Specialty Code: Energy Efficiency Analysis,* NEEA (March 2020)

Codes for Climate™

Codes for Climate is an initiative of NBI and RMI to deliver the climate-aligned building codes and standards needed by U.S. states and cities in the face of the pressing demands of policy goals. To scale greenhouse gas reductions in the buildings sector to be in step with a 1.5°C future, the initiative works to support policy makers at multiple levels to move codes and standards forward, making significant reductions in energy consumption and GHG emissions from buildings possible and effective. The Decarbonization Code supports the goals of the Codes for Climate Initiative.

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New Buildings Institute (NBI) is a nonprofit organization driving better energy performance in buildings to make them better for people and the environment. We work collaboratively with industry market players—governments, utilities, energy efficiency advocates, and building professionals—to promote advanced design practices, innovative technologies, public policies, and programs that improve energy efficiency. The Getting to Zero website houses over 300 curated resources including guidance, educational webinars, policy models, research, case studies, and more to help all buildings achieve zero energy. Visit **gettingtozeroleadership.org** to learn more.

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