

# Comm. Min. Renewable Capacity Consensus (592)

IECC@: C103.2, SECTION 202 (New), C405.1, C405.13 (New), C405.13.1 (New), C405.13.2 (New), C405.13.2.1 (New), C405.13.2.2 (New), C405.13.3 (New), C405.13.4 (New), C406.5.1, C406.5.2, TABLE C407.4.1(1), C502.3.7 (New), Green-e (New), (New)

Proponents:

## 2021 International Energy Conservation Code

Revise as follows:

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

1. Energy compliance path.
2. Insulation materials and their *R*-values.
3. Fenestration *U*-factors and solar heat gain coefficients (SHGCs).
4. Area-weighted *U*-factor and solar heat gain coefficient (SHGC) calculations.
5. Mechanical system design criteria.
6. Mechanical and service water-heating systems and equipment types, sizes and efficiencies.
7. Economizer description.
8. Equipment and system controls.
9. Fan motor horsepower (hp) and controls.
10. Duct sealing, duct and pipe insulation and location.
11. Lighting fixture schedule with wattage and control narrative.
12. Location of *daylight* zones on floor plans.
13. Air barrier and air sealing details, including the location of the air barrier.
14. Location of pathways for routing of raceways or cable from the on-site renewable energy system to the electrical distribution equipment.

Add new definition as follows:

**COMMUNITY RENEWABLE ENERGY FACILITY.** A facility that produces energy harvested from *renewable energy resources* and is qualified as a community energy facility under applicable jurisdictional statutes and rules.

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

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

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

Revise as follows:

**C405.1 General.** Lighting system controls, the maximum lighting power for interior and exterior applications, and electrical energy consumption and generation shall comply with this section. *Sleeping units* shall comply with Section C405.2.5 and with either Section C405.1.1 or C405.3. *General lighting* shall consist of all lighting included when calculating the total connected interior lighting power in accordance with Section C405.3.1 and which does not require specific application controls in accordance with Section C405.2.5.

Transformers, uninterruptable power supplies, motors and electrical power processing equipment in data center systems shall comply with Section 8 of ASHRAE 90.4 in addition to this code.

Add new text as follows:

**C405.13 Renewable energy systems.** *Buildings in Climate Zones 0-7* shall comply with C405.13.1 through C405.13.4.

**C405.13.1 On-site renewable energy systems.** *Buildings shall install equipment for on-site renewable electricity generation with a direct current (DC) nameplate power rating of not less than 0.75 W/ft<sup>2</sup> (8.1 W/m<sup>2</sup>) multiplied by the sum of the gross conditioned floor area of all floors not to exceed the combined gross conditioned floor area of the three largest floors.*

Exception: The following buildings or building sites shall comply with Section C405.13.2:

1. A building site located where an unshaded flat plate collector oriented toward the equator and tilted at an angle from horizontal equal to the latitude receives an annual daily average incident solar radiation less than 1.1 kBtu/ft<sup>2</sup> - day (3.5 kWh/m<sup>2</sup> - day).
2. A building where more than 80% of the roof area is covered by any combination of permanent obstructions such as, but not limited to, mechanical equipment, vegetated space, access, pathways, or occupied roof terrace.
3. Any building where more than 50% 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. A building with gross conditioned floor area less than 5,000 square feet (465 m<sup>2</sup>).

**C405.13.2 Off-site renewable energy.** *Buildings that qualify for one or more of the exceptions to Section 405.13.1 and do not meet the requirements of Section 405.13.1 either in part or in full, with an on-site renewable energy system, shall procure off-site renewable electrical energy, in accordance with C405.13.2.1 and C405.13.2.2, that shall not be less than the total off-site renewable electrical energy determined in accordance with Equation 4-12.*

$$TRE_{off} = (REN_{off} * 0.75 \text{ W/ft}^2 * FLRA - IRE_{on}) * 15$$

**(Equation 4-12)**

where:

TRE<sub>off</sub> = Total off-site renewable electrical energy in kilowatt-hours (kWh) to be procured in accordance with Table C405.13.2

REN<sub>off</sub> = Annual off-site renewable electrical energy from Table C405.13.2, in units of kilowatt-hours per watt of array capacity

FLRA = the sum of the gross conditioned floor area of all floors not to exceed the combined floor area of the three largest floors

IRE<sub>on</sub> = Annual on-site renewable electrical energy generation of a new on-site renewable energy system, to be installed as part of the building project, whose rated capacity is less than the rated capacity required in Section C405.13.1

Table C405.13.2 Annual Off-site Renewable Energy Requirement

<u>Climate Zone</u>	<u>Annual Off-site Renewable Electrical Energy (kWh/W)</u>
<u>1A, 2B, 3B, 3C, 4B, and 5B</u>	<u>1.75 kWh/W</u>
<u>0A, 0B, 1B, 2A, 3A, and 6B</u>	<u>1.55 kWh/W</u>
<u>4A, 4C, 5A, 5C, 6A, and 7</u>	<u>1.35 kWh/W</u>

**C405.13.2.1 Off site procurement.** *The building owner as defined in the International Building Code shall procure and be credited for the total amount of off-site renewable electrical energy, not less than required in accordance with Equation 4-12, with one or more of the following:*

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

**C405.13.2.2 Off-site contract.** *The renewable energy shall be delivered or credited to the building site under an energy contract with a duration of not less than 10 years. The contract shall be structured to survive a partial or full transfer of ownership of the building property. The total required off-site renewable electrical energy shall be procured in equal installments over the duration of the off-site contract.*

**C405.13.3 Renewable energy certificate documentation.** *The property owner or owner's authorized agent shall demonstrate that where RECs or EACs are associated with on-site and off-site renewable energy production required by Sections C405.13.1 and C405.13.2 all of the following criteria for RECs and EACs shall be met:*

1. Are retained and retired by or on behalf of the property owner or tenant for a period of not less than 15 years or the duration of the contract in C405.13.2.2 whichever is less;
2. Are created within a 12-month period of the use of the REC; and
3. Are from a generating asset constructed no more than 5 years before the issuance of the certificate of occupancy.

**C405.13.4 Renewable energy certificate purchase.** *A building that qualifies for one or more of the exceptions to Section C405.13.1 and where it can be demonstrated to the code official that the requirements of Section C405.13.2 cannot be met, the building owner shall contract for renewable*

electricity products complying with the Green-e Energy National Standard for Renewable Electricity products equivalent to five times the amount of total off-site renewable energy calculated in accordance with Equation 4-12.

Revise as follows:

**C406.5.1 Basic renewable credit.** The total minimum ratings of on-site renewable energy systems, not including systems used for credits under Sections C406.7.2 or installed systems used for compliance with Section C405.13.1, shall be one of the following:

1. Not less than 0.86 Btu/h per square foot (2.7 W/m<sup>2</sup>) or 0.25 watts per square foot (2.7 W/m<sup>2</sup>) of *conditioned floor area*.
2. Not less than 2 percent of the annual energy used within the building for building mechanical and service water-heating equipment and lighting regulated in Section C405.

**C406.5.2 Enhanced renewable credit.** Where the total minimum ratings of on-site renewable energy systems exceeds the rating in Section C406.5.1, additional energy efficiency credits shall be determined based on Equation 4-14, rounded to the nearest whole number.

$$AEEC_{RRa} = AEEC_{2.5} \times (RR_a - RR_{REQ} - RR_{WH}) / RR_1$$

(Equation 4-14)

where:

$AEEC_{RRa}$  = Section C406.5.2 additional energy efficiency credits.

$AEEC_{2.5}$  = Section C406.5 credits from Tables C406.1(1) through C406.1(5).

$RR_a$  = Actual total minimum ratings of *on-site renewable energy* systems (in Btu/h, watts per square foot or W/m<sup>2</sup>).

$RR_1$  = Minimum ratings of *on-site renewable energy* systems required by Section C406.5.1 (in Btu/h, watts per square foot or W/m<sup>2</sup>).

$RR_{REQ}$  = Minimum rating of installed on-site renewable energy systems required by Section C405.13 (in BTU/h, watts per square foot or W/m<sup>2</sup>).

$RR_{WH}$  = Minimum rating of installed on-site renewable energy systems used for credits under Section C406.7.2.

**TABLE C407.4.1(1) SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS**

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Space use classification	Same as proposed	The space use classification shall be chosen in accordance with Table C405.3.2(1) or C405.3.2(2) for all areas of the building covered by this permit. Where the space use classification for a building is not known, the building shall be categorized as an office building.
Roofs	Type: insulation entirely above deck	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table C402.1.4	As proposed
	Solar absorptance: 0.75	As proposed
	Emittance: 0.90	As proposed
Walls, above-grade	Type: same as proposed	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table C402.1.4	As proposed
	Solar absorptance: 0.75	As proposed
	Emittance: 0.90	As proposed
Walls, below-grade	Type: mass wall	As proposed
	Gross area: same as proposed	As proposed
	U-Factor: as specified in Table C402.1.4 with insulation layer on interior side of walls	As proposed
Floors, above-grade	Type: joist/framed floor	As proposed
	Gross area: same as proposed	As proposed
	U-factor: as specified in Table C402.1.4	As proposed
Floors, slab-on-grade	Type: unheated	As proposed
	F-factor: as specified in Table C402.1.4	As proposed
Opaque doors	Type: swinging	As proposed
	Area: Same as proposed	As proposed
	U-factor: as specified in Table C402.1.4	As proposed
Vertical fenestration other than opaque doors	Area	As proposed
	1. The proposed vertical fenestration area; where the proposed vertical fenestration area is less than 40 percent of above-grade wall area.	
	2. 40 percent of above-grade wall area; where the proposed vertical fenestration area is 40 percent or more of the above-grade wall area.	
	U-factor: as specified in Table C402.4	As proposed
	SHGC: as specified in Table C402.4 except that for climates with no requirement (NR) SHGC = 0.40 shall be used	As proposed
	External shading and PF: none	As proposed

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN				
Skylights	<p>Area</p> <table border="1"> <tr> <td>1.</td> <td>The proposed skylight area; where the proposed skylight area is less than that permitted by Section C402.1.</td> </tr> <tr> <td>2.</td> <td>The area permitted by Section C402.1; where the proposed skylight area exceeds that permitted by Section C402.1.</td> </tr> </table>	1.	The proposed skylight area; where the proposed skylight area is less than that permitted by Section C402.1.	2.	The area permitted by Section C402.1; where the proposed skylight area exceeds that permitted by Section C402.1.	As proposed
	1.	The proposed skylight area; where the proposed skylight area is less than that permitted by Section C402.1.				
	2.	The area permitted by Section C402.1; where the proposed skylight area exceeds that permitted by Section C402.1.				
	U-factor: as specified in Table C402.4	As proposed				
SHGC: as specified in Table C402.4 except that for climates with no requirement (NR) SHGC = 0.40 shall be used.	As proposed					
Lighting, interior	The interior lighting power shall be determined in accordance with Section C405.3.2. Where the occupancy of the building is not known, the lighting power density shall be 1.0 watt per square foot based on the categorization of buildings with unknown space classification as offices.	As proposed				
Lighting, exterior	The lighting power shall be determined in accordance with Tables C405.5.2(1), C405.5.2(2) and C405.5.2(3). Areas and dimensions of surfaces shall be the same as proposed.	As proposed				
Internal gains	Same as proposed	Receptacle, motor and process loads shall be modeled and estimated based on the space use classification. End-use load components within and associated with the building shall be modeled to include, but not be limited to, the following: exhaust fans, parking garage ventilation fans, exterior building lighting, swimming pool heaters and pumps, elevators, escalators, refrigeration equipment and cooking equipment.				
Schedules	Same as proposed <b>Exception:</b> Thermostat settings and schedules for HVAC systems that utilize radiant heating, radiant cooling and elevated air speed, provided that equivalent levels of occupant thermal comfort are demonstrated by means of equal Standard Effective Temperature as calculated in Normative Appendix B of ASHRAE Standard 55.	Operating schedules shall include hourly profiles for daily operation and shall account for variations between weekdays, weekends, holidays and any seasonal operation. Schedules shall model the time-dependent variations in occupancy, illumination, receptacle loads, thermostat settings, mechanical ventilation, HVAC equipment availability, service hot water usage and any process loads. The schedules shall be typical of the proposed building type as determined by the designer and approved by the jurisdiction.				
Mechanical ventilation	Same as proposed	As proposed, in accordance with Section C403.2.2.				
Heating systems	Fuel type: same as proposed design	As proposed				
	Equipment type <sup>a</sup> : as specified in Tables C407.4.1(2) and C407.4.1(3)	As proposed				
	Efficiency: as specified in the tables in Section C403.3.2.	As proposed				
	Capacity <sup>b</sup> : sized proportionally to the capacities in the proposed design based on sizing runs, and shall be established such that no smaller number of unmet heating load hours and no larger heating capacity safety factors are provided than in the proposed design.	As proposed				

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Cooling systems	Fuel type: same as proposed design	As proposed
	Equipment type <sup>c</sup> : as specified in Tables C407.4.1(2) and C407.4.1(3)	As proposed
	Efficiency: as specified in Tables C403.3.2(1), C403.3.2(2) and C403.3.2(3)	As proposed
	Capacity <sup>b</sup> : sized proportionally to the capacities in the proposed design based on sizing runs, and shall be established such that no smaller number of unmet cooling load hours and no larger cooling capacity safety factors are provided than in the proposed design.	As proposed
	Economizer <sup>d</sup> : same as proposed, in accordance with Section C403.5.	As proposed
Service water heating <sup>e</sup>	Fuel type: same as proposed	As proposed
	Efficiency: as specified in Table C404.2	For Group R, as proposed multiplied by SWHF. For other than Group R, as proposed multiplied by efficiency as provided by the manufacturer of the DWHR unit.
	Capacity: same as proposed	As proposed
	Where no service water hot water system exists or is specified in the proposed design, no service hot water heating shall be modeled.	
On-site Renewable Energy	<p><u>Where a <i>system providing on-site renewable energy</i> has been modeled in the <i>proposed design</i> the same system shall be modeled identically in the <i>standard reference design</i> except the rated capacity shall meet the requirements of Section C405.13.1</u></p> <p><u>Where no system is designed or included in the proposed design, model an unshaded photovoltaic system with the following characteristics:</u></p> <p><b><u>Size:</u></b> Rated capacity per Section C405.13.1</p> <p><b><u>Module Type:</u></b> Crystalline Silicone Panel with glass cover, 19.1% nominal efficiency and temperature coefficient of -0.35%/°C. Performance shall be based on a reference temperature of 77° F (25° C), airmass of 1.5 atmosphere and irradiance of 317 Btu/h x ft<sup>2</sup> (1000 W/m<sup>2</sup>).</p> <p><b><u>Array Type:</u></b> Rack mounted array with installed nominal operating cell temperature (INOCT) of 103° F (45° C).</p> <p><b><u>Total System Losses</u></b> (DC output to AC output): 11.3%.</p> <p><b><u>Tilt:</u></b> 0-degrees (mounted horizontally).</p> <p><b><u>Azimuth:</u></b> 180 degrees.</p>	As proposed

For SI: 1 watt per square foot = 10.7 w/m<sup>2</sup>.

SWHF = Service Water Heat Recovery Factor, DWHR = Drain Water Heat Recovery.

- a. Where no heating system exists or has been specified, the heating system shall be modeled as fossil fuel. The system characteristics shall be identical in both the standard reference design and proposed design.
- b. The ratio between the capacities used in the annual simulations and the capacities determined by sizing runs shall be the same for both the standard reference design and proposed design.
- c. Where no cooling system exists or no cooling system has been specified, the cooling system shall be modeled as an air-cooled single-zone system, one unit per thermal zone. The system characteristics shall be identical in both the standard reference design and proposed design.
- d. If an economizer is required in accordance with Table C403.5(1) and where no economizer exists or is specified in the proposed design, then a supply-air economizer shall be provided in the standard reference design in accordance with Section C403.5.
- e. The SWHF shall be applied as follows:
  1. Where potable water from the DWHR unit supplies not less than one shower and not greater than two showers, of which the drain water from the same showers flows through the DWHR unit then  $SWHF = [1 - (DWHR \text{ unit efficiency} \times 0.36)]$ .
  2. Where potable water from the DWHR unit supplies not less than three showers and not greater than four showers, of which the drain water from the same showers flows through the DWHR unit then  $SWHF = [1 - (DWHR \text{ unit efficiency} \times 0.33)]$ .
  3. Where potable water from the DWHR unit supplies not less than five showers and not greater than six showers, of which the drain water from the same showers flows through the DWHR unit, then  $SWHF = [1 - (DWHR \text{ unit efficiency} \times 0.26)]$ .
  4. Where Items 1 through 3 are not met,  $SWHF = 1.0$ .

**Add new text as follows:**

**C502.3.7 Renewable energy systems.** Additions shall comply with Section C405.13 for the addition alone.

## **Green-e**

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Green-e Energy National Standard for Renewable Electricity Products