International Energy Conservation Code
Electric Power, Lighting, and Renewables (PLR) Subcommittee

Meeting Agenda

February 28, 2022
11:00 AM EST to 2:00 PM EST (3 hours)
Webex Link

Committee Chair: Michael Jouaneh (mjouaneh@lutron.com); **Committee Vice Chair:** Jack Bailey (jbailey@oneluxstudio.com); **Note Taker:** Michael Myer (Michael.myer@pnnl.gov)

1. Call to order – Jouaneh **[start 11:02 am]**

2. Roll Call – Bailey (11 SC voting members needed for quorum)

	First Name	Last Name	Category	Company
	Ali	Alaswadi*	Gov. Regulator	DC
	Jack	**Bailey***	**User**	**One Lux Studio/Int'l Assoc. of Lighting Designers**
	Bernard	Bauer	User	Integrated Lighting Concepts
	Payam	Bozorgchami	Gov. Regulator	CA Energy Comm
	Joe	Cain	Manufacturer	Solar Industries Assoc
	Nick	Ferzacca	User	Architectural Engineers, Inc.
	Anthony	Floyd*	Gov. Regulator	City of Scottsdale
	Glenn	Heinmiller	User	Lam Partners/Int'l Assoc. of Lighting Designers
	Bryan	Holland*	Standards Promulgator	NEMA
	Harold	Jepsen	Manufacturer	Legrand
	Michael	**Jouaneh***	**Manufacturer**	**Lutron**
	Joyce	Kelly	User	GLHN Arch
	Andrew	Klein*	Consumer	BOMA
	Mark	Lien	Standards Promulgator	IES
	Jon	McHugh	Gov. Regulator	CA codes & standards
	Hope	Medina*	Gov. Regulator	Cherry Hills Village
	Melissa	Moseley*	User	HDR/American Society of Interior Designers
	Susan	Musngi*	Consumer	Camden
	Michael	**Myer**	**Consultant**	**PNNL**
	Steven	Rosenstock*	Utility	Edison Electric Institute
	Wayne	Stoppelmoor	Manufacturer	Schneider Electric
	Mitchell	Tolbert	Gov. Regulator	City of Austin
	Michael	Turns	Gov. Regulator	MA Program Administrator

*denotes member of EC4 consensus committee

3. Introduction of any guests -- Bailey (name/representation type into chat)

4. Review/approve agenda – Jouaneh

5. Meeting conduct -- Jouaneh

- Antitrust Reminder
- Identification of Representation / Conflict of Interest (CP#7 Section 5.1.10)
- Code of Ethics

6. Review key actions from last meeting and approve minutes – Jouaneh

7. New business.

- Proposal grouping update – Bailey **[end by 11:10 am]**
- Discuss proposal(s): -- Jouaneh **[end by 1:55 pm]**

CEPI-156-21	Multilevel Lighting Controls
CEPI-155-21	Multilevel Lighting Controls
CEPI-158-21	Multilevel Lighting Controls
CEPI-157-21	Multilevel Lighting Controls
	[end by 11:40 am]
CEPI-151-21	LLLC re-write (high-end trim)
CEPI-160-21	High End Trim **[WITHDRAWN]**
	[end by 12:00 pm]
CEPI-154-21	Multilevel Lighting Controls and DRC
CEPI-161-21	Delete LPA alternate for DRC
CEPI-163-21	MERGED WITH CEPI-161-21
CEPI-162-21	DRC wattage threshold
CEPI-164-21	DRC wattage threshold
CEPI-165-21	Daylight Zones **[WITHDRAWN]**
CEPI-166-21	Daylight Zones
CEPI-167-21	Daylight zone language cleanup
	[end by 12:45 pm]
BREAK	**[end by 12:50 pm]**
CEPI-147-21	Delete LLLC section
CEPI-149-21	LLLC re-write

	[end by 1:10 pm]
Renewable WG	Consensus renewable proposal
CEPI-005-21	Renewable Energy (Mandatory Req. in C405)
CEPI-143-21	Renewable Energy (Mandatory Req. in C405)
CEPI-144-21	Renewable Energy (Mandatory Req. in C405)
	[end by 1:55 pm]

8. Other business – Jouaneh **[end by 1:59 pm]**

- Teams site

9. Future meeting: 11:00 am – 2:00 pm ET on March 14, 2022

10. Adjourn **[2:00 pm]**

FOR FURTHER INFORMATION BE SURE TO VISIT THE ICC WEBSITE:
ICC Energy webpage
Code Change Monograph
FOR ADDITIONAL INFORMATION, PLEASE CONTACT:
Subcommittee Chair

CEPI-151-21

IECC®: C405.2.7 (New)

Proponents: Mike Kennedy, Mike D. Kennedy Inc., representing Northwest Energy Efficiency Alliance; Kevin Rose, representing Northwest EnergyEfficiency Alliance (NEEA) (krose@neea.org)

2021 International Energy Conservation Code

Revise as follows:

Add new definition as follows:

C202 HIGH-END TRIM. A lighting control setting which limits the maximum power to individual luminaires or groups of luminaires in a space.

Add new text as follows:

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

1. Lighting controls as specified in Sections C405.2.1 through C405.2.~~8~~9.

Insert new section

C405.2.7 High-end trim controls. High-end trim controls complying with C405.2.7.1 shall be installed to control the *general lighting* in open plan office space greater than 5,000 square feet.

C405.2.7.1 High-end trim control function. Where required, high-end trim controls shall comply with the following:

1. Limit the initial maximum lighting power to meet desired light levels.
2. Automatic reset of the maximum power setting to accommodate lumen maintenance is allowed.
3. The means of setting the high end trim shall be accessible only to authorized personnel.

C408.3.1.4 High-end trim. Where lighting controls are configured for *high end trim*, verify the following:

1. That the high end trim has been set and report generatinged documenting the settings for each group of fixtures.
2. That the calibration adjustment equipment is located for *ready access* only by authorized personnel.
3. That lighting controls with *ready access* for users cannot increase the lighting power above the maximum level established by the *high-end trim* controls.

Renumber current Sections C405.2.7 and C405.2.8 to be C405.2.8 and C405.2.9 and update references to those sections.

Modified Reason: The modified proposal drops the original proposals requirement for LLLC in open office and the restructuring of the various enhanced lightly specifications. Left is a requirement for high-end trim in open plan offices.

Reason: This proposal restructures the luminaire level lighting control (LLLC) and C406 enhanced lighting control language, modifies the LLLC requirements, adds a high-end trim requirement for LLLC and enhanced controls, and proposes to require LLLC luminaires for general lighting in open offices areas over 5,000 square feet. The goal is to clarify language and increase energy savings.

The proposal moves the C402.2 luminaire level lighting control (LLLC) functional requirements and C406.4 enhanced lighting functional requirementsto a new section. The C402.2 LLLC control alternate and C406.4 language requirement now point to this new section. This arrangement is more congruous with the format of the sections where these requirements currently reside. The LLLC control requirements are clarified so that it is clear that LLLC controls must implement all code required control functions.

The proposal adds high-end trim requirements to both LLLC and enhanced lighting control. New luminaires deliver excess light in anticipation of lumen depreciation and other factors. High-end trim involves the adjustment of the maximum light output fixture so that the delivered light meets design specifications much like test and balance in fan systems. A study by NEEA, Energy Savings from

Networked Lighting Control systems Withand Without Luminaire Level Lighting Controls - October 2, 2020, found high-end trim savings of 27% for LLLC and network lighting controls acrossa study of 194 buildings (Table 2).

Lastly, the proposal adds a requirement to have LLLC for the general lighting in open office spaces larger than 5,000 square feet. A study by NEEA,Energy Savings from Networked Lighting Control systems With and Without Luminaire Level Lighting Controls - October 2, 2020, found LLLC savings of 25% across a study of 194 buildings (Table 2). Savings derived from the finer control resolution afforded by LLLC and possibly the greater usability of the controls. Note that these savings are not over the current 2021 IECC open office control requirements. Savings will be less but still should be significant.
Proposal is drawn from the Washington State Energy Code and the Seattle energy code which have adopted similar language.

Bibliography: 2020 Luminaire Level Lighting Controls Incremental Cost Study. Page 18. January 7, 2021. Northwest Energy Efficiency Alliance. Available at: https://neea.org/resources/2020-luminaire-level-lighting-controls-incremental-cost-study

Energy Savings from Networked Lighting Control systems With and Without Luminaire Level Lighting Controls. October 2, 2020. Northwest Energy Efficiency Alliance. Portland OR. Available at: https://neea.org/resources/energy-savings-from-networked-lighting-control-systems-with-and-without-luminaire-level-lighting-controls
Adjusting lighting levels in commercial buildings: Energy savings from institutional tuning. 2015. Minnesota Department of Commerce, Division of Energy Resources. MN. Available at: http://mn.gov/commerce-stat/pdfs/card-report-lighting-levels-commercial.pdf

Cost Impact: The code change proposal will increase the cost of construction.
Task tuning is estimated to coast $0.03/sf to $0.06/sf by the Minnesota Dept. of Commerce. Assuming 80 square feet per fixture, task tuning costs
$4.80 per fixture.

The Northwest Energy Efficiency Alliance found an incremental LLLC fixture cost of $29 (2020 Luminaire Level Lighting Controls Incremental Cost Study, page 18). This cost was over a code baseline control that did not include the current IECC requirement for open office to have OS control ofall general lighting with zones no larger than 600 square feet. The discussion indicates only 2 occupancy sensors are required (2020 Luminaire Level Lighting Controls Incremental Cost Study, page 16). If the base line control is double to account for 4 sensors and optionally additional time wiring and configuring the baseline cost increases by $200 (controls only) to $500 (controls and labor) which would reduce the incremental cost by
$8 to as much as $20 per fixture. This results in an incremental cost for LLLC fixtures of $9 to $21.

Commercial Minimum Renewable Capacity NBI/DOE Consensus Proposal

SECTION 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:

14. Location of pathways for routing of raceways or cable from the on-site renewable energy system to the electrical distribution equipment.

SECTION C202
GENERAL DEFINITIONS

Add new definitions 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."

OWNER. Any person agent, operator, entity, firm or corporation having any legal equitable interest in the property; or recorded in the official records of the state, county or municipality as holding an interest or title to the property; or otherwise having possession or control of the property, including the guardian of the estate of any such person, and the executor or administrator of the estate of such person if ordered to take possession of real property by a court.

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).

SECTION C405
ELECTRICAL POWER AND LIGHTING SYSTEMS

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 C405.2.4 and 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 C405.2.4.

Add new section C405.13 as follows:

C405.13 Renewable energy systems. *Buildings* in *Climate Zones* 0-7 shall comply with C405.13.1 through C405.13.3.

C405.13.1 On-site renewable energy systems. *Buildings* shall install equipment for on-site renewable electricity generation with a direct current (DC) power rating, at standard rating conditions, of not less than 0.75 W/ft2 (8.1 W/m2) multiplied by the sum of the gross conditioned floor area of all floors not to exceed the combined 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 3.5 kWh/m^2·day (1.1 kBtu/ft^2·day).
2. A *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. A *building* with gross conditioned floor area less than 5,000 square feet (465 m2).

C405.13.2 Off-site renewable energy. Where a *building* does not meet the requirements of Section 405.13.1, either in part or in full, with an o*n-site renewable energy system*, the *building* 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 wth Equation 4-12.

$$TRE_{OFF} = (ARE_{ON} - IRE_{ON}) * 15 \quad \textbf{(Equation 4-12)}$$

Where:

TRE_{OFF} = Total off-site renewable electrical energy in killowatt-hours (kWh) to be procurred in accordance with C405.13.2

ARE_{ON} = Annual on-site renewable electrical energy generation calculated in accordance with the Standard Reference Design on-site renewable energy characteristics in Table C407.4.1(1) and the rated capacity in Section C405.13.1

IRE_{ON} = Annual on-site renewable electrical energy generation of an installed *on-site renewable energy system* whose rated capacity is less than the rated capacity required in Section C405.13.1.

C405.13.2.1 Off site procurement. The building *owner* shall procure and be credited for an 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 project *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.

Exception: Building projects that demonstrate to the AHJ that they cannot comply with Section 405.13.2 and that 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.

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;
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.

SECTION C406
ADDITIONAL EFFICIENCY REQUIREMENTS

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 2.6 Btu/h per square foot (8.1 W/m2) or 0.75 watts per square foot (8.1 W/m2) 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 installed on-site renewable energy systems exceeds the rating in C406.5.1, additional energy efficiency credits shall be determined based on Equation 4-14., rounded to the nearest whole number.

$$AEEC_{RRa} = AEEC_{2.5} \times (RR_a - RR_{REQ} - RR_{WH})/RR_1 \quad \text{(Equation 14-4)}$$

where:

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

$AECC_{2.5}$ = Section 406.5 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^2).

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^2)

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^2)

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

SECTION C407
TOTAL BUILDING PERFORMANCE

Revise as follows:

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

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
On-site Renewable Energy	Where a *system* providing *on-site renewable energy* has been modeled in the *proposed design* the same *system* shall be modeled identically in the *standard reference design* except the rated capacity shall meet the requirements of Section C405.13.1 Where no system is designed or included in the proposed design, model an unshaded photovoltaic system with the following characteristics: **Size:** Rated capacity per Section C405.13.1 **Module Type:** Crystalline Silicon Panel with a 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·ft^2 (1000 W/m^2). **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.	As proposed

SECTION C502
ADDITIONS

Revise as follows:

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

CEPI-156

Proposed Modification

C405.2.3 Dimming controls.

Dimming controls complying with Section C405.2.3.1 are required for the following space types:

1. Classroom / lecture hall / training room.

2. Conference / multipurpose / meeting room.

3. In a dining area for bar/lounge or leisure, family dining.

4. Laboratory.

5. Lobby.

6. Lounge / Break Room.

7. Offices.

8. Gymnasium / fitness center.

9. Library reading room.

10. In a health care facility for imaging rooms, exam rooms, nursery, and nurses' station.

11. Spaces not provided with occupant sensor controls complying with Section C405.2.1.1.

Exception: Luminaires controlled by special application controls complying with Section C405.2.5.

C405.2.3.1 Dimming control function.

Spaces required to have dimming control shall be provided with *manual* controls that allow lights to be dimmed from full output to less than ~~20~~ 10 percent of full power with continuous dimming, as well as turning lights off. *Manual* control shall be provided within each room to dim lights.

~~Exception: *Manual* control is not required where lights are controlled by a programmable dimming system which allows lights to be set to one or more pre-programmed (dimmed) levels.~~

Exception: *Manual* dimming control is not required where lighting controls have a *high-end trim* setting and have undergone functional testing in accordance with C408.3.1.4.

C202 HIGH-END TRIM. A lighting control setting which limits the maximum power to individual luminaires or groups of luminaires in a space.

C408.3.1.4 High-end trim.

Where lighting controls are configured for *high end trim*, verify the following:

1. That *high-end trim* has been set.
2. That the calibration adjustment equipment is located for *ready access* only by authorized personnel.
3. That lighting controls with *ready access* for users cannot increase the lighting power above the maximum level established by the *high-end trim* controls.