TITLE 24, PART 6 | 2025 CODE CYCLE

Controlled Environment Horticulture Lighting

Codes and Standards Enhancement (CASE) Proposal
Nonresidential | Covered Process
Round 2 Stakeholder Meeting

Kyle Booth
May 16, 2023

CALIFORNIA ENERGY CODES & STANDARDS
A STATEWIDE UTILITY PROGRAM

Agenda

- Proposal Summary of Need
- Stakeholder Feedback and Feedback Requested
- Cost-effectiveness, Energy Savings and Statewide Impacts
- Next Steps

Code Change Proposal

- Code Change Proposal
- Code Change Language

Proposed Code Change – CEH Lighting

1. Increase minimum photosynthetic photon efficacy (PPE) for indoor CEH lighting to **2.3 µMol/J**
2. Increase minimum PPE for greenhouse CEH lighting to **1.9 µMol/J**

Summary of Need

High Savings Potential: Estimated first-year statewide savings of 111 GWh
Cost Effective Measures: Cost effectiveness range of 3.6-4.9, highly cost effective
Energy Intensive Industry: CEH industry energy use can help meet state GHG reduction goals

Additional information, including the slides from Round 1 meetings, can be found here:
https://title24stakeholders.com/measures/cycle-2025/controlled-environment-horticulture/

Measure Evolution – CEH HVAC/Dehumidification

Measure is being dropped from the 2025 code change proposal

Options Reviewed for CEH HVAC/D Code Development:

1. Integrated CEH HVAC/D controls
2. Variable speed condensing units on CEH HVAC/D systems
3. CEH HVAC/D commissioning
4. CEH HVAC load calculations for right-sizing of systems

Barriers to CEH HVAC/D Code Development:

1. Federal pre-emption for stand-alone dehumidifiers
2. Lack of test procedures, standards, and sizing guides specific to the CEH industry
3. Lack of industry-accepted commissioning guidelines

Potential Resolutions to Barriers for Future Code Cycles:

1. Development of a CBECC performance model for CEH HVAC/D
2. ASHRAE development of CEH-specific standards, test procedures, and guidelines

Draft Code Change Language - Indoor

Draft code language available in the Handouts section of GoToWebinar

2. Indoor growing, horticultural lighting. In a building with CEH spaces and with more than 40 kW of aggregate horticultural lighting load, the electric lighting systems used for plant growth and plant maintenance shall meet all of the following requirements:

A. The horticultural lighting systems shall have a photosynthetic photon efficacy (PPE) rated in accordance with ANSI/ASABE S640 for wavelengths from 400 to 700 nanometers and meet one of the following requirements:

i. Integrated, nonserviceable luminaires shall have a rated PPE of at least 2.3 ~~1.9~~ micromoles per joule~~; or~~

~~ii. Luminaires with removable or serviceable lamps shall have lamps with a rated PPE of at least 2.3 1.9 micromoles per joule.~~

Draft Code Change Language - Greenhouse

Draft code language available in the Handouts section of GoToWebinar

6. Greenhouses, horticultural lighting. In a greenhouse with more than 40 kW of aggregate horticultural lighting load, the electric lighting system used for plant growth and plant maintenance shall meet the following requirements:

A. The horticultural lighting systems shall have a photosynthetic photon efficacy (PPE) rated in accordance with ANSI/ASABE S640 for wavelengths from 400 to 700 nanometers and meet one of the following requirements:

i. Integrated, nonserviceable luminaires shall have a rated PPE of at least ~~1.7~~ 1.9 micromoles per joule; or

ii. Luminaires with removable or serviceable lamps shall have lamps with a rated PPE of at least ~~1.7~~ 1.9 micromoles per joule.

Discussion

Questions:

Should the lamps pathway be removed for indoor lighting given that there are likely no lamp products with a 2.3 PPE or higher?

Should the 40-kW threshold be revised?

Are there any recommendations to improve the lighting controls requirements to better reflect CEH industry practices for lighting controls?

Poll

- **Measure Name:** Controlled Environment Horticulture
- **Type of Poll:** Multiple answer, ranked
- **Question:** Which factors matter most to growers when choosing a grow light?
- **Answers:** First cost, operating cost, light intensity, spectrum, technology type, form factor

Placement: Present after draft code language (currently slide 19)

Summary of Stakeholder Feedback

- Summary of Feedback Received
- Stakeholder Outreach Summary
- Potential Barriers and Solutions

Summary of Feedback from Round 1 Meeting

Concern on using DesignLights Consortium's (DLC) Horticultural Lighting Requirements V3.0 as code minimum efficacy

1. Massachusetts currently utilizes DLC as one of its paths for code minimum efficacy
2. Open to hearing other alternate minimum efficacies, no alternate suggestions received yet

Concern about grow light incentives going away with the proposed increase in minimum PPE

1. Cal NEXT is working to consider pathways for grow light incentives, potentially accelerated replacement measure application type if applicable for retrofits
2. Potential to go a certain percentage above code for savings, common practice in conventional lighting programs

Individual Stakeholder Outreach to Date

Contact	Organization
Andrew Gustafson	TRC
Nicole Hathaway	CLTC
Jeremy Yon	Current lighting
Nicole Hathaway	CLTC
Corinne Wilder	Fluence
Ihor Lys	Agnetix
Tony Vilgiate	CABA Tech
Ryan Doyle	Agxano
Tom Roth	Hawthorne Gardening Company
Bob Gunn	Seinergy
Tony Vilgiate	CABA Tech
Ryan Doyle	Agxano
Andrew Horowitz	Kubo Greenhouses
Dick Kramp	AB Energy
Kurt Parbst	Borlaug

Contact	Organization
Dan Dettmers	Quest Climate
Keith Coursin	Desert Aire
Brian Kammers	Desert Aire
Adrian Giovenco	Inspire Transpiration Solutions
Rupal Choksi	Madison Indoor Air Quality
Garth Torvestad	2050 Partners
Joji Singh	Inspire Transpiration Solutions
HVAC Working Group	Quest Climate, Desert Aire, Inspire, TRC, McHugh Energy, Franklin Energy
David Morrison	NGMA
Aaron Hodgson	Glass House
Robert Hanifin	Svensson

Poll

- **Measure Name:** Controlled Environment Horticulture
- **Type of Poll:** Multiple choice (multiple answer)
- **Question:** What steps can the industry take to support CEH HVAC/D codes development moving forward?
- **Answers:** Open-ended

Placement: Present after “Individual stakeholder outreach to date” (currently slide 25)

Cost Effectiveness and Energy Savings

Methodology and Assumptions

- Energy Savings Methodology and Results
- Cost Impacts Methodology and Results
  - Incremental costs
  - Energy cost savings

Preliminary Energy Savings Estimates Per sq. ft.

Annual Electricity Savings (kWh/yr)	63.35
Peak Demand Reduction (W)	0.047
Life Cycle Energy Savings (kBtu/yr)	332.71
Annual Source Energy Savings (kBTU/yr)	71.94

Key Assumptions:

Indoor:

Baseline: 1.9 PPE

Proposed: 2.3 PPE

Greenhouse:

Baseline: 1.7 PPE

Proposed: 1.9 PPE

Incremental Per Luminaire Cost – Indoor

Over 30 Year Period of Analysis

Incremental First Cost	
Equipment	$720.40
Installation	$0.00
Total	**$720.40**

Incremental Maintenance Cost	
Equipment Replacement	$1,440.80
Incremental Maintenance	($2,010.68)
Total	**($569.88)**

Total per luminaire incremental cost over 30-year period of analysis for indoor CEH lighting: **$150.52**

Baseline technology cost: Double-ended HPS
Proposed measure cost: Horticultural LED

Cost data came from:

- Online lighting distributor pricing
- Manufacturer pricing

Are there LED maintenance costs we should factor in?

Incremental Per Luminaire Cost – Greenhouse

Over 30 Year Period of Analysis

Incremental First Cost	
Equipment	$60.92
Installation	$0.00
Total	**$60.92**

Incremental Maintenance Cost	
Equipment Replacement	$121.84
Incremental Maintenance	($82.37)
Total	**$39.47**

Total incremental cost over 30-year period of analysis: **$100.39**

Assumes a mix of double-ended HPS and CMH luminaires for baseline, all double-ended HPS for proposed code efficiency

Cost Effectiveness

Indoor CEH Lighting

Climate Zone	Benefits Life Cycle Energy Cost Savings + Other PV Savings [a] (2026 PV$)	Costs Total Incremental PV Costs [b] (2026 PV$)	Benefit-to-Cost Ratio
All	$292.25	$7.56	3.63

Greenhouse CEH Lighting

Climate Zone	Benefits Life Cycle Energy Cost Savings + Other PV Savings [a] (2026 PV$)	Costs Total Incremental PV Costs [b] (2026 PV$)	Benefit-to-Cost Ratio
All	$40.46	$4.95	4.88

Poll

- **Measure Name:** Controlled Environment Horticulture
- **Type of Poll:** Open-ended
- **Question:** Any additional information to provide that could inform CEH lighting costs, savings, or feasibility?
- **Answers:** Open-ended

Placement: Present after “Cost effectiveness” (currently slide 32)

Statewide Impacts

Methodology and Assumptions

- Statewide Energy Impacts Methodology and Results

Preliminary Statewide Energy Savings Estimates

Annual Electricity Savings (GWh/yr)	111.20
Peak Demand Reduction (MW)	0.08
Life Cycle Energy Cost Savings (Million $2026 PV)	590.34
Annual Source Energy Savings (Million kBTU/yr)	114.89

Key Assumptions:

- 30% of existing facilities and new construction have LEDs
- 2026 CEC construction forecast
- 8% of building stock affected by alterations

Statewide Economic Impacts Methodology

The Statewide CASE Team estimates annual statewide impacts by multiplying **A x B x C**:

A. per-unit energy impacts (discussed in previous section)
B. number of units of new construction/additions/alterations of each applicable building type
C. portion of affected units in each climate zone

Example:

Per Unit Impacts

Savings type	**Savings** per square foot
Electricity	[X] kWh
Peak demand	[X] Watts
Natural gas	[X] Therms
GHG emissions	[X] Tons CO_2e

×

Affected New Construction

Climate Zone	**Large Office** sq ft	**Assembly** sq ft
1	100	20
2	1,000	1,500
…		
16	5,000	3,000

=

Statewide Energy Impacts

Climate Zone	**Elec Savings** (GWh)	…	**GHG savings** (MT CO_2e)
1	20		1,500
2	50		3,000
…			
16	100		2,000

Discussion and Next Steps

We want to hear from you!

- Provide **any last comments or feedback** on this presentation now verbally or over the GoTo Webinar Questions Pane
- More information on pre-rulemaking for the 2025 Energy Code at https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2025-building-energy-efficiency

Comments on this measure are due by May 31, 2023. Please send comments to info@title24stakeholders.com and copy CASE Authors (see contact info on following slide).

Thank You

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