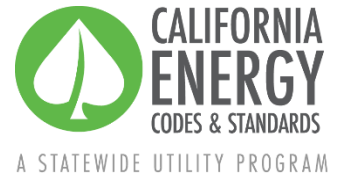


Submeasure Proposal Summary



2022 California Energy Code (Title 24, Part 6)

Covered Processes – Controlled Environmental Horticulture

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Introduction

The document summarizes proposed code changes that will be discussed during a utility-sponsored public stakeholder meeting on April 16, 2020. The Statewide Utility Codes and Standards Enhancement (CASE) Team is seeking input and feedback. Please share comments by email to info@title24stakeholders.com.

Measure Description

The Statewide CASE Team proposes to evaluate indoor horticulture measures for inclusion in the 2022 update cycle of the Title 24, Part 6, Building Energy Efficiency Standards. The proposed measures aim to reduce energy and water use, while maintaining product quality and production volume for crops grown in non-stacked and stacked indoor farms and greenhouses. The Statewide CASE Team considered the plant growth requirements for the following crops in the evaluation of the proposed measures: cannabis, microgreens, vegetable transplants, basil (representing herbs), lettuce (representing leafy greens), tomatoes (representing vine plants), and roses.

Controlled environment horticulture (CEH) is best categorized as a covered process. The primary sections of Title 24, Part 6 for the proposed measures include:

- 120.6 Mandatory Requirements for Covered Processes and
- 141.1 Requirements for Covered Processes in Additions, Alterations to Existing Nonresidential, High-Rise Residential, and Hotel/Motel Buildings.

Greenhouse Envelope

Greenhouses with heating that has capacity greater than 10 Btu/hr-ft² or mechanical cooling that has capacity greater than 5 Btu/hr-ft² are currently defined by Title 24, Part 6 as “conditioned space.” As such, they must meet nonresidential building envelope requirements, which were never intended for greenhouses. This submeasure proposes envelope requirements specific to greenhouses: either non-opaque walls and roof assemblies must have a U-value of 0.71 or less, or a shade curtain system must be installed. These requirements would apply to conditioned greenhouses.



Lighting Minimum Efficacy

The proposed Lighting Minimum Efficacy submeasure requires a minimum photosynthetic photon efficacy (PPE) of 2.1 micromole per joule for luminaires used for plant growth and maintenance in indoor growing facilities and a minimum PPE of 1.4 for greenhouses. The submeasure applies to new construction and lighting alterations of at least 10% of existing luminaires serving an enclosed space in CEH facilities with at least 1,000 ft² of canopy.

Efficient Dehumidification and Reuse of Transpired Water

The Efficient Dehumidification and Reuse of Transpired Water submeasure requires using one of the following dehumidification equipment in indoor growing facilities:

- Free-standing dehumidification units with a minimum energy factor of 1.9 L/kWh.
- Chilled water system with heat recovery for reheating dehumidified air.
- Integrated HVAC system with heat recovery for reheating dehumidified air.

Under this measure, indoor growing facilities with more than 1,000 ft² of canopy and with stand-alone dehumidification system(s) would be required to reuse transpired water for irrigation.

Furthermore, the measure requires CEH facilities – greenhouses and indoor growing facilities – to have integrated thermostatic and humidity controls. This measure also exempts CEH facilities from the prescriptive requirement to install an air-side economizer when CO₂ enrichment as a strategy to promote plant growth is used.

Draft Code Language

The proposed changes to the Standards are provided below. Changes to the 2019 documents are marked with red underlining (new language) and ~~strikethroughs~~ (deletions).

SECTION 100.1 – DEFINITIONS AND RULES OF CONSTRUCTION

PROCESS, COVERED is a process that is regulated under Part 6, Section 120.6 and 140.9, which includes computer rooms, data centers, elevators, escalators and moving walkways, laboratories, enclosed parking garages, commercial kitchens, refrigerated warehouses, commercial refrigeration, compressed air systems, ~~and~~ process boilers, and controlled environment horticulture facilities (including greenhouses and indoor growing facilities).

CONDITIONED SPACE, DIRECTLY: an enclosed space that is provided with wood heating, mechanical heating that has a capacity exceeding 10 Btu/hr-ft², or mechanical cooling that has a capacity exceeding 5 Btu/hr-ft². Directly conditioned space does not include process space or ~~greenhouses~~. (See “process space” and “greenhouse.”)

ANSI/ASABE S640 JUL2017 is the American National Standards Institute / American Society of Agricultural and Biological Engineers document titled “Quantities and Units of Electromagnetic Radiation for Plants (Photosynthetic Organisms),” (ANSI/ASABE S640 JUL2017).

USDOE 10 CFR 430 is the regulation issued by Department of Energy and available in the Code of Federal Regulation - Title 10, Chapter II, Sub-chapter D, Part 430 – Energy Conservation Program for Consumer Products. Relevant testing methodologies are specified in “Appendix N to sub-part B of Part 430 – Uniform test method for measuring the energy consumption of furnaces and boilers.” and in “Appendix X to sub-part B of Part 430 – Uniform Test method for Measuring the Energy Consumption of Dehumidifiers.”

CONTROLLED ENVIRONMENT HORTICULTURE definitions:

Controlled Environment Horticulture (CEH) facility is Occupancy Group F-1 or U building or space that is used for plant growth and production by manipulating indoor environmental conditions including the use of artificial lighting.

Greenhouse is a structure or a thermally isolated area of a building that maintains a specialized sunlit environment used for, and essential to, the cultivation, protection, or maintenance of plants.

Indoor Growing Facility is a type of CEH facility that primarily relies on artificial lighting to grow plants. A warehouse with or without skylights converted to grow plants is an example of an indoor growing facility.

Photosynthetic Photon Efficacy (PPE) is photosynthetic photon flux divided by input electric power in units of micromoles per second per electric watt, or micromoles per joule. **Photosynthetic Photon Flux** is the rate of flow of photons between 400 to 700 nanometers in wavelength from a radiation source as defined by ANSI/ASABE S640 JUL2017.

Horticultural Lighting consists of luminaires used for plant growth and maintenance. Horticultural luminaires may have either plug-in or hardwired connections for electric power.

Shade Curtain System consists of shade cloth material and retractable mounting equipment for shading greenhouse ceilings. The retraction is automated or accomplished manually.

SECTION 120.2 –REQUIRED CONTROLS FOR SPACE CONDITIONING SYSTEMS

(l) Humidistat Control for Controlled Environment Horticultural Facilities. CEH facilities shall have integrated controls for humidity and thermostatic control in 120.2(b).

SECTION 120.6 – MANDATORY REQUIREMENTS FOR COVERED PROCESSES

(h) Mandatory Requirements for Controlled Environment Horticulture Facilities

1. **Canopy Calculations.** Canopy shall be calculated by summing the surface area of spaces that will be used for growing and maintaining plants. Canopy may be noncontiguous, but each unique area included in the total canopy calculation shall be separated by an identifiable boundary that includes, but is not limited to, interior walls, shelves, and fencing. If plants are being cultivated using a shelving system, the surface area of each level shall be included in the total canopy calculation.
2. **Indoor Growing Facilities, HVAC.** HVAC systems used to condition space for the cultivation, protection, or maintenance of plants in indoor growing facilities shall comply with Section 110.2(a).
3. **Indoor Growing Facilities, Dehumidification.** Dehumidification system in indoor growing facilities shall conform to the following requirements:
 - A. **Dehumidification equipment shall be one of the following:**
 - i. **Free-standing dehumidification units with a minimum energy factor of 1.9 L/kWh.**
 - ii. **Chilled water system with onsite heat recovery to achieve dehumidification reheat.**
 - iii. **Integrated HVAC system with onsite heat recovery to achieve dehumidification reheat.**
 - B. **The onsite heat recovery system in Section 120.6(h)3A shall be designed to fulfill at least 60% of the facility's dehumidification air reheat needs during peak dehumidification periods.**

- C. Facilities shall have thermostatic and humidity controls that comply with Section 120.2(l).
 - D. Facilities with more than 1,000 square feet of canopy and with stand-alone dehumidification system(s) shall reuse transpired water for irrigation.
4. **Indoor Growing Facilities, Horticultural Lighting.** In indoor growing facilities with more than 1,000 square feet of canopy, lighting system used for plant growth and plant maintenance shall meet the following requirements:
- A. Luminaires used for plant growth and plant maintenance shall have a photosynthetic photon efficacy of not less than 2.1 micromoles per joule rated in accordance with IES LM-79-19 for wavelengths from 400 to 700 nanometers.
 - B. Time-switch lighting controls shall be installed and comply with Section 110.9(b)1.
 - C. Multi-level lighting controls shall be installed and comply with Section 130.1(b).
- NOTE:** Acceptance test in Reference Nonresidential Appendix NA7.6.2 for time-switches controlling horticultural lighting is not required.
5. **Greenhouses, Horticultural Lighting.** In greenhouses with more than 1,000 square feet of canopy, artificial lighting system used for plant growth and plant maintenance shall meet the following requirements:
- A. Luminaires used for plant growth and plant maintenance shall have photosynthetic photon efficacy of not less than 1.4 micromoles per joule rated in accordance with IES LM-79-19 for wavelengths from 400 to 700 nanometers.
 - B. Time-switch lighting controls shall be installed and comply with Section 110.9(b)1.
- NOTE:** Acceptance test in Reference Nonresidential Appendix NA7.6.2 for time-switches controlling horticultural lighting is not required.
6. **Greenhouses, Envelope.** Greenhouses with heating that has a capacity exceeding 10 Btu/hr-ft² or mechanical cooling that has a capacity exceeding 5 Btu/hr-ft² shall meet one of the following two requirements:
- A. Non-opaque wall and roof assemblies shall have the weighted average U-factor of 0.71 or less.
 - B. Shade curtain system shall be installed.

SECTION 140.4 – PRESCRIPTIVE REQUIREMENTS FOR SPACE CONDITIONING SYSTEMS

(e) Economizers.

EXCEPTION 7 to Section 140.4(e)1: Systems installed in Controlled Environment Horticulture facilities that use carbon dioxide enrichment as a strategy to promote plant growth.

SECTION 140.6 – PRESCRIPTIVE REQUIREMENTS FOR INDOOR LIGHTING

(a) [...]

3. Lighting wattage excluded. The watts of the following indoor lighting applications may be excluded from Adjusted Indoor Lighting Power. ~~(Indoor lighting not listed below shall comply with all applicable nonresidential indoor lighting requirements in Part 6.)~~

[...]

G. Lighting for plant growth or maintenance, if it is controlled by a multi-level astronomical time-switch control that complies with the applicable provisions of Section 110.9. For controlled environment horticulture, the requirements of Section 120.6(h) apply.

[...]

O. Lighting in occupancy group U buildings less than 1,000 square feet. For controlled environment horticulture, the requirements of Section 120.6(h) apply.

P. Lighting in unconditioned agricultural buildings less than 2,500 square feet. For controlled environment horticulture, the requirements of Section 120.6(h) apply.

SECTION 141.1 – REQUIREMENTS FOR COVERED PROCESSES IN ADDITIONS, ALTERATIONS TO EXISTING NONRESIDENTIAL, HIGHRISE RESIDENTIAL, AND HOTEL/MOTEL BUILDINGS

Covered processes in additions or alterations to existing buildings that will be nonresidential, high-rise residential, and hotel/motel occupancies shall comply with the applicable subsections of section 120.6 and 140.9.

(a) Controlled Environment Horticulture Facilities.

1. All newly installed heating, ventilation, air conditioning systems or dehumidification systems in indoor growing facilities shall meet the applicable requirements of Section 120.6(h)2 and 120.6(h)3.
2. Alterations to horticultural lighting systems that increase lighting wattage or include adding, replacing or altering 10% or more of the luminaires serving an enclosed space shall meet the requirements of Section 120.6(h)4 for indoor growing facilities or Section 120.6(h)5 for greenhouses.

EXCEPTION 1 to Section 141.1(a)2: Lighting alterations that only involve replacement of lamps.

NOTE: For alterations that change the occupancy classification of the building, the requirements of Section 141.1 apply to the occupancy that will exist after the alterations.