



Code Amendment Proposal Application Proposal 9

Department of Consumer & Business Services
Building Codes Division
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Read the entire code amendment proposal application before completing this form. Please complete all parts before submitting your proposal and refer to the provided checklist.

APPLICANT INFORMATION

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PROPOSAL INFORMATION

Specialty code: Oregon Reach Code
Code section(s): 3.2; 6.5.6.5; 8.4.3
Briefly explain the subject of your proposal: Horticultural lighting and dehumidification

INSTRUCTIONS AND CHECKLIST


Fill in all the information above and submit this page, signed and dated, with the required supplementary information for Parts I, II, and III listed in the following checklist. This application may be submitted by mail to the mailing address above, or by email to BCD.PTSPtech@oregon.gov.

Checklist:

- Part I** Code amendment language is attached in the proper format.
- Part II** Amendment proposal requirements for amending the code have been reviewed.
- Part III** Amendment proposal criteria questions have been answered and are attached.

Note: One application is required for each code section you are proposing to amend. If this proposal requires changes in other sections of the code for alignment, include those changes as part of this application.

APPLICANT SIGNATURE

Signature:  Date: 2/24/2022

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Oregon Reach Code Proposal: Horticultural lighting and dehumidification

Part I: Code Amendment Language

Modify Section 3.2: Definitions as follows:

DESSICANT DEHUMIDIFICATION SYSTEM. A mechanical dehumidification technology that uses a solid or liquid material to remove moisture from the air.

GREENHOUSE. A structure or a thermally isolated area of a building that maintains a specialized sunlit environment with a skylight roof ratio of 50% or more above the growing area exclusively used for, and essential to, the cultivation, protection or maintenance of plants. *Greenhouses* are those that are erected for a period of 180 days or more.

HORTICULTURAL LIGHTING. Electric lighting used for horticultural production, cultivation or maintenance.

INTEGRATED HVAC SYSTEM. An HVAC system designed to handle both sensible and latent heat removal. Integrated HVAC systems may include, but are not limited to HVAC systems with a sensible heat ratio of 0.65 or less and the capability of providing cooling, dedicated outdoor air systems, single package air conditioners with at least one refrigerant circuit providing hot gas reheat, and stand-alone dehumidifiers modified to allow external heat rejection.

PHOTOSYNTHETIC PHOTON EFFICACY (PPE). Photosynthetic photon flux emitted by a light source divided by its electrical input power in units of micromoles per second per watt, or micromoles per joule ($\mu\text{mol}/\text{J}$) between 400-700nm as defined by ANSI/ASABE S640.

STAND-ALONE DEHUMIDIFIER. A product with the sole purpose of dehumidifying the space that does not include a portable air conditioner, room air conditioner, or packaged terminal air conditioner. Stand-alone dehumidifier is a self-contained, electrically operated, and mechanically encased assembly consisting of 1) a refrigerated surface (evaporator) that condenses moisture from the atmosphere, 2) a refrigerating system, including an electric motor, 3) an air-circulating fan, and 4) a means for collecting or disposing of the condensate.

Add a new section as follows:

6.5.6.5 Dehumidification in spaces for plant growth and maintenance. Equipment that dehumidifies building spaces used for plant growth and maintenance shall comply with one of the following:

1. Dehumidifiers regulated under federal law in accordance with DOE 10 CFR 430 and tested in accordance with the test procedure listed in DOE 10 CFR 430 and DOE 10 CFR 430, Subpart B, Appendix X or X1 as applicable.
2. Integrated HVAC system with on-site heat recovery designed to fulfill at least 75 percent of the annual energy for dehumidification reheat;
3. Chilled water system with on-site heat recovery designed to fulfill at least 75 percent of the annual energy for dehumidification reheat; or
4. Solid or liquid desiccant dehumidification system for system designs that require dewpoint of 50°F or less.

CHAPTER 6
REFERENCED STANDARDS

Revise standard as follows:

DOE

US Department of Energy
c/o Superintendent of
Documents
1000 Independence
Avenue SW
Washington, DC 20585

10 CFR, Part 430—2015: Energy Conservation Program for Consumer Products: Test Procedures and Certification and Enforcement Requirement for Plumbing Products; and Certification and Enforcement Requirements for Residential Appliances; Final Rule

Table C403.3.2(1), Table C403.3.2(2), Table C403.3.2(5), Table C403.3.2(6), Table C403.3.2(14),
Table C404.2, C403.15

Modify Section 8.4 as follows:

8.4.3 Electrical Energy Monitoring

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:

- a. Total electrical *energy*
- b. HVAC systems
- c. Interior lighting
- d. Exterior lighting
- e. Receptacle circuits
- f. Lighting used for plant growth and maintenance.

For *buildings* with tenants, these *systems* shall be separately monitored for the total *building* and (excluding shared *systems*) for each individual tenant.

Exception to 8.4.3.1

Up to 10% of the load for each of the categories (b) through (fe) shall be allowed to be from other electrical loads.

Add new language in Section 9.4: Mandatory Provisions:

9.4.4 Lighting for plant growth and maintenance

Permanently installed luminaires used for plant growth and maintenance shall meet the following requirements:

a. Photosynthetic photon efficacy of not less than 1.7 $\mu\text{mol}/\text{J}$ for greenhouses and not less than 1.9 $\mu\text{mol}/\text{J}$ for all other indoor growing spaces, rated in accordance with ANSI/ASABE S640.

b. Shall be controlled by a time switch lighting control.

Exception

Buildings with no more than 40kW of aggregate horticultural lighting load.

Add new language to Chapter 12 Normative Reference:

Reference	Title
<u>ANSI/ASABE S640</u>	<u>Quantities and Units of Electromagnetic Radiation for Plants (Photosynthetic Organisms)</u>

Part II –Code Amendment Proposal Requirements

To the best of our knowledge, this proposal aligns with all statutes and rules governing the Oregon state building code.

Part III -Code amendment proposal criteria

Indoor Horticultural Lighting

Indoor agriculture energy usage is projected to grow substantially nationwide over the next several years, driven in large part (but not entirely) by the legalization of medical and recreational marijuana. Oregon currently allows for the use of both medical and recreational marijuana.

A total of 46 million square feet of grow area in the U.S. is lit by electric horticultural lighting, 58% of which was in supplemental greenhouses, 41% in non-stacked indoor farms, and 1% in vertical farms. 1 The majority of luminaires in indoor farms and greenhouses are inefficient high-pressure sodium and metal halide high intensity discharge lamps. Because of the large opportunity for energy savings by requiring more efficient luminaires in these applications, the 2021 IECC regulates lighting in these applications although ASHRAE 90.1-2019 does not. Illinois, Massachusetts and California, plus many cities across the country, have completed the process of regulating this use of energy for indoor horticultural. The most common luminaires used in horticultural lighting are single-ended High Pressure Sodium and Metal Halide fixtures which have a typical efficacy of 1.02 $\mu\text{mol}/\text{J}$.3 The luminaire efficacy requirement for indoor and vertical farms of 1.9 $\mu\text{mol}/\text{J}$ can easily be met by almost all LED luminaires on the market for this purpose as well as many double-ended high pressure sodium luminaires. The proposed requirement of 1.7 $\mu\text{mol}/\text{J}$ for greenhouses can be met using a more efficient double-ended high-pressure sodium lamp, and were set following consultations during 2020 with the industry in California. The exception to these requirements for farms with a total connected horticultural lighting load of less than 40 kW helps minimize any financial burden on smaller growers.

Adoption of a requirement for higher efficacy luminaires such as LEDs for electric horticultural lighting would benefit Oregon's controlled environment horticulture industry through a significant reduction in energy use and an associated reduction in both operation and maintenance costs.

In March of 2021, California Statewide Codes and Standards (CASE) Enhancement published a study outlining the associated incremental costs in equipment and maintenance for this new proposed lighting standard. Incremental initial costs for indoor facilities for installing a double ended high pressure sodium lamp was found to be \$4,300 per thousand square feet of indoor canopy and \$2,150 per thousand square feet of canopy for greenhouses.⁴ However, the costs associated with a requirement to switch to higher efficacy luminaires in controlled environmental horticulture application are more than offset by the energy and maintenance cost saving. In fact, for every dollar spent on additional equipment costs, the owner would reap between \$7 in operating and maintenance cost savings in indoor facilities and \$2 in operating and maintenance cost savings for greenhouses.

Horticultural Dehumidification

Indoor agriculture energy usage is projected to grow significantly nationwide in this decade, driven in large part by state legalization of medical and recreational marijuana across the country. In 2017, a total of 20 million square feet of building space was dedicated to growing crops indoors. Energy use by HVAC systems in indoor horticulture facilities can account for 30 to 65% of energy use - primarily because these systems must maintain specific humidity and temperature levels to promote plant growth. Section 403 already requires HVAC systems meet a certain efficiency threshold but does not address the efficiency of dehumidification systems.

The proposed language provides projects with a range of efficient dehumidification strategies. Indoor grow facilities can install dehumidifiers that meet federal minimum efficiency requirements. The proposal also provides options for solid or liquid desiccant dehumidification systems, for utilizing recovered energy in integrated HVAC systems, and for chilled water systems that can meet dehumidification reheat needs.

The incremental cost of installing more efficient dehumidification systems is around \$8.11 per square foot of canopy. This measure results in significant energy savings of between 212 to 255 TDV kBtu/yr per square foot of canopy in Climate Zones 2-4. Every dollar spent to install more efficient equipment resulted in between \$2.33 and \$2.80 in operating and maintenance cost savings over the life of the system.

This proposal is based largely on the requirements listed in Section 120.6(h)1 of [Title 24-2022](#) and is similar to requirements adopted in Denver, CO and being considered for adoption in Washington State, Michigan, and Illinois.