Meeting Notes: March 5, 2026

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These notes summarize the content from the 2028 Title 24, Part 6 Code Cycle Utility-Sponsored Stakeholder Meeting on Nonresidential Controlled Environment Horticulture.

If you are interested in providing input on any of the topics covered in this meeting, please email your comments to info@title24stakeholders.com by April 2, 2026. Comments received after then may not be incorporated into the final version of the CASE Report.

Quick Links

- ***Key Points from Meeting*** – Read through highlights from each measure and review feedback requested from stakeholders.
- ***In-Meeting Questions / Comments*** – Navigate directly to questions asked during the meeting and responses from CASE Authors
- ***Zoom Polls & Responses*** – Review the Poll Questions asked during the meeting and see the responses from stakeholders.
- ***Meeting Materials*** (available on Title24Stakeholders.com) – Review slides, measure summaries, proposed code language and more on our website.

Meeting Information

Meeting Date: 3/5/2026

Meeting Time: 9:30 a.m. – 1:00 p.m.

Meeting Host: California Statewide Utility Codes and Standards Team

Meeting Agenda

Time	Topic	Presenter
9:30	Introduction	
9:45	Controlled Environment Horticultural Lighting Efficacy	Nicole Hathaway
10:15	Controlled Environment Horticulture Daylight Responsive Controls for Greenhouses	Nicole Hathaway
10:45	Controlled Environment Horticulture – Greenhouse Glazing Comment Letter	Lydia Miner
11:15	Controlled Environment Horticulture HVAC/D and Prototype	Garth Torvestad
12:45	Adjourn	

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California Energy Commission

Contact for 2028 Code Cycle:

Any questions for the CEC can be sent to: EnergyCodeUpdateInquiries@energy.ca.gov

CEC Docket

Comments on the 2028 Energy Code update can be formally submitted to the docket: **https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=25-BSTD-03**

Key Points from Meeting

The purpose and benefits of each measure presented at this meeting are noted below. Specific topics we are looking for feedback on are highlighted.

To provide input, email the CASE Authors noted above or send to info@title24stakeholders.com.

Controlled Environment Horticultural Lighting Efficacy

- **Purpose**: Strengthen existing CEH lighting efficacy requirements by requiring horticultural lighting to achieve a luminaire photosynthetic photon efficacy (PPE) of 2.5 micromoles per joule.
- **Benefits**: Cost-effective and technically feasible energy savings.
- **Feedback requested**:
  - Market prevalence of CEH lighting with PPE ≥2.5 micromoles per joule.

- Any situation where lighting fixtures with PPE ≥2.5 micromoles per joule could not achieve the desired lighting spectra.
- Information on standard dimming practice for horticultural lighting.
- PPFD (Photosynthetic Photon Flux Density) maintained in indoor cannabis flowering rooms.
- Incremental first costs moving from a PPE ≥2.3 micromoles per joule horticultural lighting requirement to a PPE ≥2.5 micromoles per joule horticultural lighting requirement for various crop types.

Controlled Environment Horticulture Daylight Responsive Controls for Greenhouses

- **Purpose**: Replace existing CEH lighting controls requirements with more comprehensive efficiency and controls requirements. Requiring daylight responsive controls in greenhouses would prevent over-lighting horticultural spaces when already sufficiently lit by daylight will reduce energy consumption.
- **Benefits**: Cost-effective and technically feasible energy savings.
- **Feedback requested**:
  - The share of larger greenhouses (>40 kW of connected horticultural lighting) that use sensor-based lighting controls.
  - Information on challenges that greenhouse operators have with sensor-based lighting controls.
  - Incremental first costs of PAR sensors with dimming controllers.
  - Effective use life of time clock lighting controls.
  - Effective use life of dimming controllers.
  - Effective use life of PAR sensors.
  - Input on acceptance test protocol in Draft CASE Report.

Controlled Environment Horticulture – Greenhouse Glazing Memo

- **Purpose**: Provide an additional compliance pathway so conditioned greenhouses can either meet the current double-glazing requirement or use single-pane glass paired with a thermal curtain meeting key specifications.
- **Benefits**: Flexibility for growers using glass glazing by allowing either double-glazing or single-pane glazing paired with a high-performance curtain system.
- **Feedback requested**:

- Test methods currently used for greenhouse thermal curtains
- Importance of curtain-gap sealing for greenhouse curtains
- Typical warranty lengths for thermal curtains and for mechanical and control systems
- Typical replacement intervals for curtain fabrics and hardware

Controlled Environment Horticulture HVAC/D and Prototype

- **Purpose**: The CEH HVAC and dehumidification measure intends to provide comprehensive space conditioning requirements for indoor CEH facilities with high lighting intensity serving over 5000 square feet of plant canopy. Improving the sizing and controls of products used for CEH space conditioning and prescriptively requiring space conditioning systems meet specific requirements will reduce the amount of energy consumed by these facilities.
- **Benefits**: Cost-effective energy savings and improved crop yields.
- **Feedback requested**:
  - Availability and customization requirements of integrated space conditioning controls.
  - Approach to implementing energy code ventilation requirements in CO_2 enriched CEH spaces.
  - Replacement intervals for compressors in conventional RTUs used in indoor agriculture flower rooms.
  - Replacement intervals for conventional RTUs used in indoor agriculture flower rooms.
  - Input on posted Space Conditioning, Load Calculation, Sizing, and Unit Performance tool.
  - Input on posted Indoor High Lighting Intensity CEH Prototype.
  - Input on posted Indoor High Lighting Intensity CEH EnergyPlus Model.

In-Meeting Questions / Comments

During the meeting, questions and comments were submitted in the Q&A pane in Zoom as well as asked aloud. Answers are provided below.

Attendees were also asked to respond to polls. Navigate directly to the ***Zoom Polls & Responses*** by clicking the link.

Due to time limitations, not all written questions and comments were discussed during the meeting, but all have responses available in these meeting notes.

Controlled Environment Horticulture Lighting Efficacy, Nicole Hathaway

1. **Question asked via Zoom question pane anonymously:** Is the Cannabis Business Times a California-based magazine?
    a. Amy Droitcour: No, it is not. We would welcome suggestions for additional data sources with California-specific market penetration data.
2. **Question asked via Zoom question pane by Bob Gunn:** The Cannabis Business Times article should not be considered valid market saturation data. It's an informal survey sponsored by an LED company that asks growers if they use any LEDs. LED penetration is likely far less than 78 percent.
    a. Amy Droitcour: We are open to additional data and surveys that would more accurately capture market penetration of LEDs in CA or across the industry. Maybe we can set up time to talk after this meeting to discuss any recommendations you might have?
3. **Question asked via Zoom question pane by Evan Gutierrez:** This was a tricky question because it depends on the context.
    a. Amy Droitcour: Thanks for the input. We'd be happy to discuss further if you have additional inputs.
4. **Question asked via Zoom question pane by Justin Lewis:** Does Title 24 code apply to research greenhouses? As someone in academia, I'm not sure what constraints they have for their research, so I can't vote on lighting needs.
    a. Amy Droitcour: Title 24's horticultural lighting efficacy requirements apply to all greenhouses with at least 40kW of connected horticultural lighting.
5. **Question asked via Zoom question pane by Jeanne Sikora:** Why is calculated savings for cannabis greenhouses lower per square foot when greenhouses use much less electricity than an indoor warehouse?
    a. Amy Droitcour: Because the lighting in greenhouses is less intense and operates less hours per day, the baseline energy per square foot is lower. The percentage of energy saved is the same. Therefore, the savings per square foot from increasing efficacy are lower.
6. **Question asked via Zoom question pane by Rahul Athalye:** What inputs are changed in the energy model to differentiate between the three crops?
    a. Amy Droitcour: Inputs which vary across different crop types are - PPFD, Canopy Area per Luminaire (ft2), & Photoperiod. Baseline andproposed PPE remain constant across all crop types.
7. **Question asked via Zoom question pane anonymously:** How common is it for CEC codes to exceed DLC or Energy Star(R) standards?
    a. Amy Droitcour: In terms of CEH, it is uncommon. These code change proposals are for the 2028 cycle and meet current DLC v4.0 technical requirements. While the 2025 code is equivalent to DLC v3.0.
8. **Question asked via Zoom question pane by Kyle Clark:** In your industry standard practice research, did you take a survey of CEH growers in California, or primarily rely on the 2025 Cannabis Business Times survey? My understanding is that this survey had very small sample size not necessarily representative of California. We primarily

see HPS top lights in California non-stacked sole source cannabis operations, and HPS/MH are still widely used in greenhouse operations.

   a. Amy Droitcour: Thank you for the feedback. Yes, we have talked with California growers. However, we are open to additional data and surveys that would more accurately capture market penetration of LEDs in California or across the industry. Maybe we can set up time to talk after this meeting to discuss any recommendations you might have?

9. **Question asked Verbally by Shamim Ahamed:** Will the model be publicly available with how you did the validations? Asking about the energy model validation.
   a. Joe Sullivan: We've used the same model for a number of years. For each crop type we calculate the energy savings on a per unit basis. The calculation is described in detail in the Draft CASE Report.
   b. Shamim Ahamed: Are you including HVAC savings in the lighting efficacy energy savings calculations?
   c. Joe Sullivan: We include those savings in the ancillary benefits. It would be a good exercise to review those with you. They are included in our lighting model. There are some heating benefits applied.
10. **Question asked via Zoom question pane by Peter Yiannou:** Has cost consideration taken into account the climate computer software?
   a. Amy Droitcour: Software was not considered an incremental cost for the lighting efficacy measure. Please reach out if you think there is software that should be included for this measure.
11. **Question asked via Zoom question pane by Bob Gunn:** Summarizing costs on a $/watt basis might be a more helpful starting point.(Growers and vendors understand this better).
   a. Amy Droitcour: Thanks Bob. Yes, that is a useful metric to include. A lot of the industry feedback we have received in the past expressed concern about changing technology, so we wanted to use photons.
12. **Question asked via Zoom question pane by Daniel Rogers:** I am surprised the EUL in greenhouses is the same as indoor. Could you speak to why those are the same?
   a. Amy Droitcour: Thank you for this comment. Our analysis for the PPE measure assumed that the greenhouse lamps were on a basic timer and not controlled by daylight or PAR sensors. Therefore, greenhouse lighting had the same annual run hours for indoor and greenhouse for each crop type. We have spoken to growers and there are many different approaches to how the lamps are

controlled. We would like to talk more with you about greenhouse strategies if you have input on this.

13. **Question asked via Zoom question pane by Shamim Ahamed:** Would this would cover only for lighting aspect for CEH?
    a. Amy Droitcour: We include some ancillary benefits in the calculations and would be happy to review this with you.

Controlled Environment Horticulture Daylight Responsive Controls, Nicole Hathaway

1. **Question asked via Zoom question pane by Shamim Ahamed:** Is that proposed lighting control based on PPFD or DLI?

    a. Amy Droitcour: There are two options, timeclock + PAR sensor or DLI. Savings were calculated for timeclock + PAR sensor.

    Timeclock + PAR is based on available PPFD at the plant canopy.

2. **Question asked via Zoom question pane by Evan Gutierrez:** I see a large difference in adoption between non-cannabis and cannabis.
    a. Amy Droitcour: Thank you for this input! If you could share data on this, we would be happy to integrate this into our analysis.
3. **Question asked via Zoom question pane by Jeanne Sikora:** I would say all of the above to the poll question about challenges with sensor-based lighting controls.
    a. Amy Droitcour: Thanks for this input!
4. **Question asked via Zoom question pane by Evan Gutierrez:** Is that model publicly available?
    a. Amy Droitcour: The calculations were described in detail in the Draft CASE Report, and we would be happy to review our excel file with you.
5. **Question asked via Zoom question pane by Gene Giacomelli:** ...for poll #6....all of the above listed will be problems at some point during installation and then operation
    a. Amy Droitcour: Thank you for this input!
6. **Question asked via Zoom question pane by Jeanne Sikora:** How do you determine daylight at canopy from solar weather data?
    a. Amy Droitcour: We used solar data from the CEC 2028 weather files for each climate zone and assumed an average light transmission loss based on different greenhouse envelope materials.
7. **Question asked via Zoom question pane by Kyle Clark:** Would the proposed daylight responsive controls measure be applicable to greenhouses using HID lighting (HPS, MH, etc.)? HID fixtures cannot be dimmed as easily as LEDs (or at all in some cases), but there are add-on daylight responsive controls for HIDs that have high savings potential, and HIDs are still the dominant lighting type in California's greenhouses.
    a. Amy Droitcour: Good question! This code would impact newly constructed greenhouses with >40kW of connected lighting, additions or alterations that add at least 40kW of connected lighting, or those that replace at least 40kW of connected lighting. In all these cases, the lighting would be required to be LED.

We will keep an eye out for scenarios where this could be interpreted as applying to lighting that does not dim. Please reach out if you would like to discuss further.

8. **Question asked via Zoom question pane by Matt Stuppy:** Will growers still have the ability to set their desired PAR, PPFD, DLI? They may want to speed crops up or slow them down at different times in the year.
    a. Amy Droitcour: Yes. The input would be the grower's target and could be changed anytime. Some assumptions were made for calculating energy savings, but the proposed code does not prescribe the values.
    b. Amy Droitcour: To clarify: growers can set whatever light level control they desire. The code only requires control capability.
9. **Question asked via Zoom question pane by Kasey Holland:** Seconding Jeannie and Gene's earlier comments about all of those being challenges with sensor-based lighting controls
    a. Amy Droitcour: Thank you!
10. **Question asked via Zoom question pane by Peter Yiannou: Eight** years replacement may be a fair number but recalibration on PAR sensors should take place every two years
    a. Amy Droitcour: Got it. Thank you for the input, Peter!
11. **Question asked via Zoom question pane by Bob Gunn:** General comment: seems good for utilities claiming code savings without offering ratepayer-funded incentives to customers, but unfortunate for utility program participants (vendors and growers) who might have wanted to leverage incentives to adopt new technology.
    a. Amy Droitcour: Thank you for the feedback.
    For DRC control there would still be an opportunity to go above and beyond timeclock + PAR sensor and potentially receive an incentive.
    The 2028 PPE increase is equivalent to DLC v4.0, which is current industry standard.
12. **Question asked via Zoom question pane by Evan Gutierrez:** Are there energy savings documented from an existing measure package to compare against?
    a. Amy Droitcour: We have compared against energy savings from published literature and the recent CalNEXT Report. We are not aware of deemed programs data for timeclock + PAR controls, but would welcome that data if available.

Controlled Environment Horticulture – Greenhouse Glazing Memo, Lydia Miner

1. **Question asked via Zoom question pane by Regnier Ten Haaf:** A double pane glazing also requires a more expensive ventilation system with motors and rack and

pinions. Here in NL, double screen systems are standard, and triple screen systems are moving in, just to be flexible in either energy saving, sun shading, moisture control
    a. Amy Droitcour: Thank you for this input.
2. **Question asked via Zoom question pane by Matt Stuppy:** U Factor testing should be done with a specified lab test to make it consistent.
    a. Amy Droitcour: Thank you for this input!
3. **Question asked via Zoom question pane by Peter Yiannou:** Warranty length for controls is unclear
    a. Amy Droitcour: We would be happy to discuss this further. Please reach out and so we can discuss controls
4. **Question asked via Zoom question pane by Matt Stuppy:** I do not think the code should force manufacturers warranties. Many of the problems referenced are not warranty issues, but operational and maintenance related.
    a. Amy Droitcour: Thanks for the feedback. The goal of a warranty requirement is to ensure lasting energy savings from the curtains, but we would be open to other ways to address this concern. We would be happy to discuss further if you are open to a call.
5. **Question asked via Zoom question pane by Gene Giacomelli:** Dirt?...you mean earthen floor
    a. Nadia: Yes. This is the standard set by IECC in the 90s. Same with the 32 ft x 250 ft dimensions.
6. **Question asked Verbally by Amy Droitcour:** Why single-pane glass and not other materials?
    a. Lydia Miner: Stakeholders have told us that double pane glass is very expensive so we want to find a way for them to achieve efficient operation with single-pane glass.
7. **Question asked Verbally by Peter Yiannou:** Has cost-effectiveness analysis taken into account the added structure, dry systems, and electrical that would be required for double-pane glass greenhouses?
    a. Lydia Miner: This analysis is offering an energy-equivalent option, and not cost-effectiveness.
    b. Peter: It's not cost effective, was just wondering if there are some actual numbers.
    c. Jon McHugh: The current requirement does not require double pane glass. It allows a variety of materials, double-pane. For conditioned greenhouses. I wouldn't look at the base case being double glazed glass. There has been a lot of interest in single-pane. This proposal is looking at the energy equivalence of

single-pane glass greenhouses with energy conserving curtains as vs. a twin wall.

d. David Morrison: I agree with Jon. There are double layer rigid plastic options that this should be compared to. The baseline should be double plastic glazing so as not to misconstrue the savings.

8. **Question asked via Zoom question pane by Peter Yiannou:** Since the double-pane glass requirement, how many of these style greenhouses projects have been realized in California?
    a. Amy Droitcour: Are you asking how many double-pane glass greenhouses have been installed? We can look for that data and get back to you.
9. **Question asked via Zoom question pane by Matt Stuppy:** Would corrugated polycarbonate be an option with a curtain system?
    a. Amy Droitcour: Single-pane glass with curtains or double-pane with any materials would be options.
10. **Question asked via Zoom question pane by Matt Stuppy:** This doesn't consider seasonal production where you may have heating, but not through the entire winter.
    a. Amy Droitcour: Thanks Matt! We will look into adding this to our analysis.

11. **Question asked via Zoom question pane by Peter Yiannou:** Has there been consideration to the UV degradation of polycarbonate thereby restricting the light to the crop? Replacing corrugated Polycarbonate in a venlo style greenhouse is not as easy as a conventional polycarbonate ridge vent.

    Additionally, if a greenhouse has LED lights, considering a light abatement climate screen additionally contributes to energy savings thereby negating the double pane.

    a. Amy Droitcour: Thanks, Peter! Our team agrees that there are a lot of ways curtains can provide energy savings in California greenhouses.

    This is an alternative to an envelope requirement which is inherently a thermal measure. We would be happy to discuss this further offline if you have more input.

Controlled Environment Horticulture HVAC/D and Prototype, Garth Torvestad

1. **Question asked via Zoom question pane by Ian Atkins:** Comments: a decoupled system as a whole has a variable sensible heat ratio depending on how much AC vs how many dehumidifiers are running and can achieve good T/RH control with staging of multiple dehumidifiers for dehumidification capacity control
    a. Amy Droitcour: The issue with the decoupled systems is that dehumidification does not have the ability to reject the excess heat to the outdoors, requiring the secondary, mostly sensible, HVAC system to re-cool that load to remove it from the space. This duplicated cooling is what consumes additional energy. While it is true that there are several stages during the plant's life that the reheat is

welcomed (lights off in late flower for example), there are significant savings opportunities during other portions of the lifespan.

2. **Question asked via Zoom question pane by Ian Atkins:** Any time dehumidifier is running (call for dehumidification) the heat just helps the AC dehumidify more so the heat is never "extra" from a standalone dehumidifier
    a. Amy Droitcour: I think this would be easier to discuss in a separate meeting. I'd be happy to set up a call with our SME team.
3. **Question asked via Zoom question pane by Ian Atkins:** Given the impact of the rule proposed, could you share the unpublished field study data that you reference to support this measure requiring integrated systems? As well as your energy modeling inputs and methodology? My own calculations do not agree with a 40% reduction in HVAC energy use of integrated compared to decoupled systems. A previous Title 24 code also tried to require integrated units but reversed this after 5 commenters pointed out that "standalone can be just as efficient".
    a. Amy Droitcour: The CASE Report cites several other studies that also show energy savings. The CASE Report and the Prototype file posted on the meeting page show the modeling inputs, and the EnergyPlus model is also posted on that page.
4. **Question asked via Zoom question pane by Ian Atkins:** I'd also note that kWh per Ton is not the metric I would use since the integrated and decoupled systems will have a different amount of tons of primary systems (and are you including the dehumidifiers in the energy use and "tons" denominator?). I would suggest using a ratio of HVACD kWh compared to lighting kWh.
    a. Amy Droitcour: In the CASE Report we calculate savings in kWh/canopy square foot because the water vapor drives need for dehumidification.
    In the study that used kWh/ton, the authors did include dehumidifiers in the tonnage.
5. **Question asked Verbally by Ian Atkins:** I'm alarmed that fully decoupled systems are being pushed toward integrated systems. Remember this happened in a previous code cycle and there were a lot of comments about continuing to allow a decoupled system. In the unpublished study with those 10 sites, can you talk about the data comparing integrated and decoupled systems?
    a. Garth Torvestad: That one study is unpublished and we are limited in what we can talk about. Some studies analyze efficiency on a per canopy square foot basis, and this is what we are using for the CASE Report. Broadly at the model and different sources seem to indicate energy savings from 20 to –40 percent. The proposed code does not prevent a decoupled system it is looking to prevent the worst case, very inefficient decoupled system. Decoupled systems would have to follow the performance path.
    b. Ian Atkins: I model decoupled and integrated systems as quite similar energy consumption. There are various variables that can make it go either way. I am skeptical that the code should push for this.
    c. Garth Torvestad: We should meet to compare models and discuss.
6. **Question asked via Zoom question pane by Gene Giacomelli:** Amy, Being GH oriented I will drop off here. Thanks for this opportunity today. I will further Matt Stuppy about other single-layer plastic glazings that may replace the single glass choice [less

$$$, lightweight, but shorter lifespan]...a potentially good choice for a startup to save $$ initially but later to re-glaze with glass.
    a. Amy Droitcour: Thank you for your input! Please reach out if you want to discuss any of the measures further.
7. **Question asked Verbally by Clint Reese:** The 90% reheat, what is that looking at? Winter vs summer? What is that 90% reheat capacity?
    a. Garth Torvestad: Been one of the most challenging things to calculate. We've been using the sixconditions and making sure it's at least 90 percent of the heating load. I'd be happy to talk offline to understand if we should be looking at it a different way. How do you describe it when providing a system?
    b. Clint Reese: Not sure how we do this for this particular system type, but I can reach out to you.
    c. Garth Torvestad: Let's talk further.
8. **Question asked Verbally by Amy Droitcour:** Having to model a decoupled system seems complicated, why not have mandatory efficiency requirements for all the options?
    a. Garth Torvestad: Decoupled systems are federally regulated, so we have to default to the federal minimum regulatory requirements. The legal interpretation is that for a federally regulated piece of equipment, you cannot set an efficiency requirement level more strict than that. When you create the performance path we're not specifying the efficiency. It's particularly tricky because there is not a consistent rating system for the integrated equipment.
9. **Question asked Verbally by Amy Droitcour:** Is there an ASHRAE sizing method you can use, or they can use on their own sizing methodology to demonstrate compliance?
    a. Garth Torvestad: ASHRAE has been working on this. There's an ASHRAE measure moving forward in parallel that would use a similar sizing approach, but we can't count on it being ready in time. Ideally, we would adopt ASHRAE's method, depending on what they come up with. Designers should be able to use their own sizing but should need to have all the info to populate the tool we are using.

Wrap-Up

The meeting concluded with a call for participation throughout the code cycle. Several future meeting dates were presented.

Please reach out to the specific topic lead or info@title24stakeholders.com with input on the measures presented today.

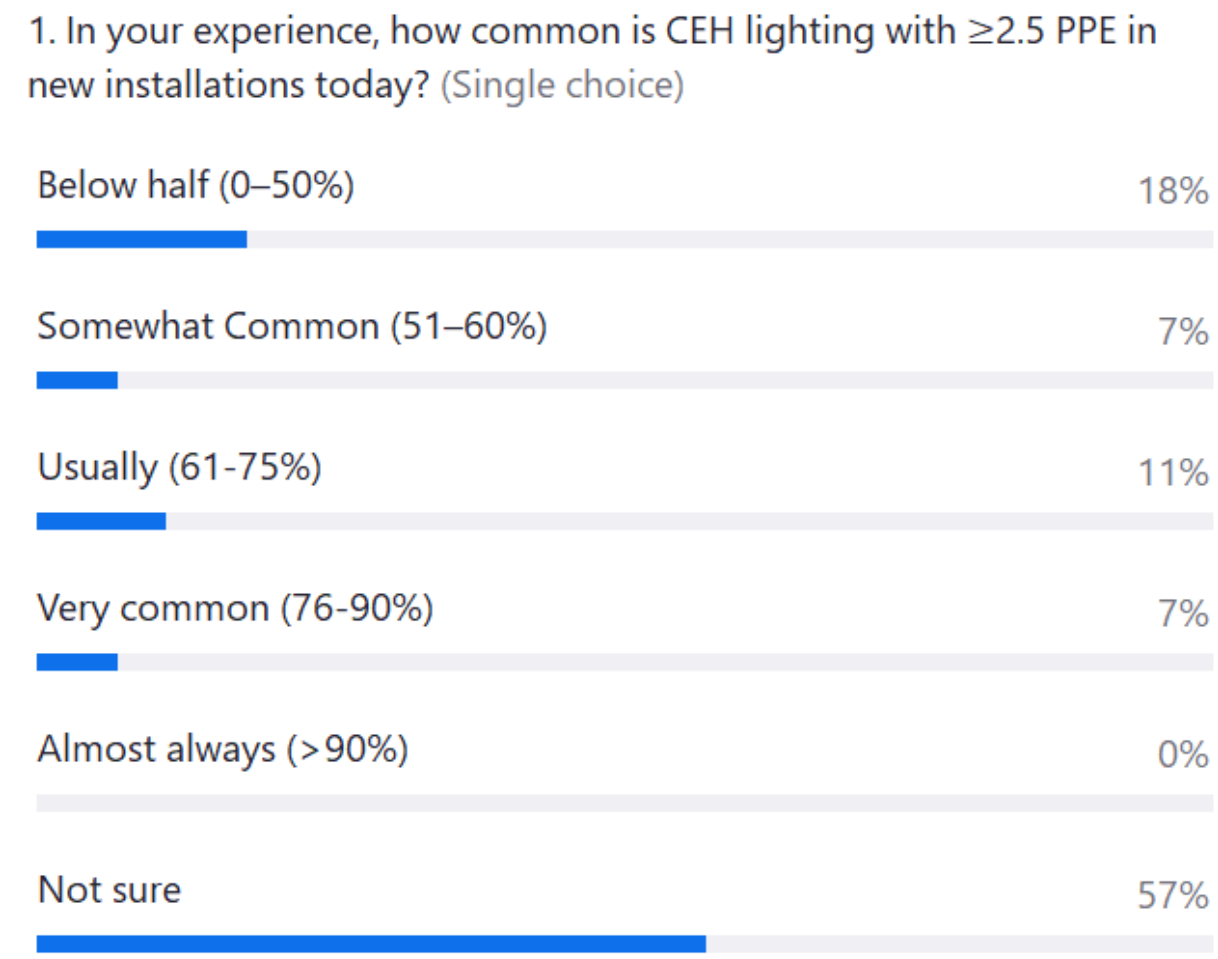
The meeting adjourned at 1:00 p.m. PST.

Zoom Polls & Responses

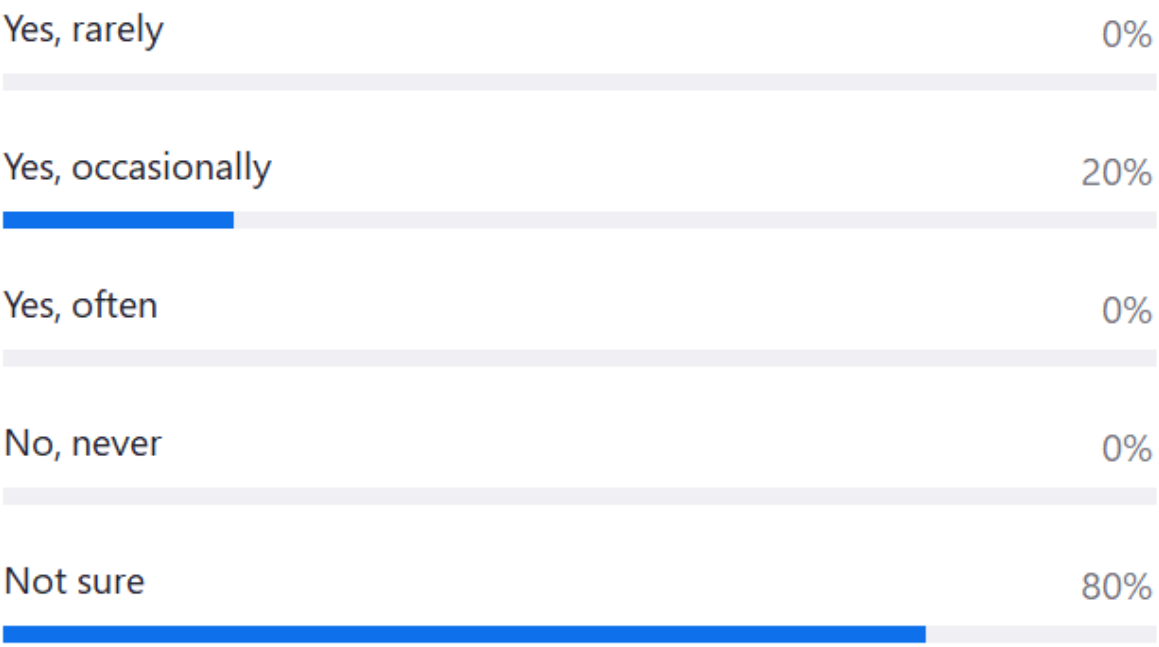
Multiple Choice Questions

For multiple choice questions, below each chart the percentage and number of individuals that chose a particular response is noted in **blue.**

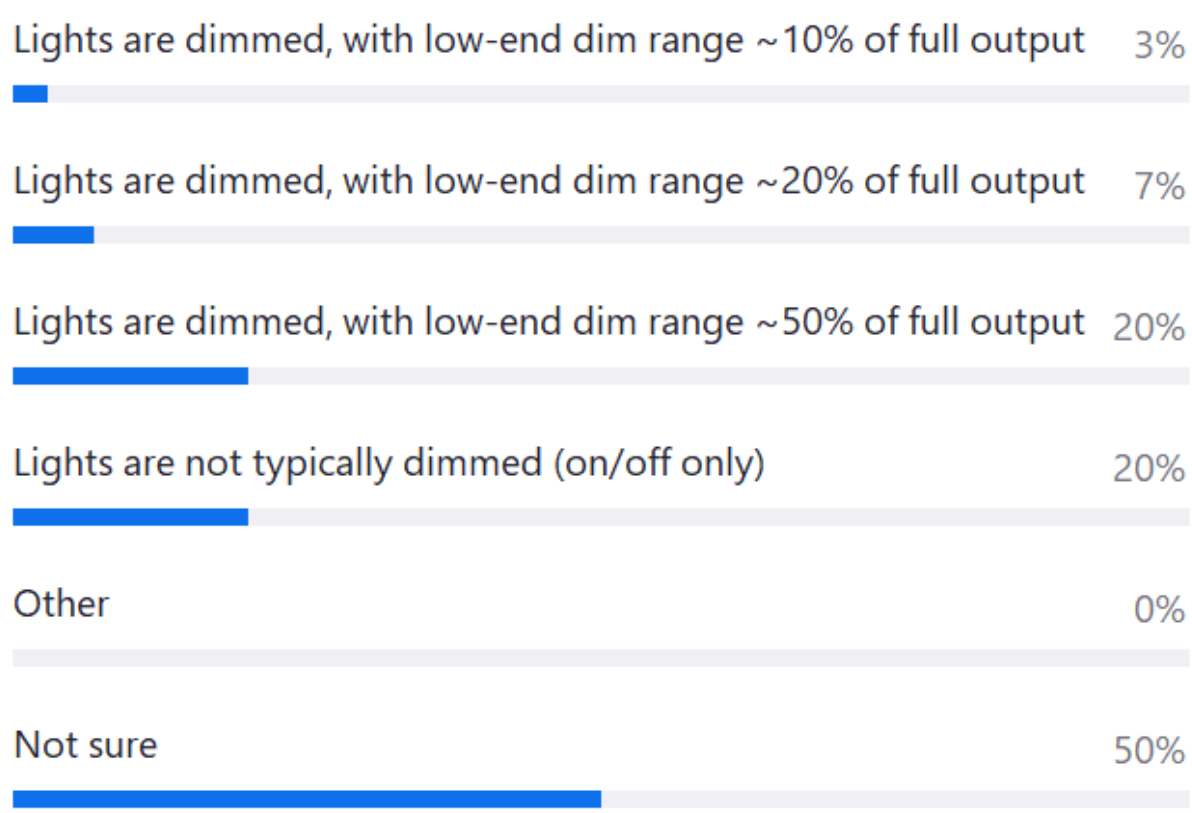
Controlled Environment Horticulture Lighting Efficacy



1. In your experience, have you encountered situations where lighting fixtures with a Photosynthetic Photon Efficacy (PPE) of 2.5 µmol/J or higher could not achieve the desired lighting spectra? (Single choice)



1. Based on your experience, which best describes standard dimming practice for horticultural LED lighting? (Single choice)

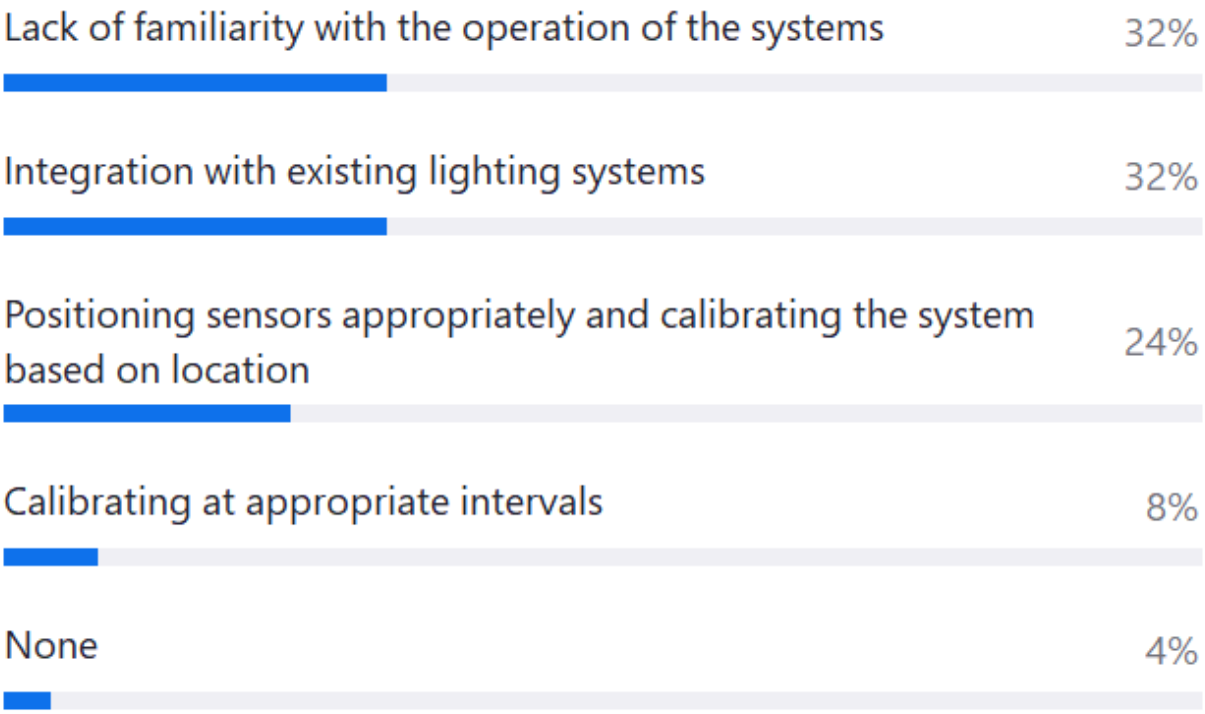


1. What is the typical PPFD (Photosynthetic Photon Flux Density) you maintain in your indoor cannabis flowering rooms? (Single choice)

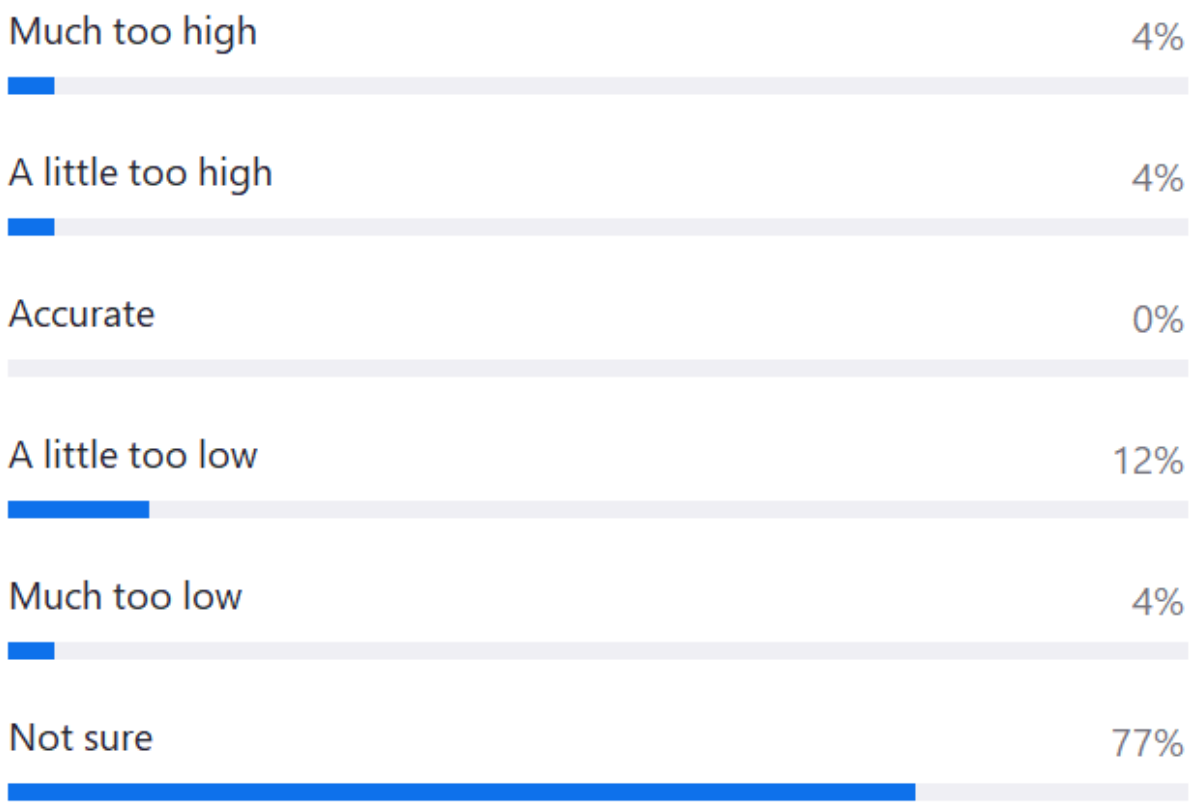
Below 800 µmol/m^2/s	0%
801–1000 µmol/m^2/s	6%
1001–1200 µmol/m^2/s	6%
1201-1400 µmol/m^2/s	9%
Above 1400 µmol/m^2/s	0%
Not sure / don't have an indoor cannabis flower room	79%

Controlled Environment Horticulture Daylight Responsive Controls

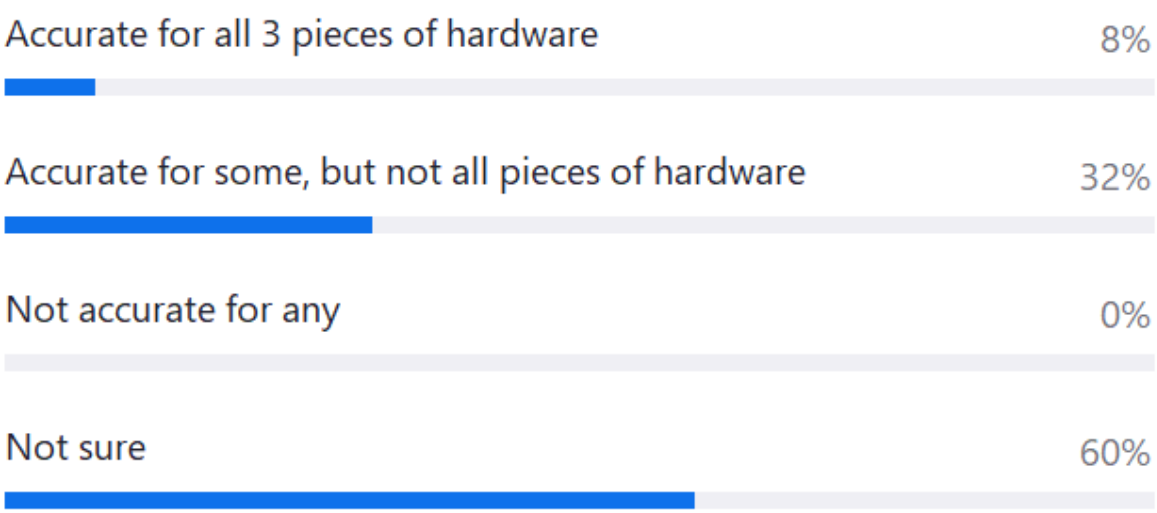
1. Based on your experience, what challenges would greenhouse operators have with sensor-based lighting controls? (Single choice)



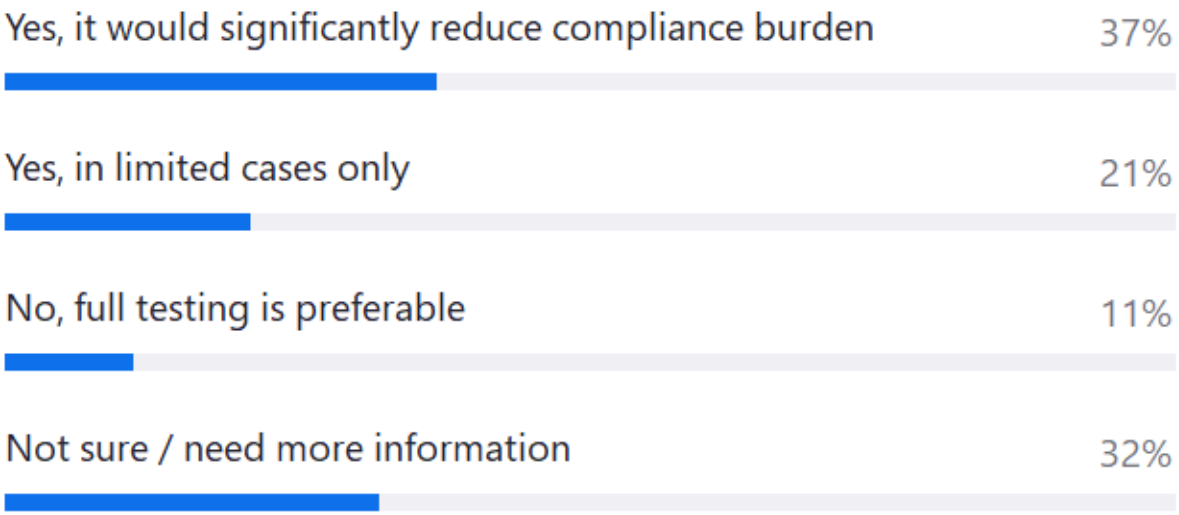
1. Based on your experience in the market, is the proposed incremental first cost ($1499) accurate? (Single choice)



1. Based on your experience in the market, is the EUL of 8 years for time clocks, dimming controllers, and PAR sensors accurate? (Single choice)



1. If lighting zone sampling for acceptance testing were an allowable compliance option, would it be helpful for greenhouses with many lighting control zones? (Single choice)



Controlled Environment Horticulture – Greenhouse Glazing Memo

1. Which curtain types are most commonly used for energy savings in California? (Rank order)

A. Energy Screens/Thermal Curtains 100%

B. Shade Screens 100%

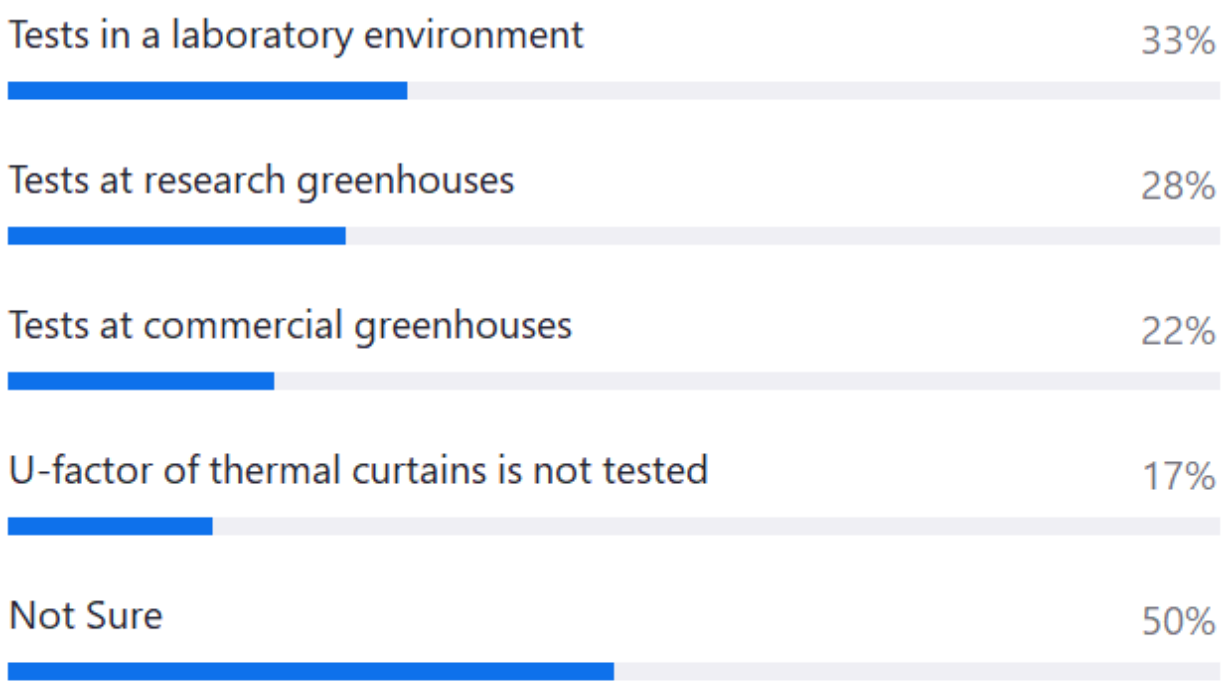
C. Dual Purpose (shade and thermal) 100%

D. Both a Thermal Curtain and a Shade Screen 100%

E. Blackout 100%

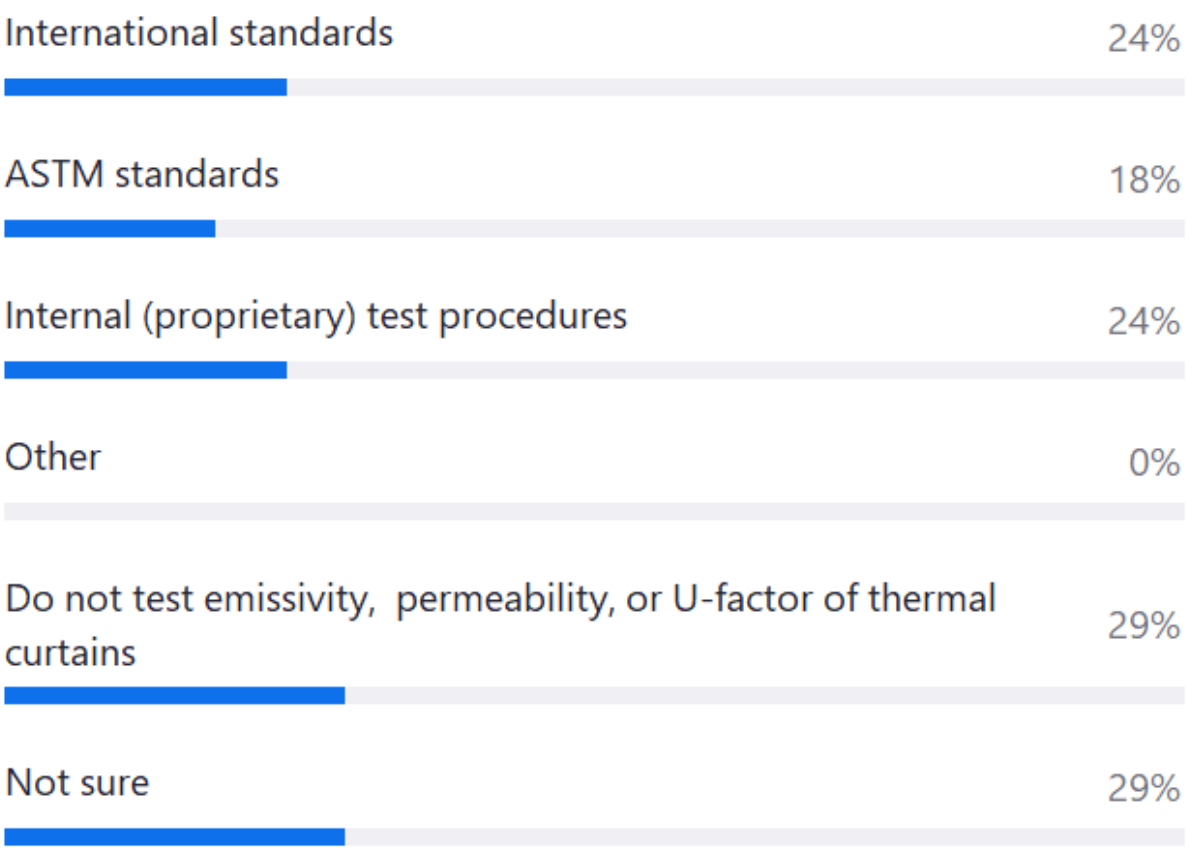
1 - Most common 2 3 4 5 - Least common

1. How do you test U-factor of a greenhouse thermal curtain? Select all that apply (Multiple choice)

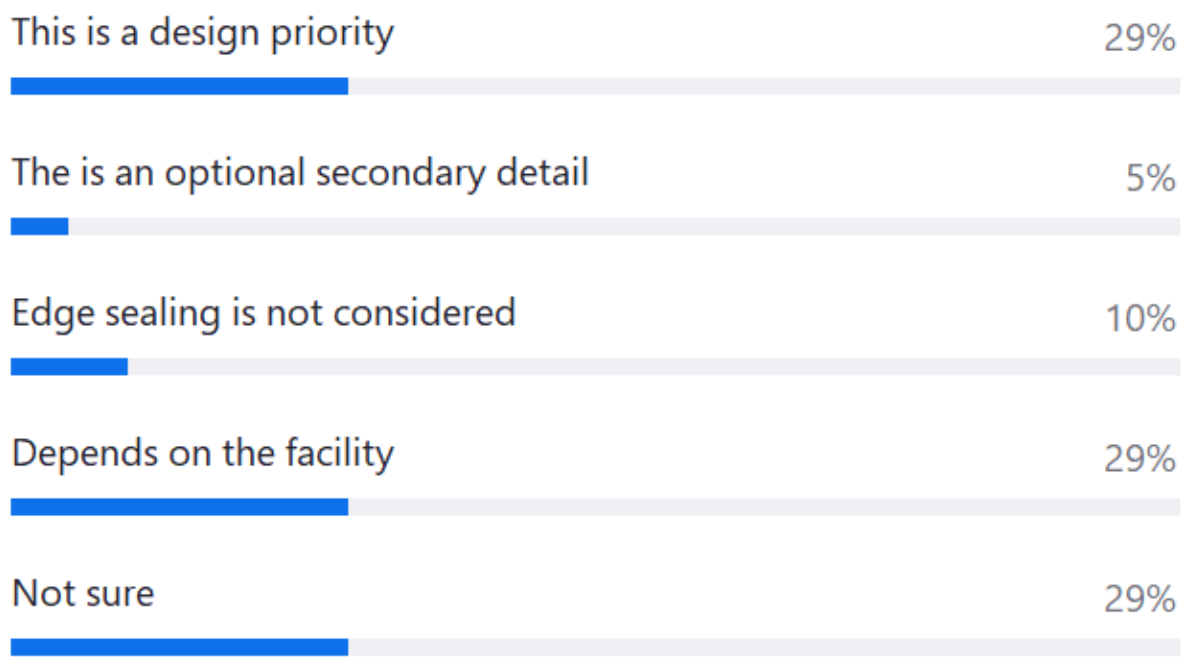


You did not answer this question

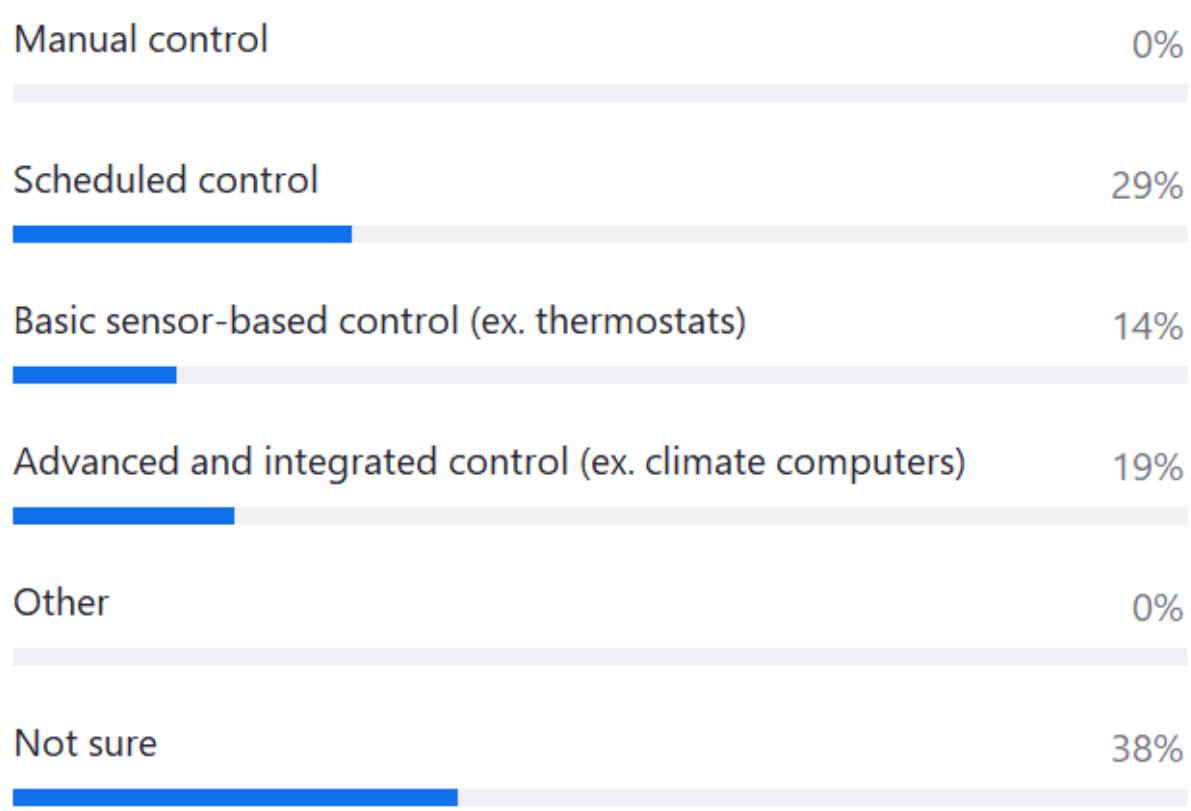
1. What types of test methods do you use to test your greenhouse thermal curtains for emissivity, permeability, and U-factor? Select all that apply (Multiple choice)



1. How do you prioritize curtain gap sealing in your designs or greenhouses? (Single choice)



1. Which types of curtain controls are most commonly used in California greenhouses? (Single choice)

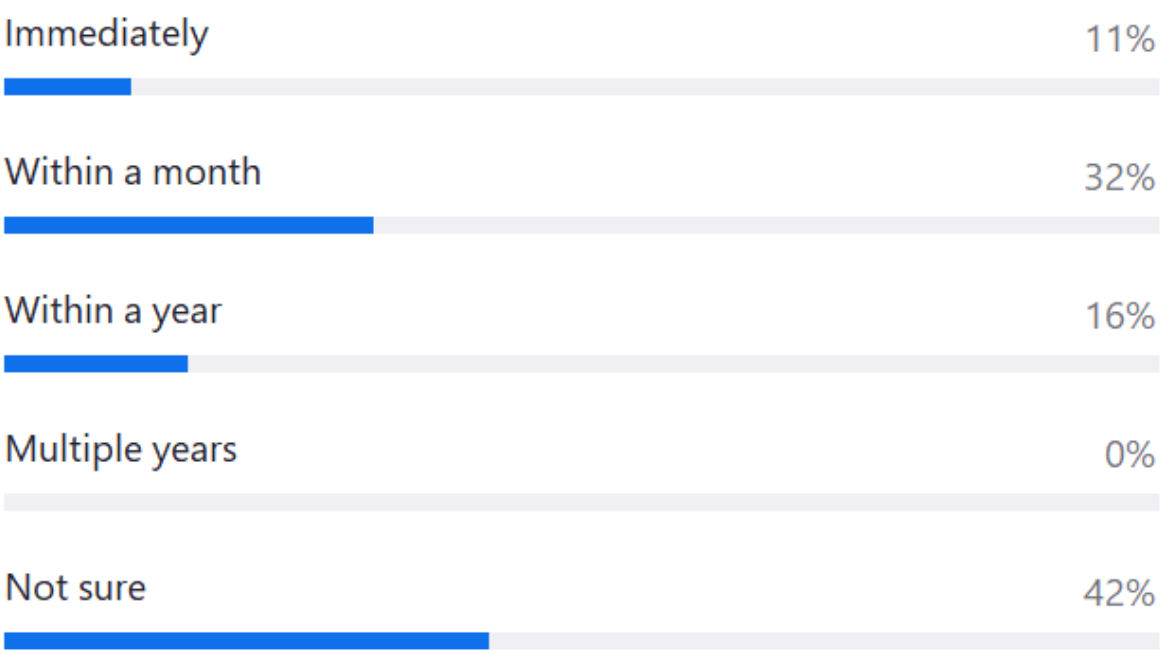


1. What are the warranty-lengths of longer-lasting thermal curtains for greenhouses and their automated controls? (Single choice)

10 years or longer for both curtains and controls	0%
10 years or longer for curtains but 5 years for controls	20%
10 years or longer for controls, but 5 years for curtains	30%
5 years for both curtains and controls	15%
Other (please enter information in chat)	10%
Not sure	25%

1. What is the average interval between greenhouse curtain fabric replacement in California greenhouses? (Single choice)

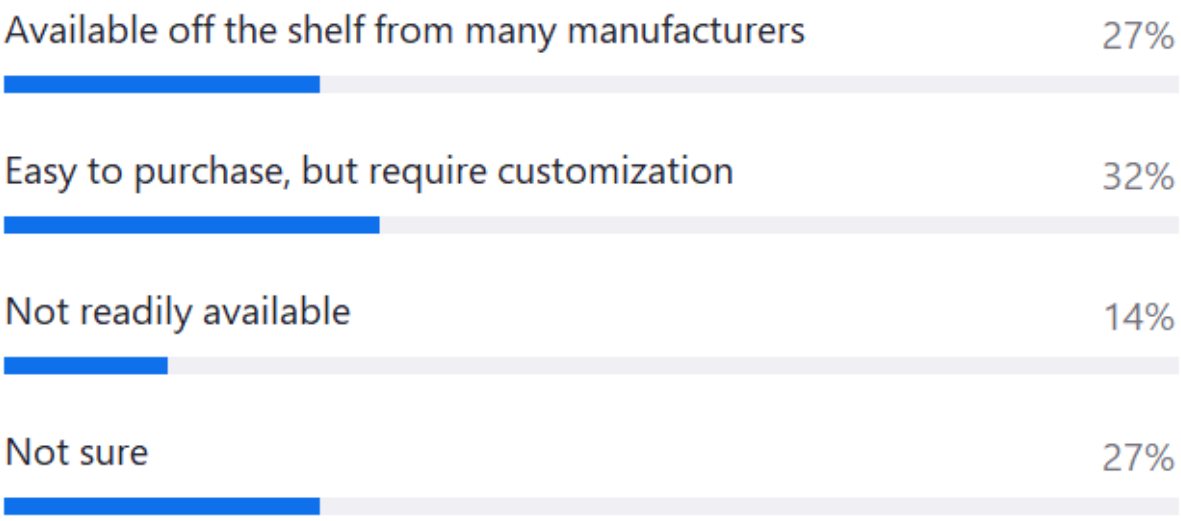
1. How long after curtain hardware or motors stop working are they typically replaced? (Single choice)



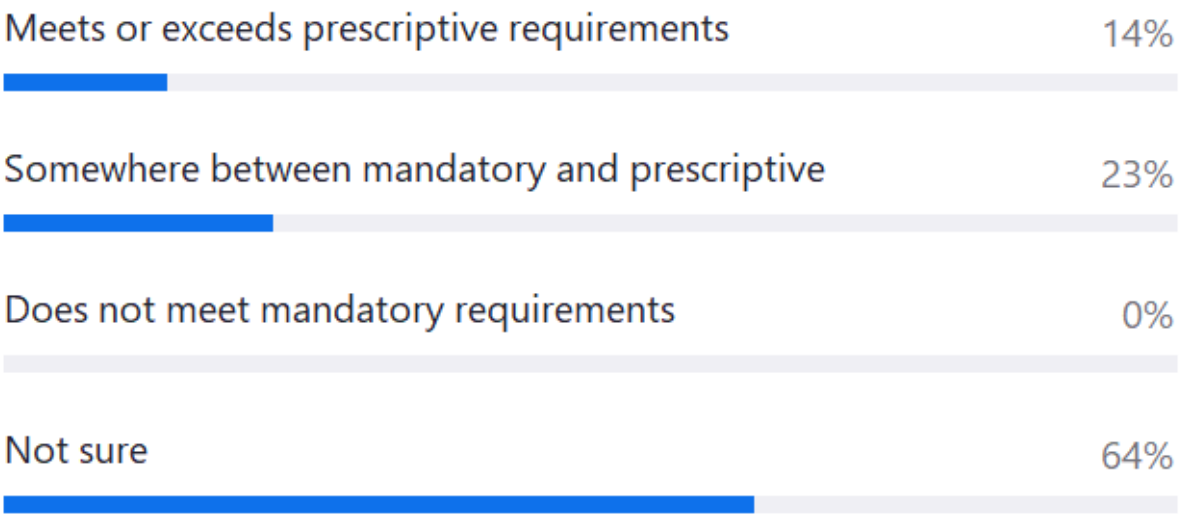
Controlled Environment Horticulture HVAC/D and Prototype

1. How widely available are space conditioning controls that meet the following requirements:

use co-located temperature and humidity sensors within the canopy, provide integrated control for all types of space conditioning equipment in the room,
and stage standalone dehumidifiers, if used? (Single choice)



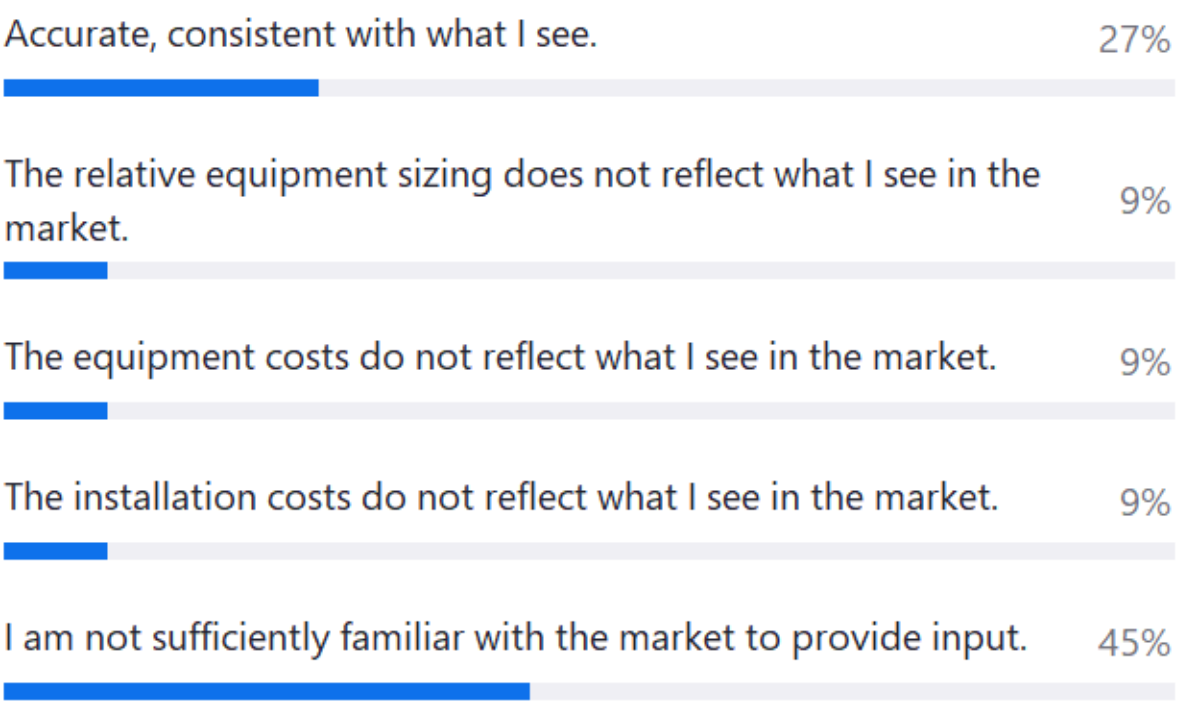
1. How does typical envelope insulation in newly constructed indoor CEH spaces compare to mandatory and prescriptive requirements for metal buildings? (Single choice)



1. When conventional RTUs are used for cooling in indoor agriculture flower rooms, what are common replacement intervals for compressors and for the full unit? (Single choice)

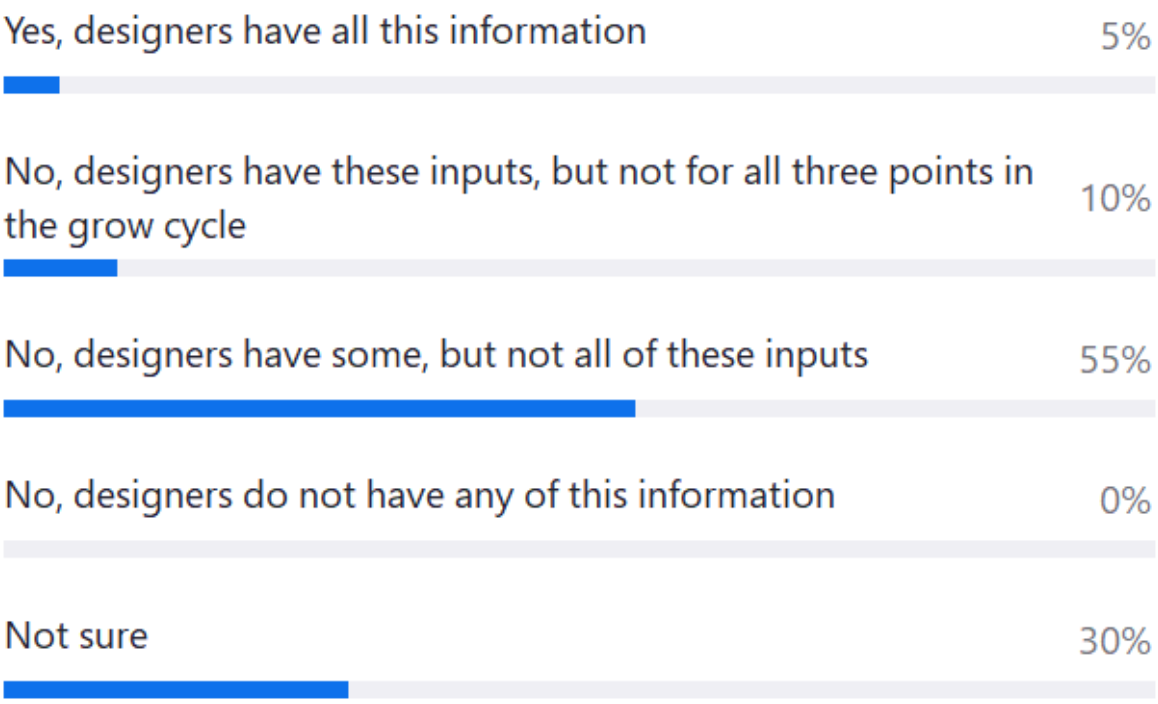
1. Although the cost per ton is higher for integrated systems than decoupled systems, the total tonnage required is less and the installation costs are lower, leading to comparable installed costs, within ~5%.

Based on your experience in the market, do you feel this incremental cost estimate is: (Multiple choice)



1. Do CEH HVAC/D designers know all the required inputs for grow room load calculations?

The proposed required inputs for grow room load calculations include: canopy area (square feet), lighting power (kW), lighting on time (hours), and plant irrigation (gal/day), for day 1 of the grow cycle, an early/mid grow cycle period, and a late grow cycle period.



Long Answer Questions

Controlled Environment Horticulture – Greenhouse Glazing Memo

1. **What else should we know? Are there market or technical barriers or solutions we should consider?**
    a. You should consider the added cost in structure should the double pane requirement remain in place as well as the added cost for drive systems
    b. I am not familiar enough to know.
    c. I'm not aware of any growers trying to maximize their energy usage. It is a significant cost input and will typically be a priority to conserve as much as possible

Controlled Environment Horticulture HVAC/D and Prototype

2. **Do you have any concerns with providing the required equipment performance at user-specified setpoints for lights on and lights off times in the early grow period and late grow period?**
   The proposed required equipment performance parameters include: air flow (CFM), total cooling capacity (BTU/hr), latent removal capacity (BTU/hr), reheat capacity (BTU/hr), and recovered heat capacity (BTU/hr). These parameters would need to be recorded on the NRCC form for lights on and lights off times at an early grow cycle period and late grow cycle period.
   a. No concerns
   b. Not if the provider is experienced in this industry
   c. Rooms are rarely run at the exact same points they are designed, so I do think this should be required
   d. Generally, this data should be available
   e. No
3. **Do you have concerns with a field technician (installer of controls) performing the proposed field verification process?**
   a. No
   b. Possible conflict of interest depending on the controls contractor's relationship and contractual obligations
   c. Will such technicians have some verified certifications for this type of work?
   d. No concerns
   e. No I think we need to make sure we educate them.