Meeting Notes

2022 California Energy Code (Title 24, Part 6)

Agenda for the Utility-Sponsored Stakeholder Meeting for:

Covered Processes Part 2: Controlled Environment Horticulture

Posted April 13, 2020

Meeting Information

Meeting Date: April 16, 2020

Meeting Time: 8:30am – 11:30am PST

Location: Adobe Connect webinar (sign-up at title24stakeholders.com/events)

Meeting Host: California Statewide Utility Codes and Standards Team

Meeting Agenda

Start Time	Topic	Presenter
10 minutes prior to call	Live Attendee Poll	
8:30 am	Meeting Guidelines	Statewide CASE Team
8:35 am	Opening Remarks from the California Energy Commission	Energy Commission Staff
8:40 am	Overview and Welcome	Statewide Utility Codes and Standards Representative
8:45 am	**CASE Presentation I:** Controlled Environment Horticulture	Kyle Booth (Energy Solutions)
11:15 am	Wrap Up & Closing	Statewide CASE Team

Meeting Attendees

Statewide Utility Codes and Standards Team – Utility Staff:

First Name	Last Name	Email	Affiliation
James	Kemper	James.Kemper@ladwp.com	Los Angeles Department of Power and Water
Miguel	Malabanan	Miguel.malabanan@ladwp.com	Los Angeles Department of Power and Water
Mark	Alatorre	Mark.alatorre@pge.com	Pacific Gas and Electric

Kelly	Cunningham	KACV@pge.com	Pacific Gas and Electric
Ian	Burnside	Ixbl@pge.com	Pacific Gas and Electric
John	Barbour	jbarbour@sdge.com	San Diego Gas and Electric
Jeremy	Reefe	jmreefe@sdge.com	San Diego Gas and Electric
Yung	Lin	Yung.lin@sce.com	Southern California Edison
Chris	Kuch	Christopher.kuch@sce.com	Southern California Edison
Gary	Corlett	Gary.corlett@sce.com	Southern California Edison
Josh	Rasin	joshua.rasin@smud.org	Sacramento Municipal Utility District

Codes and Standards Enhancement (CASE) Team Members:

First Name	Last Name	Email	Affiliation
Alanna	Torres	atorres@energy-solution.com	Energy Solutions
Steffi	Becking	sbecking@energy-solution.com	Energy Solutions
Heidi	Werner	hwerner@energy-solution.com	Energy Solutions
Kyle	Booth	kbooth@energy-solution.com	Energy Solutions
Greg	Barker	Gbarker@energy-solution.com	Energy Solutions
Simon	Silverberg	ssilverberg@energy-solution.com	Energy Solutions
Marissa	Lerner	mlearner@energy-solution.com	Energy Solutions
Marisa	Lee	Mlee@energy-solution.com	Energy Solutions
Zyg	Kunczynski	Zkunczynski@energy-solution.com	Energy Solutions
Joe	Sullivan	joe@cultivateEO.com	Cultivate Energy Optimization
Jon	McHugh	jon@mchughenergy.com	McHugh Energy Consultants
Ted	Tiffany	Tiffany.sbas@gmail.com	Guttmann & Blaevoet

California Energy Commission:

First Name	Last Name	Email
Payam	Bozorgchami	Payam.Bozorgchami@energy.ca.gov
Haile	Bucaneg	haile.bucaneg@energy.ca.gov
Adrian	Ownby	adrian.ownby@energy.ca.gov
Larry	Froess	Larry.foress@energy.ca.gov
Thao	Chau	Thao.chau@energy.ca.gov
Cheng	Moua	Cheng.moua@energy.ca.gov
Matthew	Haro	Matthew.haro@energy.ca.gov
Jennica	Limcaco	Jennica.limcaco@energy.ca.gov
Kelly	Morairty	Kelly.morairty@energy.ca.gov
Elmer	Mortel	Elmer.mortel@energy.ca.gov
Kevin	Mouayang	Kevin.mouayang@energy.ca.gov
Peter	Strait	Peter.strait@energy.ca.gov
Allen	Wong	Allen.wong@energy.ca.gov
Leah	Mohney	Leah.mohney@energy.ca.gov

Stakeholder Attendees:

First Name	Last Name	Affiliation
Peter	Mustacich	2050 Partners
Jennifer	Amman	ACEEE
David	Ceaser	Agritecture Consulting
Laura	Petrillo-Groh	AHRI
Aaron	Gunzer	AMCA
Jeanne	Fricot	Center for Sustainable Energy
Solana	Kaercher	Ceres GS
Josh	Gerovac	Clade9
Therese	Fisher	D+R International
Rosemary	Jojic	D+R International
Dan	Novicki	Desert Aire
Leora	Radetsky	DesignLights Consortium
Nadia	Sabeh	Dr.Greenhouse
Bryan	Jungers	E Source
Lauren	Morlino	Efficiency Vermont
Mike	Saunders	Emerson
Michael	Skroski	EnSave
Kyle	Clark	EnSave
George	Nesbitt	Environmental Design/Build
Nicholas	Maderas	F4Design
Corinne	Wilder	Fluence
Brady	Nemeth	Fluence
David	Kalensky	Gas Technology Institute
Dan	Tolles	Greenheck
Nathan	Fetting	Greenheck Fan Corporation
Brandon	Schreiner	Greenheck Fan Corporation
Mike	Anderson	Hawthorne Gardening
Daniel	Aronowitz	Hawthorne Gardening
Dengke	Cai	Hawthorne Gardening
Liam	Buckley	IES Ltd
Vicki	Gagnon	IESO
Adrian	Giovenco	InSpire Transpiration Solutions
Jesse	Porter	InSpire Transpiration Solutions
Kyle	Swenson	KCC
Kyle	Muldoon	KCC
Mark	Emberson	KCC
Harold	Jepsen	Legrand
Misti	Bruceri	MBA
Bruce	Severance	Mitsubishi Electric

Soph	Davenberry	Bserverance@hvac.mea.com
Adam	Karbaf	Niche Lighting technology
Erica	DiLello	NORESCO
Timothy	Rasinski	NVLAP
Joshua	Spalding	Quest
Sam	Milton	Resource Innovation Institute (RII)
Derek	Smith	RII
Chris	Pilek	RII
Bob	Gunn	Seinergy
Anthony	Serres	Signify
Rachelle	Winningham	Signify
Randy	Young	SMART Local 104
Neall	Digert	Solatube International
Morgan	Pattinson	Solid State Lighting Service
Casey	McKay	STULZ Air Tech Systems
Troy	Rippe	Surna
Andy	Souza	TEP Engineering
David	Vaillencourt	The GMP Collective
Edgar	Desautels	Topcool
Jill	Hootman	Trane
Eric	Sturm	Trane
Paul	Van Lare	Trane
Jeff	Wiseman	Trane
Walter	Stark	Walter Stark Consulting

Meeting Resources

1. Presentation Slides
2. Submeasure Summaries

Meeting Notes

1.1 Greenhouse Envelope (Kyle Booth, Energy Solutions)

1. Jill Hootman (Trane): Will those draft reports give more of the details of the specific modeling conditions especially what HVAC conditions?
    a. Stefaniya Becking (Energy Solutions): Yes, the CASE Report will contain detailed information on modeling inputs and calculations.
2. Jon McHugh (McHugh Energy Consultants): Does this seem right that there are more new indoor horticulture facilities than new mixed light greenhouses? Any thoughts from attendees?
    a. Corrine Wilder (Fluence): I think it is relevant to note that while it shows more indoor versus greenhouse for new construction, it shows more greenhouse versus indoor for alterations. I think that seems reasonable to me.

3. Derek Smith (RII): Thank you Kyle and Joe from all of us at Resource Innovation Institute for holding an outreach session at the indoor agriculture Energy Solutions conference! We appreciate your thorough stakeholder engagement.
4. Andy Souza (TEP Engineering): Is a "hoop house" considered a "greenhouse"?
    a. Kyle Booth (Energy Solutions): Andy, for lighting, hoop houses with supplemental lighting would be included. For the greenhouse envelope measure, it would have to trigger the "conditioned space" requirements to apply.
    b. Andy Souza (TEP Engineering): Thanks Kyle! Please make those definitions explicit in the code.
    c. Nadia Sabeh (Dr. Greenhouse): I would not consider a hoop house a greenhouse. A hoop house usually has minimal or no controllability other than rolling up curtains to let air through.
    d. Corrine Wilder (Fluence): Agreed with Nadia regarding hoop house versus greenhouse.
    e. Nadia Sabeh (Dr. Greenhouse): Hoop houses are also typically used temporarily to extend seasons, either start propagation early in spring or extend harvest into late fall.
    f. Ted Tiffany (Guttman & Blaevoet): Kyle, probably need to clarify the envelope measures are for *conditioned* greenhouses.
5. George Nesbitt (Environment Design/Build): In the Bay Area, everything is an indoor operation.
6. Edgar Desautels (TopCool): Can you elaborate on why the circulation fans measure was removed?
    a. Lauren Morlino (Efficiency Vermont): Circulation fans have high baseline and low savings, they barely screen for us in Vermont. I can understand why maybe you would not include them in an energy code.
    b. Stefaniya Becking (Energy Solutions): The measure for circulating fans was removed primarily because the savings potential is significantly lower compared to the other measures.
    c. Stefaniya Becking (Energy Solutions): Other measures are lighting in indoor growing facilities and greenhouses and a dehumidification measure for indoor growing facilities.
7. Walter Stark (Walter Stark Consulting): Do you differentiate between inside and outside curtains?
8. Nadia Sabeh (Dr. Greenhouse): Will we define minimal shade percent?
9. Nadia Sabeh (Dr. Greenhouse): Will shade percent be crop specific? Or will there be a threshold based on the crop that you would want the least amount of shade? For example, lettuce could have much higher shade percent than cannabis and tomato to meet that crop's Daily Light Integral (DLI) requirements.
    a. Jon McHugh (McHugh Energy Consultants): Washington state and IECC 2021 are requiring 0.7 U-factor for conditioned greenhouses without the shade cloth option. Why should California not follow suit?
    b. Peter Mustacich (2050 Partners): I agree with Nadia that shade performance should be clarified.
    c. Andy Souza (TEP Engineering): Loophole - Shade curtains could be installed but never actually used.
    d. Nadia Sabeh (Dr. Greenhouse): Exactly why I was asking the question about the application of shade.

e. Ian Burnside (PG&E): Good point Andy, some current shade/heat curtain systems I see are older or inoperable.

Poll 1: What percentage of greenhouses that you work with have one of these: 1) Envelope with U-value ≤ 0.7, 2) shade curtain system?

10. Nadia Sabeh (Dr. Greenhouse): U = 0.7 would eliminate glass as a glazing option. That is NOT a good idea! The Dutch will freak out!
    a. Ian Burnside (PG&E): I think that would just force shade curtains then for Dutch style greenhouses?
    b. Ted Tiffany (Guttman & Blaevoet): This would eliminate single paned glass; it is still a question if traditional greenhouse structures could support the weight of an insulated glazing unit.
    c. Stefaniya Becking (Energy Solutions): We will need to look into crop-specific shade requirements.
    d. Payam Bozorgchami (Energy Commission): Nadia, could you explain why U = 0.7 would eliminate glass as a glazing option?
    e. Ted Tiffany (Guttman & Blaevoet): Payam, it would eliminate single paned glass, it is still a question if traditional greenhouse structures could support the weight of an insulated glazing unit.
    f. Nadia Sabeh (Dr. Greenhouse): U ≤0.7 will force selection to double-inflated polyethylene, double PC, and double-pane glass.
    g. Ted Tiffany (Guttman & Blaevoet): And Nadia, the language uses a U-0.7 *or* shade structure so it *would* still allow single paned glass.
    h. Jon McHugh (McHugh Energy Consultants): Perhaps there should be some discussion of air heated greenhouses versus hydronically heated beds in regards to U-factor of greenhouses.
    i. Nadia Sabeh (Dr. Greenhouse): I like the option of glazing or shade. I was responding to Jon McHugh who asked why we do not follow Washington's guidelines of requiring U=0.7. I think that is a bad idea.

1.2 Lighting Efficacy

1. Brady Nemeth (Fluence): Are there any estimates/assumptions used for electricity costs in 2023 when these codes will become active?
2. Corrine Wilder (Fluence): We have seen paybacks of less than half a year, so I would be careful saying "as low as" 2.5 years.
    a. Corrine Wilder (Fluence): I would advise maybe saying "average" of 2.5 years? I would not want to intimidate the market and turn people off to LEDs.
3. Andy Souza (TEP Engineering): All, a minimum micromole per joule (umol/J) of 2.1 means no more double ended (DE) high pressure sodium (HPS).
4. Greg Barker (Energy Solutions): Thanks, Corinne, for pointing out the existence of lower payback! The longer period is likely out of our typical model. Any other input on typical LED payback periods?
5. Morgan Pattison (SSLS): I think there should be a single efficacy standard for both greenhouse and indoor and 2.1 is a good start.

    a. Corrine Wilder (Fluence): I agree with Morgan. It seems a bit strange to have such a wide difference for the two applications.
6. Walter Stark (Walter Stark Consulting): Greenhouse may get free lighting, but the added cooling load can be enormous. Does anyone know of a comparison of total energy consumption of indoor vs. greenhouse?
7. Corrine Wilder (Fluence): Kyle, you mentioned that greenhouse has different crops/application and that is the reason for 1.4 umol/j requirement, but can you elaborate?
    a. Kyle Booth (Energy Solutions): We didn't want to go to LEDs for greenhouses because LED fixtures may actually shade some of the sunlight coming in.
    b. Morgan Pattison (SSLS): Form factor of LED can be linear and smaller than HPS.
8. Derek Smith (RII): I appreciate the recognition of the importance of pairing training with lighting requirements. Cultivators need best practices support to ensure effective code adoption.
9. Brady Nemeth (Fluence): Is there a minimum percent of lighting to require this?
    a. Kyle Booth (Energy Solutions): Currently no. There is a minimum square footage threshold.
    b. Brady Nemeth (Fluence): Are we using the 2023 electricity cost?
    c. Kyle Booth (Energy Solutions): Yes.
10. Kyle Clark (EnSave): Can you briefly address the basis for the 2.1 umol/J requirement?
    a. Kyle Booth (Energy Solutions): The 2.1 was decided after talking to industry. The DesignLight Consortium (DLC) will update their qualified products list (QPL) to be in the low 2 range. Right now, fixtures go up to 3 micromoles per Joule. This proposal will take place in 2023.
    b. Leora Radetsky (DesignLights Consortium): Correct. DLC Version 2.0 spec is proposed to be 2.1 umol/J.
11. Greg Barker (Energy Solutions): I see support from Andy and Morgan for a higher lighting efficacy minimum at 2.1 umol/J photosynthetic photon efficacy (PPE). Do others agree or disagree?
    a. Anthony Serres (Signify): I think it is too high.
    b. Andy Souza (TEP Engineering): No, I want the minimum to be lower for indoor.
    c. Morgan Pattison (SSLS): 2.1 is not very challenging for LED technology especially by 2022.
    d. Andy Souza (TEP Engineering): I suggest 1.7 for indoor to allow the use of DE HPS.
12. Brady Nemeth (Fluence): What would be the enforcement mechanism? How would we be enforcing efficacy level? I would dissuade going by spec sheets.
    a. Kyle Booth (Energy Solutions): Resources such as the DLC QPL would be a method of doing that. The Energy Commission can develop their own list. Lighting testing using LM 79-19 would be the suggested method.
13. Jon McHugh (McHugh Energy Consultants): Why not look at 1.7 umol/J for greenhouses?
    a. Kyle Booth (Energy Solutions): We have received feedback that ceramic metal halides have advantages in greenhouse, and these usually come in around 1.5 umol/J.
14. Ian Burnside (PG&E): Another thing to consider: high intensity discharge (HID) spec sheets typically do not include ballast/reflector losses. Also, anything can be claimed on a spec sheet. Verification would be desirable (but may be impractical).
15. Andy Souza (TEP Engineering): If they are using LEDs, they are mostly like stacking lights, which increases electrical usage throughout.

    a. Morgan Pattison (SSLS): Lighting products that meet the standard are readily available now and prices are dropping.
    b. Andy Souza (TEP Engineering): It is more about the quality of the final product than the energy savings. Existing would be grandfathered in.
16. Andy Souza (TEP Engineering): So, now that the max watts per square foot (W/ft^2) has been removed these minimum lighting requirements allow growers to potentially use more light fixtures to compensate for lack of efficacy.
    a. Kyle Booth (Energy Solutions): That is something to consider, but our thought is that people won't be putting in fixtures they do not need.
17. Brady Nemeth (Fluence): Any thoughts on LED products which do not currently have a test standard - such as DC-powered systems or water-cooled systems, systems that cannot be simply tested to Illuminating Engineering Society (IES) LM-79? To note, these products are not currently eligible for DLC qualification (largely for that reason), but there are viable products out there.
    a. Greg Barker (Energy Solutions): LM-79-19 explicitly includes DC SSL products. Water-cooled still is not addressed.
18. Bob Gunn (Seinergy): Do you have an estimate of what percentage of existing installed horticulture lights comply with the proposed code levels?
    a. Kyle Booth (Energy Solutions): We are still gathering data. Based on what we have seen so far, we are guessing 15-20 percent. For greenhouses, it may be more around the 50 percent level.
    b. Brady Nemeth (Fluence): Bob's point of market transformation is worthy of consideration. This is a difficult task to make so many estimates about what the market will look like in 2023. We could reasonably come up with scenarios that put us at vastly different points along that curve.
    c. Stefaniya Becking (Energy Solutions): Yes, this is a challenge for this topic.
19. Bob Gunn (Seinergy): It is tough to codify measure since the market is changing so rapidly.
    a. Kyle Booth (Energy Solutions): With California going to zero net energy by 2030, it requires a bit more aggressive code particularly for high energy use facilities such as controlled environmental horticulture (CEH) facilities.
20. Rosemary Jojic (D+R International): IES LM-79-19 is only for solid-state lighting (SSL) products, so the standard should be updated to include the appropriate test method for non-LED products (LM-9-17, LM-41, etc).
    a. Kyle Booth (Energy Solutions): There is a different test method for LED products. Thanks, Rosemary, for point out. We will be sure to take a look at those.
    b. Morgan Pattison (SSLS): Legacy fixtures could be measured according to test procedures basically the same as LM-79.
    c. Stefaniya Becking (Energy Solutions): Thank you for the comment. We will look into calling out appropriate testing procedures in the proposed code.
21. Jon McHugh (McHugh Energy Consultants): Does this PPE target require electronic ballasts for MH? For HID lighting would these be tested according to IES LM-46?

Poll 2: What is the most common type of horticultural lighting you see in greenhouses?

Poll 3: For new construction facilities in 2023, Title 24, Part 6 should have: Standards the only prevent using the most inefficient technologies, standards that prevent using everything except double-ended HPS and LEDs, standards that require LEDs, other?

22. Kyle Booth (Energy Solutions): If anyone has data on the PPE of legacy technologies, we would greatly appreciate the chance to see those.
23. Andy Souza (TEP Engineering): The upfront cost to meet the indoor 2.1 (LED) lighting requirements, the related additional mechanical systems (since they will most likely be multi-tier) and increased electrical demand/system will be *much greater* than single tier HPS. So by the time this code becomes active, it will be much more difficult for the smaller boutique cannabis cultivators to start a business because of these increased upfront cost, which only allows the big corporate cannabis cultivators to enter the industry at that time which is not what the cannabis community wants.
24. Leora Radetsky (DesignLights Consortium): Language should be clear that this is for fixture efficacy, not lamp efficacy.
    a. Stefaniya Becking (Energy Solutions): I agree. The proposed code sets the PPE for luminaires (not lamp).
25. Andy Souza (TEP Engineering): Are these savings based on a direct trade of HID for LED with no additional tiers.
26. Leora Radetsky (DesignLights Consortium): What is the baseline in your savings estimate?
    a. Kyle Booth (Energy Solutions): Greenhouse is going from a single ended HPS or metal halides to 1.4 PPE. And for indoor DE HPS to the 2.1 umol/J.
27. Kyle Clark (EnSave): Do the first-year kWh savings values account for interactive savings from HVAC?
    a. Kyle Booth (Energy Solutions): Yes.
28. Leora Radetsky (DesignLights Consortium): Another question, savings for same photosynthetic photon flux density (PPFD) per DLI?
    a. Kyle Booth (Energy Solutions): Yes, only the efficacy changes.
    b. Greg Barker (Energy Solutions): Baseline for lighting savings is single-ended HPS for greenhouse and double-ended HPS for indoor, at the same PPFD and DLI.
29. Andy Souza (TEP Engineering): When cultivators start a new construction project with LED, they rarely grow in single tier, so I suspect multi-tiers were not considered in the savings.
    a. Greg Barker (Energy Solutions): Thanks, Andy. Would this relationship between multi-tier and LED still hold true as LED products develop further? And would it hold true if the proposed indoor PPE minimum took effect?
    b. Kyle Booth (Energy Solutions): We recognize growers are doing multiple tiers. This is why we are using canopy square feet.
30. Brady Nemeth (Fluence): We do see a lot of people who look to increase PPFD when using LED simply because they can get closer to canopy than they could with legacy technologies.
    a. Brady Nemeth (Fluence): That seems like a high incremental cost for HPS to LED. I am not sure I have seen a program use anything quite that high. What numbers were used for HPS and LED?
    b. Simon Silverberg (Energy Solutions): We were assuming around $1,300 for an LED fixture.
    c. Greg Barker (Energy Solutions): Thanks for the input, Brady! Do you know what programs are using? Or have programs that you suggest we talk to for more data?

d. Brady Nemeth (Fluence): Sorry - the 15 year is what threw me.
e. Morgan Pattison (SSLS): I think LED prices are lower now but lifetime should be the warranty period for LED.
f. Joe Sullivan (Cultivate Energy Optimization): Can you elaborate why the lifetime should only be the warranty?
g. Morgan Pattison (SSLS): Most lifetime projects are just based on LED output depreciation, not catastrophic failure rates of electronics.
h. Greg Barker (Energy Solutions): Thanks, Morgan. Is there an output depreciation that you see projects using for end-of-luminaire life?
i. Morgan Pattison (SSLS): I have heard 90 percent. That is 10 percent less yield.
j. Joe Sullivan (Cultivate Energy Optimization): Thanks Morgan. We are still conducting grower surveys so we will make sure to address this.
k. Leora Radetsky (DesignLights Consortium): DLC also uses a Q90 requirement for photon flux depreciation.

31. Leora Radetsky (DesignLights Consortium): Have you considered conducting a sensitivity analysis, if the LED fixtures only last 5 years (e.g., just longer than a warranty period)?
    a. Kyle Booth (Energy Solutions): No, we have not done a sensitivity analysis yet.
32. Jon McHugh (McHugh Energy Consultants): For PPE, should there be different requirements for Tier 1 (less than 6 W/ft^2) versus Tier 2 (more than 6 W/ft^2)?
33. Rosemary Jojic (D+R International): Also, I know some growers are replacing their fixtures as soon as they see a percent reduction in yield, which is usually before failure as Morgan mentioned.
    a. Joe Sullivan (Cultivate Energy Optimization): Are these facilities measuring their PPFD or just going by yield?
    b. Rosemary Jojic (D+R International): Sorry, I do not have that information.
34. Thao Chau (Energy Commission): We appreciate all the comments. It is important to point out that the CEH requirements apply to *all* crops, not just cannabis.
35. Andy Souza (TEP Engineering): It is not *all* about yields.
36. Yung Lin (SCE): Most of the energy consumption for horticulture lighting in California is centered around cannabis, with majority of the market (more than 70 percent) being illegal and not reporting their activity how is that factored into all the energy usage and energy saving projections discussed so far?
    a. Kyle Booth (Energy Solutions): In short, this wasn't included. Only legal grows were included in forecasts.
    b. Morgan Pattison (SSLS): Is there documentation for the 70 percent illegal estimate?
    c. Bob Gunn (Seinergy): I would love data on the following working assumptions around "Most of the energy consumption for horticulture lighting in California is centered around cannabis."
    d. Yung Lin (SCE): I will see what I can find, with the caveat that most people growing illegally are not going to raise their hand and answer surveys.
    e. Andy Souza (TEP Engineering): Ask the utility companies.

1.3 Dehumidification

1. Walter Stark (Walter Stark Consulting): Wrap-around dehumidification technologies need to be recognized for their energy conserving "free pre-cooling" function which can reduce total HVAC

power consumption by 30 percent to 65 percent https://wcec.ucdavis.edu/wp-content/uploads/2016/11/MSP_XCEL-Case-Study.pdf. These technologies are available in four broad categories: Plate, Heat Pipe, Rotor, Water (Run-Around), and are manufactured by many companies.
    a. Stefaniya Becking (Energy Solutions): I believe the current proposed code accounts for benefits from wrap-around dehumidification technologies. Take a look (link under Resources) and let us know if you have further concerns.
2. Troy Rippe (Surna): Is this hot gas bypass or hot gas reheat?
    a. Kyle Booth (Energy Solutions): Hot gas reheat.
3. Jill Hootman (Trane): Where does the 60 percent come from? Modeling? Is there a goal that is trying to be met?
    a. Kyle Booth (Energy Solutions): We originally looked at what ASHRAE has for nonresidential requirements. They have 75 percent. But since that is for commercial buildings, we decided to lower it to 60 percent.
4. Brady Nemeth (Fluence): Thank you to the whole team for your work on all of this.
5. Laura Petrillo-Groh (AHRI): Not sure if you saw Jill's question, but I would also like to know where does the 60 percent come from? Modeling? Is there a goal that is trying to be meet?
    a. Kyle Booth (Energy Solutions): ASHRAE used 75 percent for commercial buildings. We are looking for feedback if that should change.
6. Jill Hootman (Trane): I agree. Andy, what were the levels of condensate reuse based on?
    a. Jill Hootman (Trane): 1000 square foot of canopy and higher.
7. Andy Souza (TEP Engineering): Condensate water capture and reuse? Will the Energy Commission require condensate water capture and reuse? (It was mentioned in some email conversations I had between Joe and I).
    a. Kyle Booth (Energy Solutions): Yes, water reuse is a requirement.
    b. Andy Souza (TEP Engineering): Will you define the minimum water filtration requirements? Will you define what the reclaimed water can be used for? If a cultivation facility has HVAC condensate drainage from equipment serving mothers, clones, drying, admin (offices, etc) will these systems within the project also need to be captured and reused or just flowering spaces?
    c. Kyle Booth (Energy Solutions): It will be same requirements as the primary water used in the facility.
    d. Andy Souza (TEP Engineering): Fertigation water is non-potable water.
    e. Kyle Booth (Energy Solutions): Maybe we should follow up offline for specifics.
    f. Stefaniya Becking (Energy Solutions): We will look into adding a reference in our proposed code to other California codes that set water quality standards for non-potable water.
    g. Andy Souza (TEP Engineering): The water treatment requirements depends on what the Energy Commission requires the reuse to be used for.
    h. Stefaniya Becking (Energy Solutions): Noted regarding water reuse and required treatment levels.
8. Kevin Muldoon (KCC): What was the baseline system versus improved system to create the estimated savings?

    a. Kyle Booth (Energy Solutions): For baseline, we are using direct expansion air conditioning with standalone dehumidification. The proposal is chilled water with heat recovery or the integrated HVAC system with heat recovery.
9. Andy Souza (TEP Engineering): Any update on the "tools used for energy impacts analysis" that was previously shown during the last meeting?
10. Joshua Spalding (Quest): Is the 1.9 litres per kilowatt-hour (L/kWh) efficiency metric for stand alone based on 80°F per 60 percent relative humidity (RH) or a different test condition?
    a. Kyle Booth (Energy Solutions): Yes, 80°F /60 RH or 82°F /60 RH.
11. Kyle Booth (Energy Solutions): There is currently no good standards or test procedures for dehumidification that apply to indoor horticulture conditions.
12. Andy Souza (TEP Engineering): How are economizers handled?
    a. Kyle Booth (Energy Solutions): Yes, there will be an exemption for economizers.
13. Kevin Muldoon (KCC): Are dehumidification efficiency levels going to be part of the next Title 24 update? If so, what are the units or methods of test?
    a. Kyle Booth (Energy Solutions): We are not proposing a specific efficiency rather choosing one of three options.
14. Lauren Morlino (Efficiency Vermont): I am glad you did not specify technology in dehumidification or lighting - we want to make customers efficient but we do not want to thwart their innovation or force them to use certain technology in their industrial process. For example, some states have mandated variable rate flow, which I do not agree with.
    a. Walter Stark (Walter Stark Consulting): Specifying a technology is different from specifying a brand.
15. Walter Stark (Walter Stark Consulting): Will wrap-around dehumidification technologies be recognized for their energy conserving “free pre-cooling” function which can reduce total HVAC power consumption?
16. Andy Souza (TEP Engineering): What about using (outside air) ventilation for dehumidification?
    a. Kyle Booth (Energy Solutions): That is a good question. We have heard that not a lot of growers are interested in this. If you have information saying otherwise, please let us know.
    b. Nadia Sabeh (Dr. Greenhouse): There are not a lot of climate zones that allow for dehumidification with outside air.
    c. Andy Souza (TEP Engineering): Growers in mild climates (like the Bay Area) and not using CO2 enrichment may consider using outside air for dehumidification.
    d. Lauren Morlino (Efficiency Vermont): We have customers who are interested in using outside air for dehumidification.
    e. Stefaniya Becking (Energy Solutions): The proposed code does not preclude one to use outside air, only provides exemption for installing economizer if CO2 enrichment strategy is used.
    f. Kyle Booth (Energy Solutions): We will reach out to learn more.
17. Andy Souza (TEP Engineering): Any talk about fuel burning CO2 generators?
    a. Kyle Booth (Energy Solutions): For this code cycle, we will not be including them.
    b. Andy Souza (TEP Engineering): To clarify, I suggest not allowing their use.
    c. Stefaniya Becking (Energy Solutions): Are you saying fuel burning CO2 generators should be addressed from the safety perspective?
    d. Andy Souza (TEP Engineering): Yes, it is two part: safety and energy.

e. Joshua Spalding (Quest): CO2 burners produce heat and water as a byproduct. It puts a larger heat and water load on the HVAC system.
f. Andy Souza (TEP Engineering): CO2 burners create CO2, heat and water vapor (plus other byproducts). The heat and water vapor may require additional cooling/dehumidification requirements.
g. Stefaniya Becking (Energy Solutions): Thanks for clarifying! As of now, we do not plan to tackle CO2 burners in the 2022 CASE Team proposal, but we will keep it in mind.

18. Nadia Sabeh (Dr. Greenhouse): What are the controls in Section 120.2(l)?
    a. Stefaniya Becking (Energy Solutions): Are you asking about proposed controls for CEH?
    b. Nadia Sabeh (Dr. Greenhouse): Yes. Sensors and controls. What level of complexity? What level of integration? What types of sensors?
    c. Stefaniya Becking (Energy Solutions): Thanks for bringing this up! The proposal on controls would not require integration between humidity and thermostatic control given where market is.
19. Jeff Wiseman (Trane): 3.D says condensate collection is required if using stand-alone dehumidification. What about applied/chilled water systems or integrated HVAC systems?
    a. Kyle Booth (Energy Solutions): We will modify this.
20. Andy Souza (TEP Engineering): Are “automated irrigation controls” still required?
    a. Kyle Booth (Energy Solutions): No.
21. Kyle Booth (Energy Solutions): Alterations requirement for lighting changes is altering 10 percent or more of the luminaires in a space.
    a. Kyle Booth (Energy Solutions): Simple lamp replacement does not trigger code.
22. Jon McHugh (McHugh Energy Consultants): Lighting controls – I see that multi-level controls is not shown for greenhouses. Title 24 requires multi-level controls for more than 0.5 W/ft^2 in buildings and even less threshold for outdoor lighting and parking garages. For greenhouses, we could have as high as 20 W/ft^2 and no multi-level controls for partial sun and different parts of the growing cycle. One might consider more lighting controls for Tier 2 mixed light greenhouses (more than 6 W/ft^2). What are pros and cons for multi-level lighting in greenhouses?
    a. Kyle Booth (Energy Solutions): We have those written in for indoor but not greenhouses. The types of lights used for greenhouses do not have as sophisticated dimming options. We are looking at high light power densities for greenhouses.
    b. Greg Barker (Energy Solutions): Regarding Jon's multi-level light comment, we welcome stakeholder input on those pros and cons. In research so far, I have heard cons including spectral shifts at dimmed output levels and a lack of sophisticated light sensors covering enough of the canopy to give growers comfort in knowing their PPFD/DLI needs are met at dimmed light levels.
23. Andy Souza (TEP Engineering): What about allowances for retractable greenhouses like Cravo?
    a. Kyle Booth (Energy Solutions): We have not specifically considered those. Do any other companies make those?
    b. Andy Souza (TEP Engineering): It may be only Cravo.
    c. Nadia Sabeh (Dr. Greenhouse): What is your question about these retractable roof greenhouses?

d. Stefaniya Becking (Energy Solutions): Are there specific allowances do you have in mind, Andy?
e. Andy Souza (TEP Engineering): Envelope allowances.
f. Nadia Sabeh (Dr. Greenhouse): They are usually installed when growers really want to limit energy use.
g. Andy Souza (TEP Engineering): They save energy by opening up.
h. Nadia Sabeh (Dr. Greenhouse): So, I would say that they are probably the least energy intensive. They are meant for passive ventilation. Usually only closed to prevent wind, rain, and hail damage.
i. Kyle Booth (Energy Solutions): Envelope requirements are only for conditioned greenhouses? Do we see these types of greenhouses using retractable roofs?
j. Andy Souza (TEP Engineering): It depends where they are located. I have not seen a conditioned one, now that you mentioned it.
k. Walter Stark (Walter Stark Consulting): What is the meaning of "conditioned" greenhouse? Does it apply to both day and night cycles?
    i. Kyle Booth (Energy Solutions): Title 24 defines conditioned space as a space that is provided heating that has a capacity exceeding 10 British thermal units per square foot (Btu/ft^2) or a cooling capacity exceeding 5 Btu/ft^2.
l. Nadia Sabeh (Dr. Greenhouse): Yeah, I would not put restrictions on envelope for retractable roof greenhouses. They are more about protected agriculture than controlled environment agriculture.
m. Kyle Booth (Energy Solutions): We need to fine tune the structuring of the code language with regards to greenhouse envelope.

Poll Results

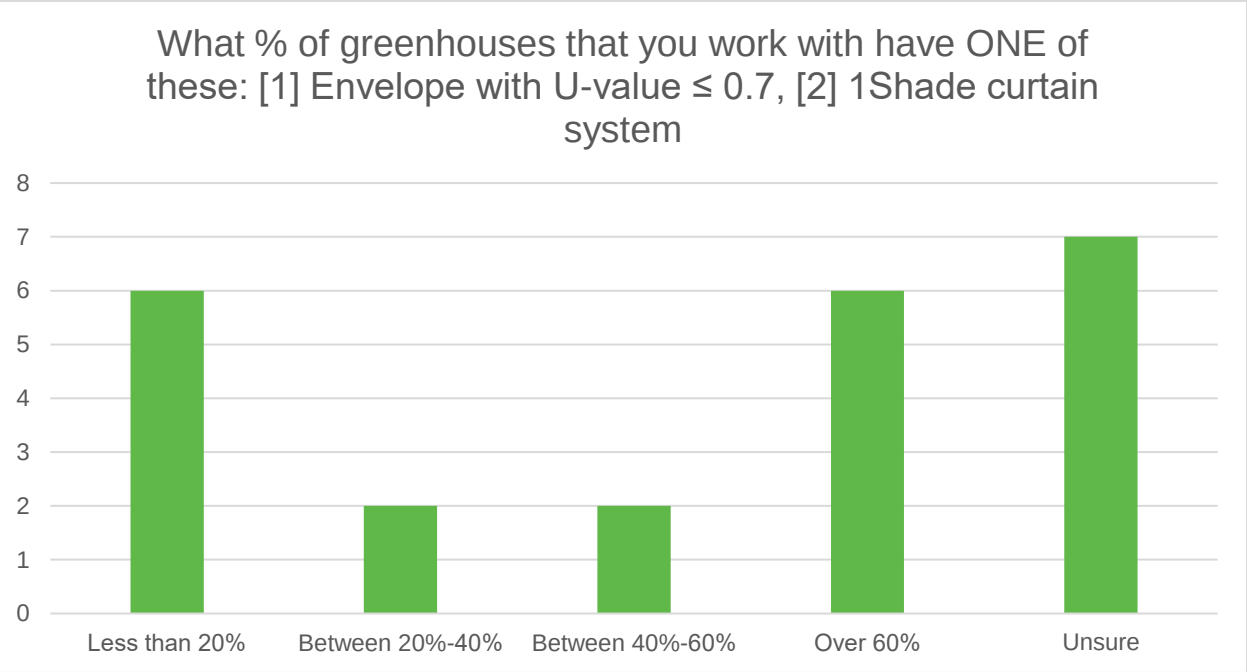

Figure 1: Results of poll 1

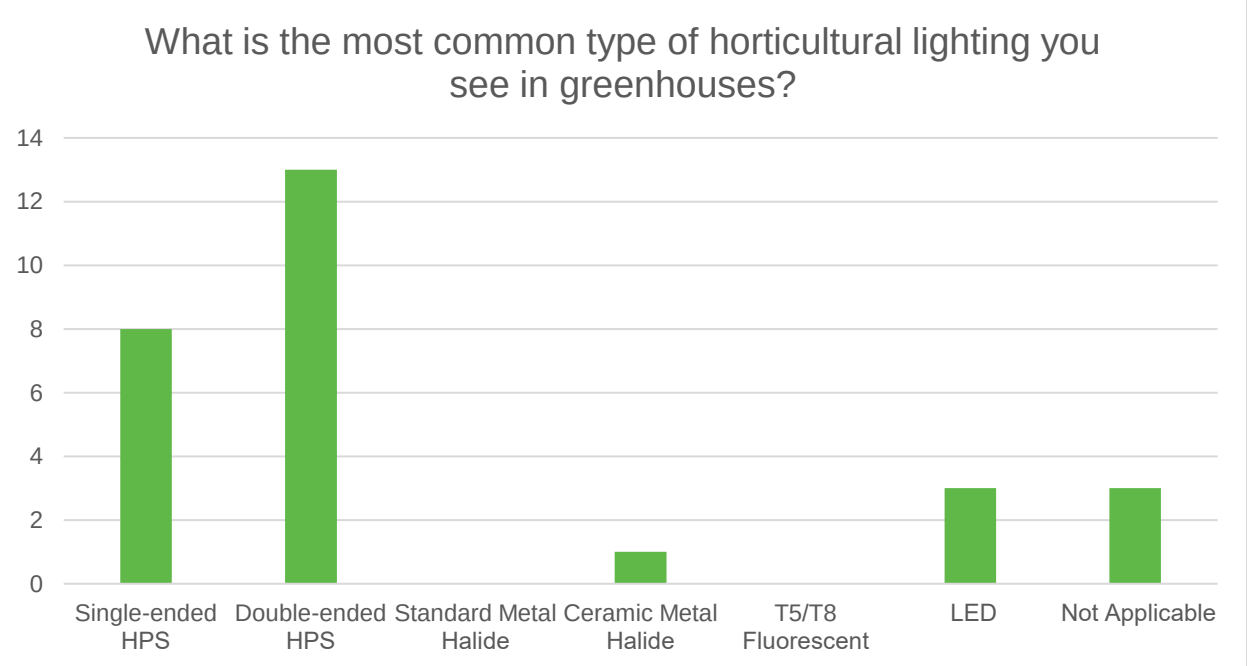

Figure 2: Results of poll 2

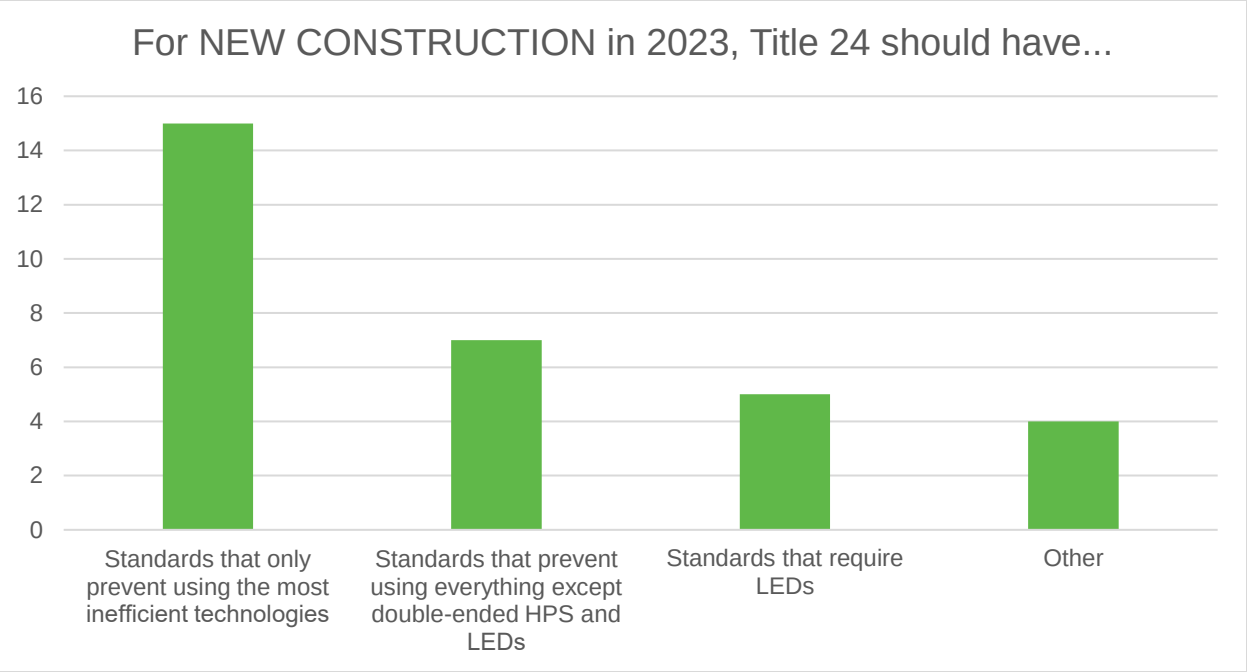

Figure 3: Results of poll 3