

## 2022 California Energy Code (Title 24, Part 6)

Notes for the Utility-Sponsored Stakeholder Meeting for:

### Single Family Whole Building and Nonresidential Software Improvements Utility-Sponsored Stakeholder Meeting

Posted December 5, 2019

#### Meeting Information

**Meeting Date:** November 12, 2019

**Meeting Time:** 8:30am – 12:30pm PST

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

**Meeting Host:** California Statewide Utility Codes and Standards Team

#### Meeting Agenda

Time	Topic	Presenter
<b>10 minutes prior to call</b>	Live Attendee Poll	
<b>8:30-8:35 am</b>	Meeting Guidelines	Marisa Lee (Energy Solutions)
<b>8:35-8:40 am</b>	Opening Remarks from the California Energy Commission	Payam Bozorgchami (California Energy Commission)
<b>8:40-8:45 am</b>	Overview and Welcome	Kelly Cunningham (PG&E)
<b>8:45-9:30 am</b>	Passive House Prescriptive Pathway	Bill Dakin (Frontier Energy)
<b>9:30-11:00 am</b>	Energy Savings & Process Improvements for Alterations and Additions	Alea German (Frontier Energy)
<b>11:00 – 11:05 am</b>	5 Minute Break	
<b>11:05-12:05 pm</b>	Nonresidential Grid Integration	Jessica Peters (Energy Solutions)
<b>12:50-12:25</b>	Nonresidential Elevator Compliance	Eric Martin (Energy Solutions)
<b>12:20-12:30 pm</b>	Closing	Marisa Lee (Energy Solutions)

## Meeting Attendees

<b>Utility Staff</b>		
Jim Kemper	<a href="mailto:James.Kemper@ladwp.com">James.Kemper@ladwp.com</a>	Los Angeles Department of Water and Power
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## Meeting Materials

- [Meeting agenda](#)
- [Presentation](#)
- [Submeasure summaries](#)

## Meeting Notes

### 1. Welcome and Meeting Ground Rules

- Alanna Torres (Statewide CASE Team) presented.

## 2. 2022 Process Overview

- Payam Bozorgchami (California Energy Commission) presented.
- Kelly Cunningham (PG&E, Statewide Utility Codes & Standards Team) presented.

## 3. CASE Presentation: Passive House Prescriptive Pathway

- *Bill Dakin (Frontier Energy, Statewide Utility Codes & Standards Team) presented.*
- Bronwyn Barry (North American Passive House Network): Passive House Planning Package (PHPP) targets for heating and cooling also allows heating load to be used. This means the heating demand can vary for each climate.
  - Alea German (Frontier Energy, Statewide CASE Team): Thanks for the clarification Bronwyn, we'll make sure that is addressed.
- Bronwyn Barry (North American Passive House Network): Only the PHPP tool has been verified via ASHRAE 140.
- Technical Barriers
  - George Nesbitt (HERS Rater): Only PHIUS requires HERS.
  - Rob Nicely (Carmel Building): I have built two certified passive houses and am currently working on a third. We have not found that adopting the actual practices onsite is anywhere near as difficult as overcoming owner fears about invoking what they see as a nonstandard practice. So, anything the state can do to support broader adoption is going to be really helpful to overcome consumer fears.
  - Alea German (Frontier Energy, Statewide CASE Team): Good point, an alternative path would support this. Thanks.
- Sid Dinwiddie (PABCO Roofing): Where are details for this program available?
  - Steve Mann (Home Energy Services): Try [this link](#).
  - Bronwyn Barry (North American Passive House Network): Sid, [here is a link](#) to the PHI criteria.

### **Poll: "Is Passive House certification required if the building design meets Passive House criteria and third-party testing and inspections are still required?"**

- Bronwyn Barry (North American Passive House Network): A simplified certification is now available for residential projects via PHI. This will remove some of the roadblocks and hopefully expedite certification.
  - Alea German (Frontier Energy, Statewide CASE Team): Bronwyn, we'll follow up with you about the simplified certification, we would like to know more about that.

### **Poll: "Is Passive House certification required if the building design meets Passive House criteria and third-party testing and inspections are still required?"**

- George Nesbitt (HERS Rater): Certification (of Passive House, PHI or PHIUS) requires a level of review and expense. Saying that you designed to PH does not
  - Alea German (Frontier Energy, Statewide CASE Team): The idea is that if certification were not required, a model would still need to be done, i.e. PHPP, and a Passive House expert involved on the project. Let us know your thoughts on this.
- Judy Roberson: Regarding Passive House (PH) air sealing requirements, please clarify that 0.6 ACH50 is a maximum, not minimum average annual infiltration rate.
  - Steve Mann (Home Energy Services): It is a maximum, but it is not an annual rate.
- Mark Lyles (New Buildings Institute): If the plan is to include a PHIUS path, are there any plans to do a similar level of analysis using the WUFI software?
  - Alea German (Frontier Energy, Statewide CASE Team): Yes, I think we will need to do that analysis as well.
- Bronwyn Barry (North American Passive House Network): 'Soft criteria,' including remaining within the comfort margin will likely force those non-compliant projects into adding overhangs, shading or lowering their SHGC.
- George Nesbitt (HERS Rater): I have worked on a number of PH projects in a variety of capacities over the years. I was involved with PH California from the beginning. PHI ventilation

requirements are the largest single conflict with our codes and standards. PHIUS was smart to harmonize and require HERS Rating.

- Alea German (Frontier Energy, Statewide CASE Team): George, we'll follow up with you to schedule a call to discuss your experience.
- Alea German (Frontier Energy, Statewide CASE Team): Regarding ventilation, the mandatory ventilation requirements per Title 24, Part 6 Section 150.0 would continue to be a requirement.
- George Nesbitt (HERS Rater): I think Title 24, part 6 has a lot to learn from PH and I have promoted it all along. We need to stop allowing building enclosure tradeoffs.
  - Ellen Steiner: I agree. If we are to meet our climate change goals, building enclosure is key.
- Randy Young (SMW Local 104): We also need to ensure equipment is air tight as well.
  - Bronwyn Barry (North American Passive House Network): Randy - certified ventilation equipment requires air-tightness testing of the units.

**Poll: "What is the best way to handle upload to the HERS registry?"**

**Poll: "Are you in favor of having a Passive House path to compliance and if it was available would you use it?"**

**Poll: "Which additional prescriptive measures do you think should be required of Passive House projects?"**

**Poll: "Which additional HERS inspections/tests do you see as needed for verification? Check all that apply"**

- Bronwyn Barry (North American Passive House Network): Passivhaus Plus standard already adds photovoltaics (PV).
- George Nesbitt (HERS Rater): PH requires you meet your heating & cooling budgets with no trade-offs with other measures.
- Bronwyn Barry (North American Passive House Network): Can you elaborate on the option to include multifamily in this in the future?
  - Bill Dakin (Frontier Energy, Statewide Utility Codes & Standards Team): One of the proposals for multifamily is to have a unified multifamily code, aligning high-rise and low-rise into a single code. This is still being discussed. The multifamily team is not addressing Passive House specifically, but some components are being addressed in various measures. If it does not end up in its own compliance path for PH, low-rise multifamily could be aligned with single family and include this prescriptive path.
- Judy Roberson: How is one to deal with the ventilation conflict that kitchen range hoods must exhaust to outside in Title 24, Part 6 and must not be exhausted to outside for PH?
  - Bill Dakin (Frontier Energy, Statewide Utility Codes & Standards Team): Any project using this proposed path would have to meet the mandatory ventilation requirements in Title 24, part 6 code, and would have to be addressed in the PH modeling.
  - Bronwyn Barry (North American Passive House Network): PH does allow kitchen hood ventilation to the outside, but it does take a penalty. It is not dis-allowed.
  - Steve Mann (Home Energy Services): There is no PH requirement that PH range hoods are not exhausted to outside.
- Tom White (Eden Housing): How about ways to limit miscellaneous plug loads?
- George Nesbitt (HERS Rater): I don't think that a prescriptive path saves one much especially if going through the PH certification.
- Steve Mann (Home Energy Services): A suggested CBECC update--handle external shading.
- George Nesbitt (HERS Rater): PHI & PHIUS could build input files for CBECC-RES even if they don't certify it.
- Tom White (Eden Housing): We need ways to address water heating loads in multifamily.

#### **4. Energy Savings & Process Improvements for Alterations and Additions**

- *Alea German (Frontier Energy, Statewide Utility Codes & Standards Team) presented.*

#### 4.A.1 - Submeasure A.1: Roof alterations, cool roofs and insulation

- George Nesbitt (HERS Rater): If we do not increase the efficiency of existing homes when they are upgraded, we are missing out on a great opportunity. Prescriptive requirements for existing and new homes have to diverge in places.
- Randy Young (SMW Local 104): Unfortunately, existing homes are retro fitted and HVAC upgrades often times are done with no permits or inspection, we will have a very difficult time in achieving compliance in existing homes.
- Chadwick Collins (Kellen Company): So, is the assumption: the original roof and insulation levels approaching 25-30 years of life?
  - Bill Dakin (Frontier Energy, Statewide Utility Codes & Standards Team): Chadwick Collins- Assumptions assume existing conditions. We are looking at situations if upgrades are made prior.
  - Chadwick Collins (Kellen Company): I ask because the point you picked is right where many would have likely re-roofed or are at the point of re-roofing. If the model isn't considering both options, then perhaps moving the model forward or backward in time to pick one would be best. Below the sheathing doesn't clarify for making sure to provide for ventilation under the deck.
- Tom Paine (Consol): HVAC compliance is a huge issue.
  - William Callahan (ARCBAC): Same with reroofing. Permits not always required. Inspections rare.
- Ronnen Levinson (LBNL): Please consider using pre-1980 construction rather than (or at least in addition to) 1990s construction to model alterations to existing homes. I know that one is tempted to pick an "intermediate" vintage to represent existing buildings, but that can easily miss the mark. For example, in 2016 California had 13.91 million housing units, of which 8.44 million (61%) were built before 1980, and 3.64 million (26%) were built between 1980 and 1999 (U.S. Census Bureau 2018). Therefore, there were 2.3 pre-1980 homes for each 1980-1999 home. Reference: U.S. Census Bureau. 2018. Table DP04: Selected Housing Characteristics, 2012-2016 American Community Survey 5-Year Estimates. Retrieved 2018-06-15 from <https://factfinder.census.gov>
  - Bill Dakin (Frontier Energy, Statewide Utility Codes & Standards Team): Thanks for this information, we will look into it.

**Poll: "Do you install/specify cool roofs on re-roofing projects you work on?"**

**Poll: "If you have used one of the exceptions, which ones? (check all that apply)"**

- Tom Paine (Consol): The incentives for homeowners and installers don't encourage efficiency upgrades. Homeowners want the cheapest thing, installers want the customer. No one considers long term costs.
- Randy Young (SMW Local 104): All ducts regardless of location in buildings should be sealed to Seal Class A.
- George Nesbitt (HERS Rater): The "average" existing home may be worse than 1990.
- George Nesbitt (HERS Rater): Cool roofs make sense even in Climate Zones 3-4, as well as some of the others not proposed.
- Tom Paine (Consol): We need on-bill financing or something similar if existing homes are ever going to be upgraded.

**Proposed code change overview**

- Chadwick Collins (Kellen Company): Is that at the attic floor for R-49?
  - Bill Dakin (Frontier Energy, Statewide Utility Codes & Standards Team): Yes, attic floor R-49 not roof deck.
- Lucas Morton (Pete Moffat Construction): Knob and Tube wiring?
- George Nesbitt (HERS Rater): Reroof is a great opportunity to upgrade insulation. But how much and where depends on lots of factors.

**Poll: “How should the steep slope insulation requirements apply to rafter roof assemblies?”**

- George Nesbitt (HERS Rater): We should require all low slope roofs (new) to leave room for roof deck insulation in the future if not installed originally.
  - Bill Dakin (Frontier Energy, Statewide Utility Codes & Standards Team): Good point on low-slope roof.
- William Callahan (ARCBAC): Also need to consider cathedral ceilings and skylights in steep slope roofs.
  - Jon McHugh (McHugh Energy): Bill Callahan – are you differentiating cathedral ceilings from rafter roofs?
  - Bill Dakin (Frontier Energy, Statewide Utility Codes & Standards Team): We mean to include cathedral roofs in the category of rafter roofs.
  - Jon McHugh (McHugh Energy): Bill Callahan – is your comment about skylights on steep slopes that integral curbs might not be tall enough if above deck insulation is added?
  - William Callahan (ARCBAC): Yes, and raising the height of the roof deck affects the gutter system and, if there are skylights, removing and reinstalling them is not only a cost but also affects the interior finish around the skylight. There is now 4 or 5 inches of interior finish that needs to be done to fill in the gap.
  - Jon McHugh (McHugh Energy): Bill Callahan – could you describe the gutter system impacts from increasing the height of the roof deck?
  - Bill Dakin (Frontier Energy, Statewide Utility Codes & Standards Team): We have heard similar concerns with gutters when adding above deck insulation but would like to hear more if you have more information.
  - William Callahan (ARCBAC): If the roof is raised 4-6 inches, the gutters need to be removed, new fascia installed to abut the new roof deck and reinstall the gutters.
- William Callahan (ARCBAC): In which case the only place to add insulation is above the deck, which can be very problematic in steep slope.
- **Poll: “What exceptions should be allowed for the low slope re-roof insulation requirements? (check all that apply)”**
- Lucas Morton (Pete Moffat Construction): There is already code language around 'R-whatever is required in rafter roofs, but if there isn't space to maintain venting, then do your best.'
- Chadwick Collins (Kellen Company): ORNL presented at IIBEC yesterday looking at the effective trade off of cool roofs in today's climate with increased R-value and re-assessing the thermal mass of other roof systems. This should be reviewed and considered.
- Jon McHugh (McHugh Energy): What if a portion of the roof deck is removed?
  - Bill Dakin (Frontier Energy, Statewide Utility Codes & Standards Team): Jon- We will look into the case where only part of roof deck is removed.
- Lucas Morton (Pete Moffat Construction): So as long as the 'best effort' exemption is there, then it should be reasonable.
- Charlie Snowden (Environmentally Safe Products, Inc): Reflective insulation that provides the same performance outcome as other products should be allowed

- George Nesbitt (HERS Rater): You can drill & fill from the top of the roof (through the sheeting), but for assembly safety exterior continuous insulation needs to be installed. 50% of the R-Value would be on the outside for moisture safety.
- Randy Young (SMW Local 104): I am not a roofing expert, I would be cautious on placing overly expensive burdens on home owners for existing roof replacements as this may lead to more homeowners opting for no permits and no inspections. Many reroofs are done out of necessity to stop leaks.
- George Nesbitt (HERS Rater): Climate zones 1,3, 5-7 should be R-38 upgraded.

### **Market trends**

- Chadwick Collins (Kellen Company): Is there consideration of the transition of the market from single family to multifamily (how many single family properties are converted/demoed and replaced with multifamily)? How do these proposals look if that segment shifts?
  - Bill Dakin (Frontier Energy, Statewide Utility Codes & Standards Team): Chadwick- We are looking at how these measures may impact MF buildings. Do you have information on the number of SF units demoed and converted to MF? We are not aware of this data.
  - Chadwick Collins (Kellen Company): I am not aware - but looking at metro growth, I would think there is a shift.
- George Nesbitt (HERS Rater): Title 24, Part 1 says "the codes applies any time the code would apply, not if you pull a permit" (ok I'm paraphrasing). You can make skylight (and other curbs) taller.
  - Jon McHugh (McHugh Energy): George – agreed, especially for skylights meant to be mounted on top of a separate curb but what is the solution for skylights with integral curbs? Replace the skylight?
- Dan Johnson (Beyond Efficiency): Many people store stuff in the attic; ducts in the attic obstruct access; all of this makes retrofit insulation a big bother & cost for homeowners.
- Bruce Severance (Mitsubishi Electric): Strategically, from a whole house perspective, and embracing Rick Chitwood's research, it doesn't make sense to require additional vented attic insulation until HVAC equipment and ducts have been replaced so air sealing can be factored into load calcs, and newly replaced ducts can be deeply buried. Insulation prior to other attic upgrades inhibits a synergistic approach. Calcerts and IHACI are developing a new certification curriculum around the idea of HVAC contractors leading the sale of insulation and other attic improvements and asking for a reinterpretation of CSLB rules.
- Ronnen Levinson (LBNL): The 2016 Title 24 Residential Compliance Manual specifies a default ceiling insulation U-factor of 0.079 BTU/(ft<sup>2</sup>·°F·h) for pre-1978 homes, corresponding to R-13 roof assembly thermal resistance. This is less than half the R-27 roof assembly thermal resistance that would result in most climate zones from the 1988 T24 prescriptions.
  - Bill Dakin (Frontier Energy, Statewide Utility Codes & Standards Team): Ronnen- This is a good point. We will look at this and revisit our base assumptions if needed.
- Tom Kabat: IPCC scientists say we need to use measures that are Rapid, Far Reaching and Unprecedented, so I favor expanding contractor license authorities to reduce barriers to preserving the climate.
  - Dan Johnson (Beyond Efficiency): Tom Kabat, I agree. Licensing is an artificial barrier.
- George Nesbitt (HERS Rater): I changed my attic insulation to roof deck insulation as part of my reroof.

- William Callahan (ARCBAC): I would have no problem with the CSLB ruling that installing required insulation is "incidental and supplemental" to reroofing, which would allow a roofing contractor to legally install attic insulation.
- Ronnen Levinson (LBNL): What is the higher (> 0.20) value of steep roof solar reflectance modeled to provide energy savings equivalent to R-49 attic insulation?
  - Ronnen Levinson (LBNL): Did the simulations of R-49 attic insulation assume that the HVAC ducts are buried in the insulation?
- George Nesbitt (HERS Rater): The more insulation between the roof deck and the dwelling the smaller the cool roof heating penalty will be.
  - Chadwick Collins (Kellen Company): George - the more thermal mass between the deck and dwelling, the smaller the color of the roof's impact per ORNL recent research.
  - George Nesbitt (HERS Rater): But insulation keeps the heat in during winter.
  - Chadwick Collins (Kellen Company): Insulation works in all seasons - it is about the heat flow between the conditioned space and exterior. It isn't purely a winter/summer issue
- Tom Paine (Consol): New code standards are only going to encourage people to avoid permitting unless new incentives are put in place.
- Ronnen Levinson (LBNL): How did you get \$0.50/ft<sup>2</sup> as a cost premium for low-slope cool roofs? If you hold the product type constant there is typically little or no cost premium to switch from black/gray to white.
  - Alea German (Frontier Energy, Statewide CASE Team): We looked at a number of different sources. This is preliminary data and we're looking to expand this. We thought there might be no incremental cost, but there are data points showing incremental costs. This is the range of the data that we saw.
  - Ronnen Levinson (LBNL): The key is to keep the product otherwise the same. There are often price differences associated with material type or service life, rather than color/solar reflectance.

#### 4.A.2 - Submeasure A.2: Electric equipment replacements

##### **Poll: "What should trigger the upgrade to a heat pump system?"**

- Dan Johnson (Beyond Efficiency): Prohibit single-function AC that is not a heat pump! It's imperative that retiring NG furnaces & ACs be replaced by heat pumps to meet CA climate goals.
- Randy Young (SMW Local 104): There are also cost differences based on labor rates, for example the bay area rates are considerably higher than those in the valley.
- Dan Johnson (Beyond Efficiency): You need to impact the ability to replace a gas furnace, this measure falls short.
  - Alea German (Frontier Energy, Statewide CASE Team): Yes, there needs to be provisions in the code to ensure that that is provided for. There will be cases where there are really small closets that might not even fit heat pump water heaters.
- Tom Paine (Consol): Consider a home occupied by a renter. The renter gets the savings. The owner only sees cost. The greater impact of such a requirement, without other incentives, will be the avoidance of repair or upgrade.
  - Randy Young (SMW Local 104): Great point Tom.
  - Jon McHugh (McHugh Energy): Tom Paine – are you suggesting that a landlord would not replace their roof when leaking because they want to avoid the cost of a re-roof? Do you feel that the visual appearance of the roof has no impact on rents?

- Dan Johnson (Beyond Efficiency): Heat pumps have lower lifecycle cost than a furnace plus AC, and lower installed cost. Better to keep ER water heaters than to accidentally encourage new tankless gas.
  - Randy Young (SMW Local 104): Prohibiting an electric water heater goes against the carbon free goals set forth in California.
  - Bill Dakin (Frontier Energy, Statewide Utility Codes & Standards Team): Randy- we are addressing opportunities for replacing existing electric resistance water heaters with HPWHs when possible.
  - Dan Johnson (Beyond Efficiency): 2022 Code metrics show zero cost and zero carbon electricity at midday, so there is not a penalty for load-shifted ER water heaters; don't shoot us in the foot here.

**Poll: "Where should replacement electric resistance water heaters be prohibited?"**

**Poll: "What alternative paths should be allowed for the heat pump water heater requirement? (check all that apply)"**

- Tom Paine (Consol): Only require heat pumps where the existing conditions have proper air space.
- Bruce Severance (Mitsubishi Electric): Solar thermal has not been cost effective in single family applications for many years.
  - Alea German (Frontier Energy, Statewide CASE Team): The cost-effectiveness we'd look at would be heat pump water heater vs. resistance and providing alternative paths.
  - Adam Chrisman (SunEarth): Solar thermal is cost effective with electric rates for heating water exceeding \$0.25kWh. We already have higher rates and decarbonization will drive water heating to electric and HPWH's are less efficient than Solar Thermal. This changes any previous data on Solar Thermal cost effectiveness when comparing to gas.
  - George Nesbitt (HERS Rater): SDHW is not "cost effective" with gas, with electric resistance it may be. but a heat pump is cheaper and easier and saves as much energy.
- George Nesbitt (HERS Rater): Electric resistance (WH or heating) generally would be discouraged. Yet conversion to gas may conflict with decarbonization (in the long term).
- Tom Paine (Consol): All of the alternatives aside from grid connected are very expensive.
- Dan Johnson (Beyond Efficiency): Also consider Accessory Dwelling Units with very few hot water draws, you can't pay back a HPWH, and space is even more precious. ER is fine in this case.
  - George Nesbitt (HERS Rater): On demand electric resistance might make sense in small ADU's.
  - Bill Dakin (Frontier Energy, Statewide Utility Codes & Standards Team): Dan J- Good point. We will consider that case.
- Lucas Morton (Pete Moffat Construction): Regrading unintended tankless retrofits-- this is plausible, but a bit of a stretch-- if gas were already easily readily available to location, then it's likely they would have fuel substituted already.
- Danny Tam (Energy Commission): The 2022 metric does not show zero cost at midday. The customer would still be paying for electricity even if wholesale price is 0.
  - Ted Tiffany (Guttman & Blaevoe Consulting Engineering): Danny, take a look at that retail adder.
  - Danny Tam (Energy Commission): There are some potential unintended consequence with that, but we are looking into it.

- Ted Tiffany (Guttman & Blaevoe Consulting Engineering): Danny, happy to discuss those, help me understand it.
- Dan Johnson (Beyond Efficiency): Zero TDV at midday.
- Danny Tam (Energy Commission): TDV is never zero because there is currently a flat retail adder, that's what Ted is talking about.
- Dan Johnson (Beyond Efficiency): Owners with ER water heating already have a cost incentive to change to HPWH if space/conditions allow. The code needs to go after gas water heaters, not ER. Danny, the retail adder is wrong, it needs to be corrected to encourage load shift.
- George Nesbitt (HERS Rater): TDV should never be 0, but the flat retail rate needs to be changed to a time of use rate.
- Danny Tam (Energy Commission): We are looking into the retail adder issue. The biggest potential issue with going too extreme with a non-flat retail adder is that any measure that saves energy during those hours, such as envelope, cooling, even PV might become not cost effective if you assume there are no consequences of using energy in those hours.
- Dan Johnson (Beyond Efficiency): Danny thanks. Then that is just the physical reality, right?
- Danny Tam (Energy Commission): Maybe one day the retail rate will match the reality on the grid, but today every utility in the State still charges the customer even when there is too much renewable on the grid.
- Dan Johnson (Beyond Efficiency): Danny, a flat retail adder does not even reflect current TOU rates with bigger differential (EV, etc.) and does not compel utilities to match CEC's TDV timeseries. Thanks.
- George Nesbitt (HERS Rater): People rarely fuel swap because of having to bring in new connections (although switching to electric is more common).
- Tom Kabat: More popular HPWHs have much better EFs than the old 2.0 federal minimum and would more than double the annual savings on the blue water heating bars.
  - Alea German (Frontier Energy, Statewide CASE Team): In our analysis we are using the federal minimum, but there is definitely market data showing most products are above that energy factor.

#### 4.A.3 - Submeasure A.3: Duct measures

##### **Poll: "What should the 40 foot limit be reduced to?"**

- Randy Young (SMW Local 104): Simple question on the duct length, is it cumulative or per run?
  - Lucas Morton (Pete Moffat Construction): Cumulative.
  - Alea German (Frontier Energy, Statewide CASE Team): Cumulative is correct. The total duct length that is added in an alteration.
- George Nesbitt (HERS Rater): Most existing ducts that I've sealed I've gotten down to 6 percent or below. 15 and 12 percent are too lax.
  - Alea German (Frontier Energy, Statewide CASE Team): Yes, we've heard that 6% from other folks as well. That was good to hear.
  - Bruce Severance (Mitsubishi Electric): George - Agree duct leakage target should be lower: 8-10 percent.
  - George Nesbitt (HERS Rater): Getting to 15 percent is easy, getting to 6 percent is a little more work.

- Randy Young (SMW Local 104): SMACNA Seal Class a should be mandatory.

### **Incremental Cost Information**

- George Nesbitt (HERS Rater): \$250 for HERS is the minimum for a one off.
  - George Nesbitt (HERS Rater): \$500 duct sealing is less than I charged, but I spend most of a day with testing out.
  - Bruce Severance (Mitsubishi Electric): \$60 an hour for four hours of sealing by a tech is also low.
  - Dan Johnson (Beyond Efficiency): This appears to add nearly \$1000 to the job, can you pay this back with efficiency savings?
  - Alea German (Frontier Energy, Statewide CASE Team): Right now we are looking at \$500/job and that is looking to be cost-effective in most if not all climate zones. If that turns out to be too low, we will have to re-evaluate in which climate zones this is cost-effective.
  - Randy Young (SMW Local 104): Agree with Bruce the cost of labor and time may be low depending on the systems.
  - Bruce Severance (Mitsubishi Electric): It can take 2-4 hours depending on access, sometimes more.
  - Tom Paine (Consol): Retro air sealing can get complicated fast, should be looking more at 10-12 man hours.
    - Bruce Severance (Mitsubishi Electric): At 12 hours it is better to replace ducts.
    - Tom Paine (Consol): Right.
    - George Nesbitt (HERS Rater): Many change outs replace all or most the ducts.

### **Additional Market Actors**

- Tom Paine (Consol): Banks, as homeowners may take equity lines.
  - Bill Dakin (Frontier Energy, Statewide Utility Codes & Standards Team): Tom - Yes. Thanks.

### **Compliance and Incentives**

- Tom Paine (Consol): I'm less concerned about the individual measures than I am with implementing any of them. Every new requirement without incentives is going to encourage grey market (non-permitted) work, or nonparticipation (especially in rentals).
  - Alea German (Frontier Energy, Statewide CASE Team): Permitting – this is a very important aspect to consider. We have been grappling with what can be done to ensure that that does not happen and that the permitting issue is not driven by this code change. Is there anything that can be done through this process to help alleviate that? Incentives are the solution, with rebates provided for following the code and complying with these requirements.
  - George Nesbitt (HERS Rater): Issues of compliance and permits should not be part of the decision making for code changes.
  - Tom Paine (Consol): Incentives are one thing, and there is some bigger picture effort behind better connecting up-front costs and long-term savings.
  - Lucas Morton (Pete Moffat Construction): George—agreed.
  - George Nesbitt (HERS Rater): Cost-effectiveness is a barrier to "doing the right thing"

- Alea German (Frontier Energy, Statewide CASE Team): Finance and education are important - communicating to home owners how to make these improvements and how they can afford it.
- George Nesbitt (HERS Rater): 90 percent of changes are noncompliant. Should we eliminate the requirements? (NO!)
- Tom Kabat: Perhaps state support of a comply on resale requirement would get folks to comply when working. And even that was a hard sell.
- Tom Paine (Consol): George, entirely right, but it will get worse not better. I worked in Massachusetts with MassSave, we had zero percent loans for energy retro work.
- Alea German (Frontier Energy, Statewide CASE Team): There are a lot of great ideas for support around these measures. There is no one solution but rather a combination of multiple that makes sense, and this will likely differ from region to region as to what really motivates people.
- Dan Johnson (Beyond Efficiency): FYI the aisle at Home Depot has 3 different tankless ER water heaters on the shelf; no HPWH to be seen; 1/2" pipe insulation is still being sold; circulation pumps with timers on display; can we get a compliance boost just by affecting HD's inventory?
  - Alea German (Frontier Energy, Statewide CASE Team): If there are more high efficiency products, maybe it's easier to comply with the requirements. Good comment.
- Randy Young (SMW Local 104): We have had major discussion on serial number tracking, wholesalers and manufacturers are not in favor as cash sales on Friday are big income.
  - Alea German (Frontier Energy, Statewide CASE Team): I'm not sure that I follow all of this. We can follow up offline.
  - Randy Young (SMW Local 104): Sounds good.

#### 4.B - Submeasure B: Clarifying Standards Language

- Jon McHugh (McHugh Energy): Compliance is often focused on the paper compliance of filling out forms etc. What is your observation on compliance in terms of unpermitted installs: charging AC, sealing ducts, equipment efficiency, etc.?
  - Alea German (Frontier Energy, Statewide CASE Team): That's a good question. We've certainly had conversations with contractors offline – they follow code requirements and not necessarily permits. Pulling that permit gives validation, verification for compliance. Any other data on this question, hard data or anecdotal, would be welcome.
  - Jon McHugh (McHugh Energy): There was a very controversial study by DNV GL<sup>1</sup> that looked at some of these issues. There are some people out there that are sometimes pulling the permits, other times not. Is there some spillover from the work that they do that is permitted? It's kind of the bigger picture – what is the net energy effect? Even when there is less than 100% compliance, is there spillover from code compliance into unpermitted projects?
  - George Nesbitt (HERS Rater): Even with permits there is a level of noncompliance. But there is also a level of compliance even without permits.

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<sup>1</sup> Link to appendices: [http://www.calmac.org/publications/HVAC\\_WO6\\_DRAFT\\_REPORT\\_APPENDICES\\_VolumeII\\_22Sept2017.pdf](http://www.calmac.org/publications/HVAC_WO6_DRAFT_REPORT_APPENDICES_VolumeII_22Sept2017.pdf)

Link to report [http://www.calmac.org/publications/HVAC\\_WO6\\_FINAL\\_REPORT\\_VolumeI\\_22Sept2017.pdf](http://www.calmac.org/publications/HVAC_WO6_FINAL_REPORT_VolumeI_22Sept2017.pdf)

- Bill Dakin (Frontier Energy, Statewide Utility Codes & Standards Team): The word we have heard is that the issue of pulling a permit is primarily a cost issue. Contractors are known to charge more if a permit is pulled.
- Tom Paine (Consol): Good question John. There may be some effect from leading best practices that falls outside of permitted. But that would be very hard to catch. Especially when the people who would know are doing unpermitted work, they don't want anyone to know about it.
- Chadwick Collins (Kellen Company): Regarding the roofing items, I suggest that any considerations for roof reflectivity/emittance be done considering the entire envelope - as has been said, nothing is a silver bullet solution. Looking at all the options in the envelope should be the approach.
- Tom Paine (Consol): I will say that it comes down to upfront cost. No one cares about savings \$8 a month on their utility bill.
- Bruce Severance (Mitsubishi Electric): Before WHPA dissolved last month, Randy was leading C&S Committee discussions and the focus turned toward incorporating a statistical method of locating patterns of violation in a statewide sole-source permitting and business license portal. When filling out the application for a business license to perform work in a jurisdiction, the HVAC contractor would be required to electronically sign a form stating number of installers and ratio of residential, commercial, repair and replacement, etc. The model would statistically project the number of permits a contractor of a specific size and variety should pull in a given quarter and automatically send emails suggesting they are behind in their permit paperwork and have only so much time to come into compliance before fines are imposed.
- Bruce Severance (Mitsubishi Electric): According to DNGVL study, less than 10 percent of residential HVAC replacements are permitted or HERS verified. Enforcement is key, and permit compliance will generate revenue for stressed building departments. All of our incremental improvements are negated without this piece. Not all manufacturers are apathetic about compliance. Our customer satisfaction hinges on QI. Anyone want to partner on grant applications to create a statewide permitting portal??
  - Tom Paine (Consol): Bruce, I think the research model would work, but using enforcement instead of incentive would be its own challenge.

#### 4.C - Submeasure C: ACM

### 5. Nonresidential Grid Integration

- *Jessica Peters and Christine Riker (Energy Solutions, Statewide Utility Codes & Standards Team) presented.*

#### 5.A - Submeasure A: Heat Pump Water Heaters with Grid Connectivity

- Dan Johnson (Beyond Efficiency): City of Berkeley mentioned they provide water heater and heat pump permits online; can CEC push other jurisdictions to offer this?
  - Peter Strait (Energy Commission): We cannot - we've been encouraging local departments to go digital for quite some time, but aside from encouragement we have no authority to push them to do so.
- **Poll 17: "Have you ever worked on a project where a Heat Pump Water Heater was installed in a commercial property?"**

- Dan Johnson (Beyond Efficiency): We just heard a presentation going after existing residential ER water heaters; can we not also go after existing Commercial ER water heaters with HPWH?
  - Christine Riker (Energy Solutions) Dan - that would be something to consider, but there could be a limitation on size and hot water demand needs. Worthwhile to review the details to see if it could make sense for certain building types or commercial hot water use cases.

## 5.B - Submeasure B: Thermal Energy Storage Systems

- **Poll 18: “Have you ever worked on a project where a Thermal Energy Storage (TES) System was installed in a commercial property?”**
  - **Poll 19: “If Yes, What kind of system was installed?”**
    - Randall Higa (SCE): Ice, chilled water.
    - Dan Johnson (Beyond Efficiency): Heat-recovery chiller with hot and cold water storage tanks.
    - Meg Waltner (Energy 350): Chilled water, ice.
    - Tom Kabat: Mid 1980s, Utility program incenting chilled water storage, ice on coil storage and ice in bin storage.
- Christine Riker (Energy Solutions) The challenge with Commercial is the volume of hot water needed in a day, in some situations it can be continuous for a period of time.
- Danny Tam (Energy Commission): Commercial is more complicated because the demand might not be met by a HPWH.
- John Bade (2050 Partners): A concern with TES is that it is usually run at night with cooler outdoor temps and in most of the country that works well. If CA has excess energy when it is hot and sunny out the chiller may struggle to make really cold water or ice. Not against the idea - just pointing out a concern
  - Christine Riker (Energy Solutions) John thanks for the comment, that's helpful.
- Dan Johnson (Beyond Efficiency): Christine and Danny there are plenty of offices with lavatories and 40-gal gas water heaters to serve only this; these offices also have cooling loads that the HPWH could help with.
- Jon McHugh (McHugh Energy): John perhaps for California we might have thermal storage that works in reverse from the traditional thermal storage systems of building ice and night and melting it in the day. We may find for auditoriums etc that have large peak cooling loads at night that they can build ice during the day for concerts etc. Compressor size could be smaller.
- Danny Tam (Energy Commission): Dan I agree there are some application that would makes sense to go with HPWH, and others that would not. It would be helpful for us to understand where the lines are. In the situation you described, it might make sense to have a point of use ER instead of a storage. We need more work.
- Dan Johnson (Beyond Efficiency): @Danny What? I thought ER was bad and it needed to be replaced with HPWH in residential, why prescribe it for commercial? Thanks.
  - Danny Tam (Energy Commission): Dan, we did look into this quite extensively. Even though apartments and ADU are physically smaller, we have to assume the person living there is using water to shower, cook, etc. The water heater load curve assumes there are less load for these smaller units, but I don't see POU ER can ever make up the difference to HPWH in residential applications.
- George Nesbitt (HERS Rater): Ice storage would make sense for SF / MF, make ice midday with PY excess, and cool in the evening when your' home. This may also make sense in commercial applications as Jon McHugh pointed.
- Jon McHugh (McHugh Energy): For new construction how frequently are we finding larger service water heating designs that are hybrid with heat pump water heater for baseload and make up water and using a gas booster heater for peak loads and reheating recirculated water?

### 5.C - Submeasure C: DC-DC Circuitry

- **Poll 20: “Have you ever worked on a project where a DC to DC Distribution System or PoE was installed in a commercial property?”**
- Danny Tam (Energy Commission): If the WH load is super low like a bathroom for handwashing a few minutes a day, it might be better to have POU ER to save on distribution and standby loss.
  - Dan Johnson (Beyond Efficiency): Danny thanks, let's apply this logic to apartments and Accessory Dwelling Units, but let's not forget the cooling co-benefit in Commercial.
- Simon Lee (Energy Commission): For DC-DC technology, LBNL has done a study on the research efforts on DC-DC. The LBNL work is sponsored by CEC Research.
  - Christine Riker (Energy Solutions) Simon Thanks, we will make sure that was included in our research and if not, add it in.
- Jon McHugh (McHugh Energy): What is meant by lighting running at 60%? Are lights dimmed 40% or is this 60% including lights turned off and some are dimmed.
- George Nesbitt (HERS Rater): Using DC directly makes sense, but unless you're off grid with batteries (and fuel backup mostly) wouldn't you have to do AC to DC conversion (or have the capacity to) some of the time? Or charge the batteries from the grid?
- Jon McHugh (McHugh Energy): Would you only get credit if you have solar PV? Otherwise there is at least one inversion step.
  - Christine Riker (Energy Solutions) Jon sorry for any confusion, it meant to be an example, but the main concern is around conversion efficiency considerations

### 5.D - Submeasure D: HVAC Pre-Cooling

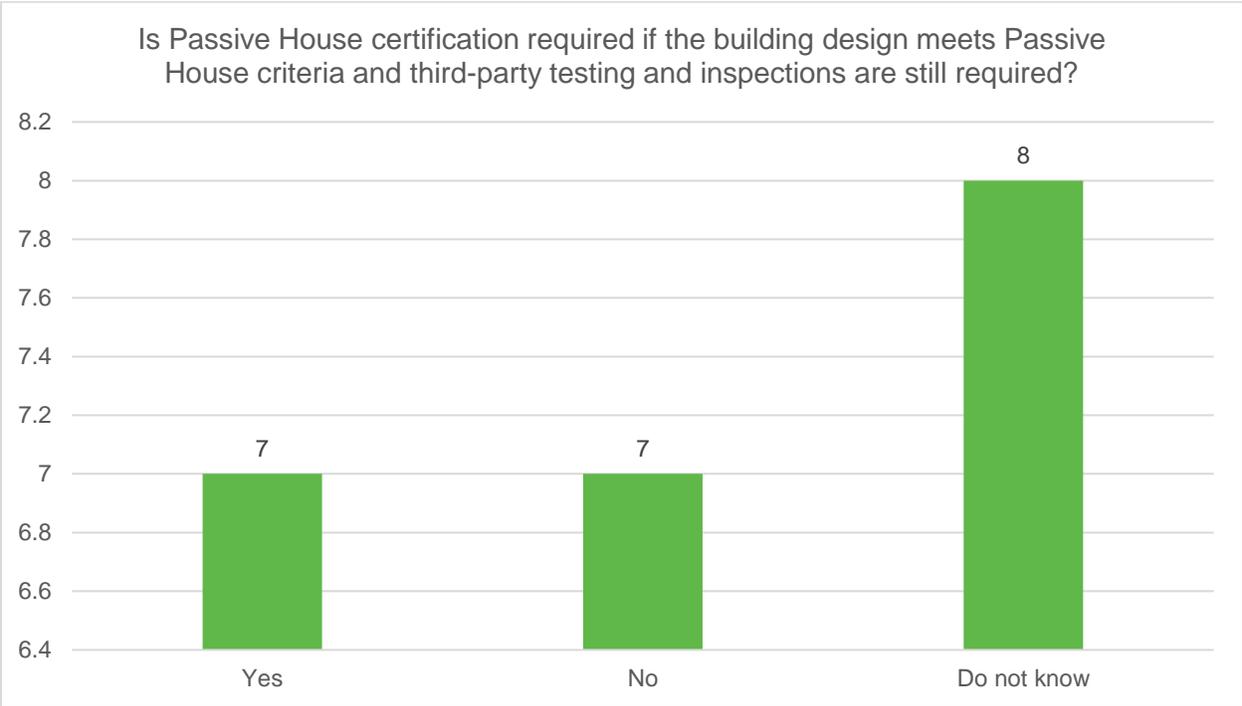
- **Poll 21: “Which update would you most like to see in CBECC-Com 2022”**
- **Poll 22: “If you chose Other, or have another area you would like us to look at, please specify.”**
  - Dan Johnson (Beyond Efficiency): We have HPWH already for Service Water Heating; need this for domestic water heating, and for heating hot water (need heat-recovery chillers and air-source heat pumps for space heating systems).
  - Anirrudh Roy (Goodman Manufacturing): “Demand response being part of load management.

## 6. Nonresidential Elevator Compliance

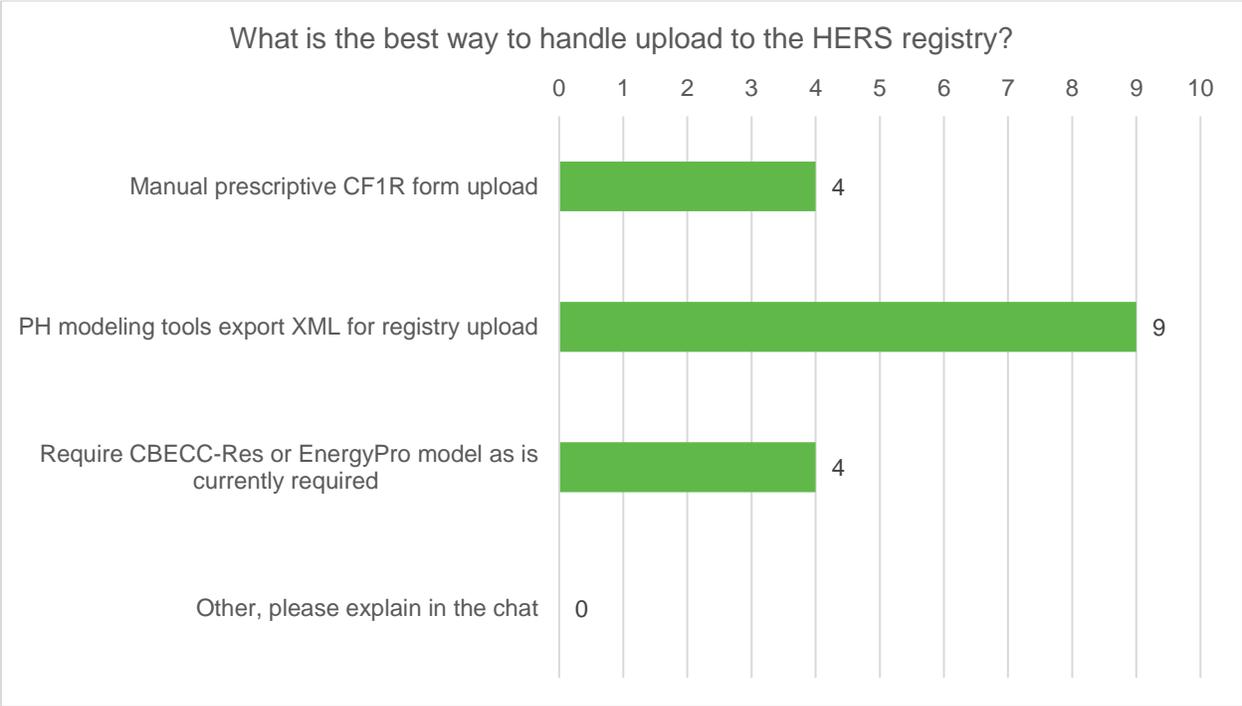
- *Eric Martin (Energy Solutions, Statewide Utility Codes & Standards Team) presented.*
- George Nesbitt (HERS Rater): I haven't heard about regenerative braking in elevators, but I like the idea.
  - Kate DoVale (Energy Solutions): George thank you for your input.
- Jon McHugh (McHugh Energy): ASHRAE has a listing requirement for b. Energy efficiency classes A through G per ISO 25745-2, Table 7.
- Jon McHugh (McHugh Energy): Perhaps setting at one of the levels.
  - Kate DoVale (Energy Solutions): Great idea, we'll look into that.
- Peter Strait (Energy Commission): Transporters are just regenerating replicators.
- Jon McHugh (McHugh Energy): Just like regenerative braking on an electric or hybrid car

# Appendix A: SF Whole Building Poll Data

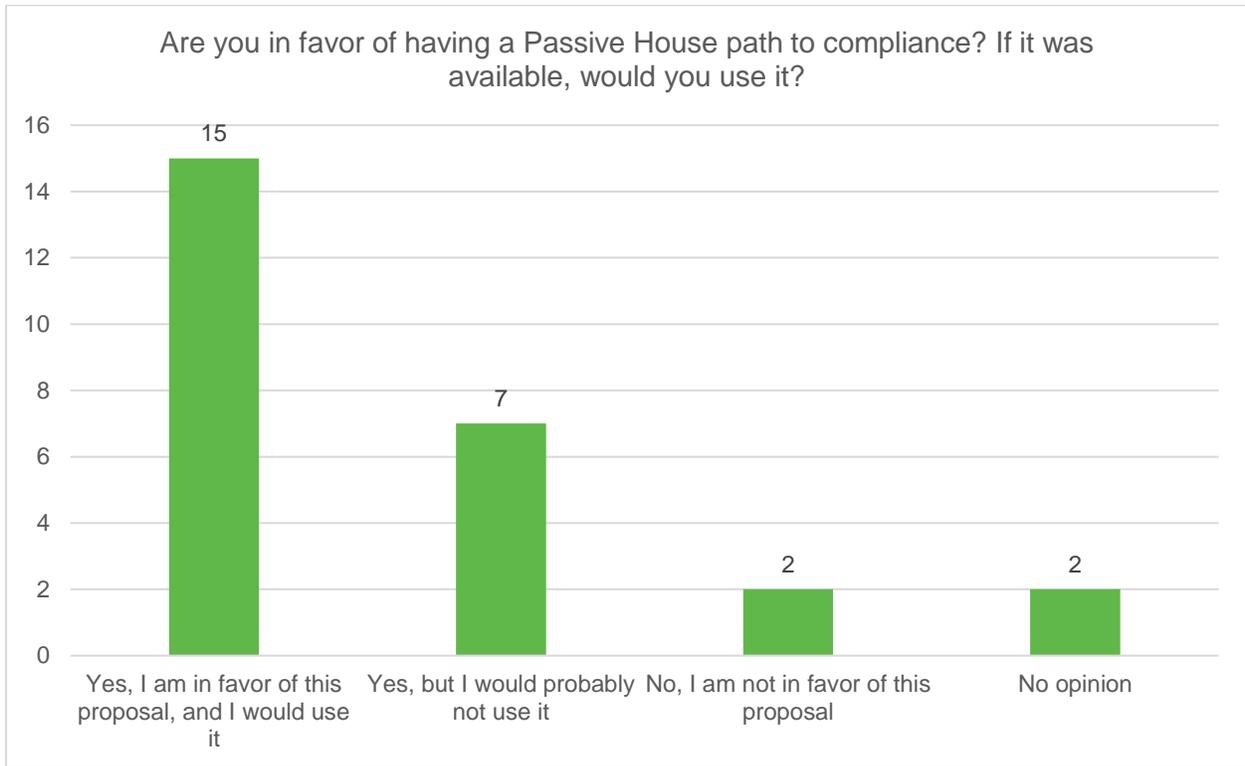
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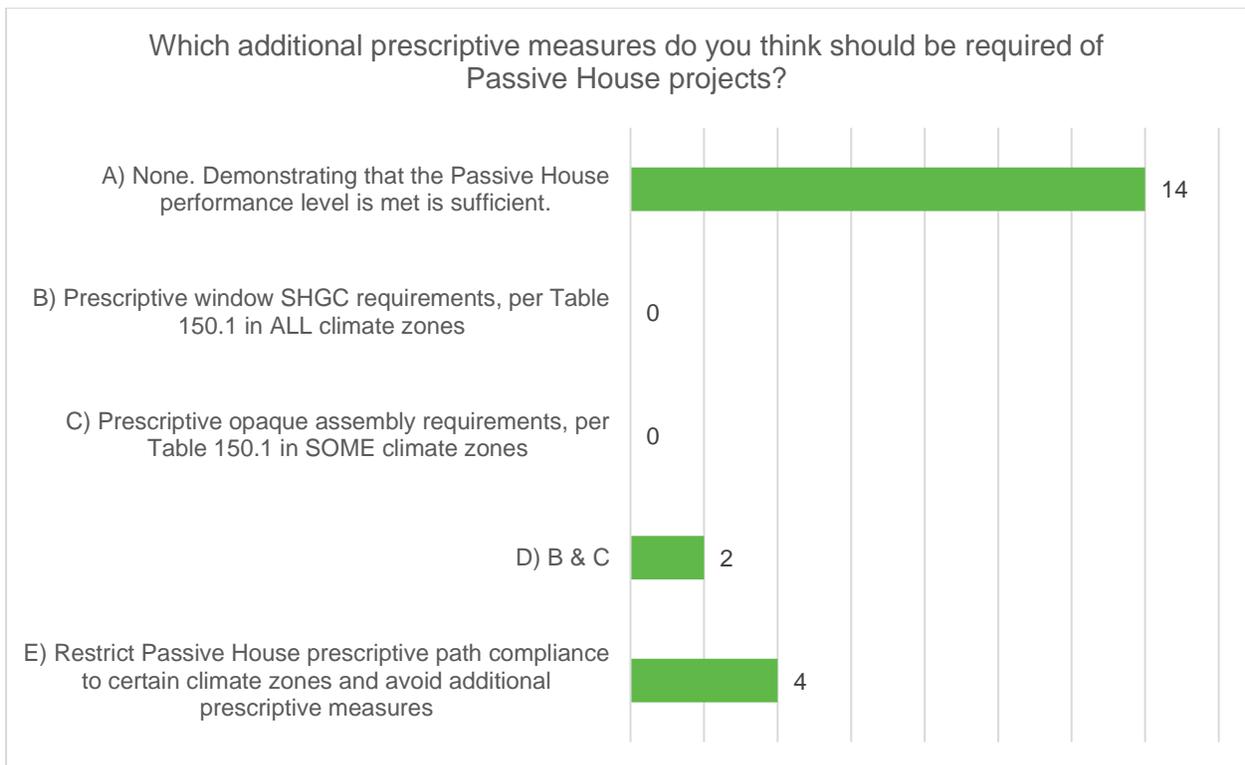
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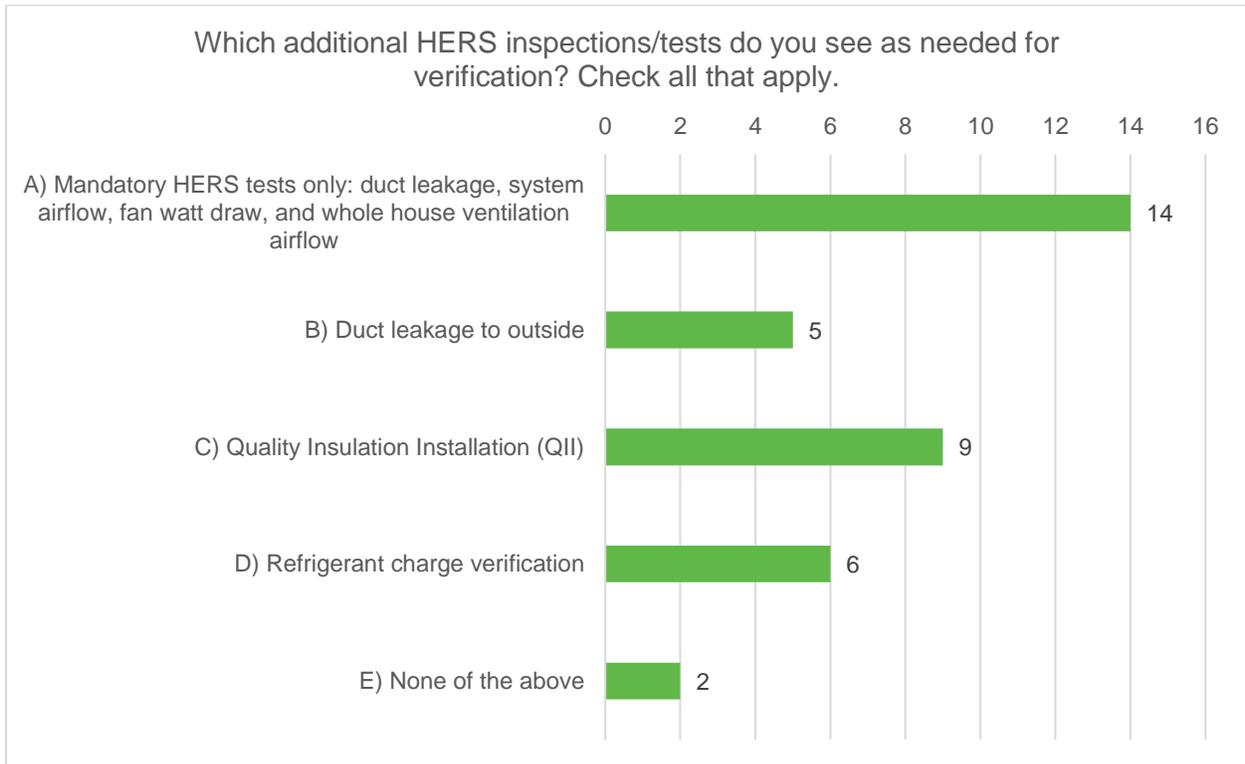
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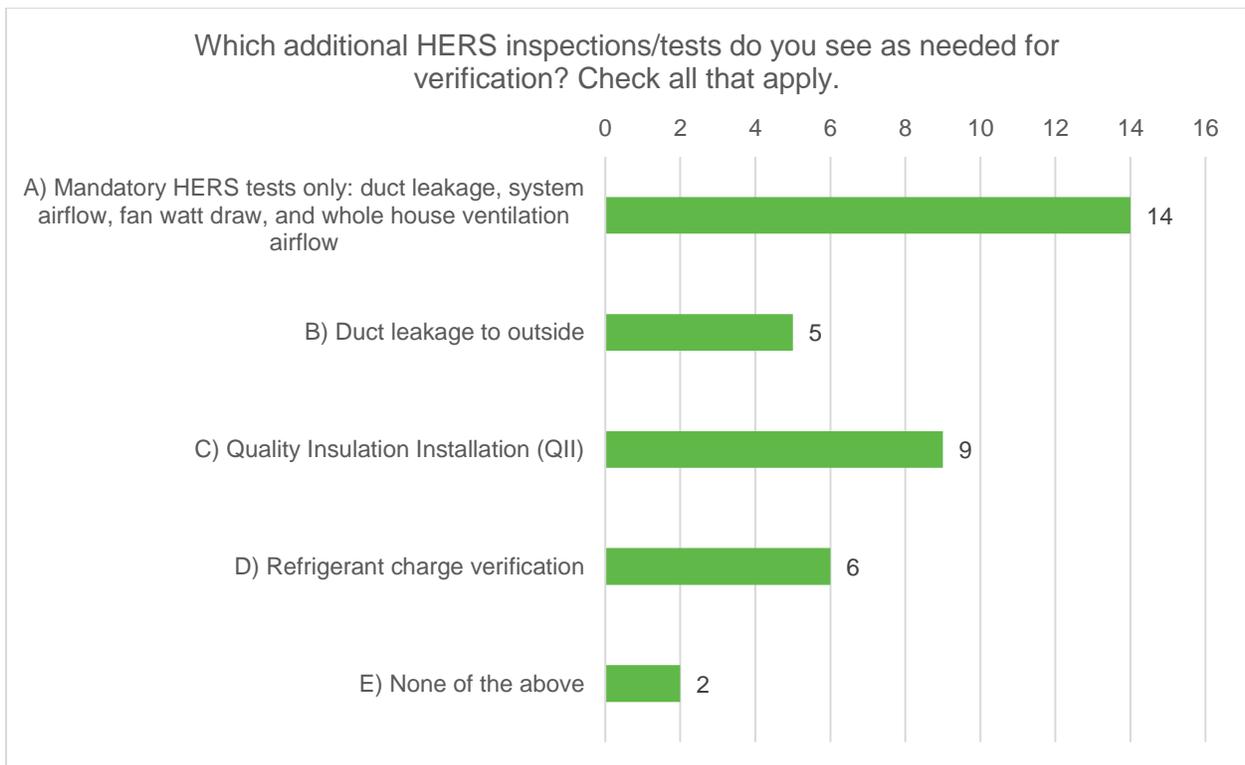
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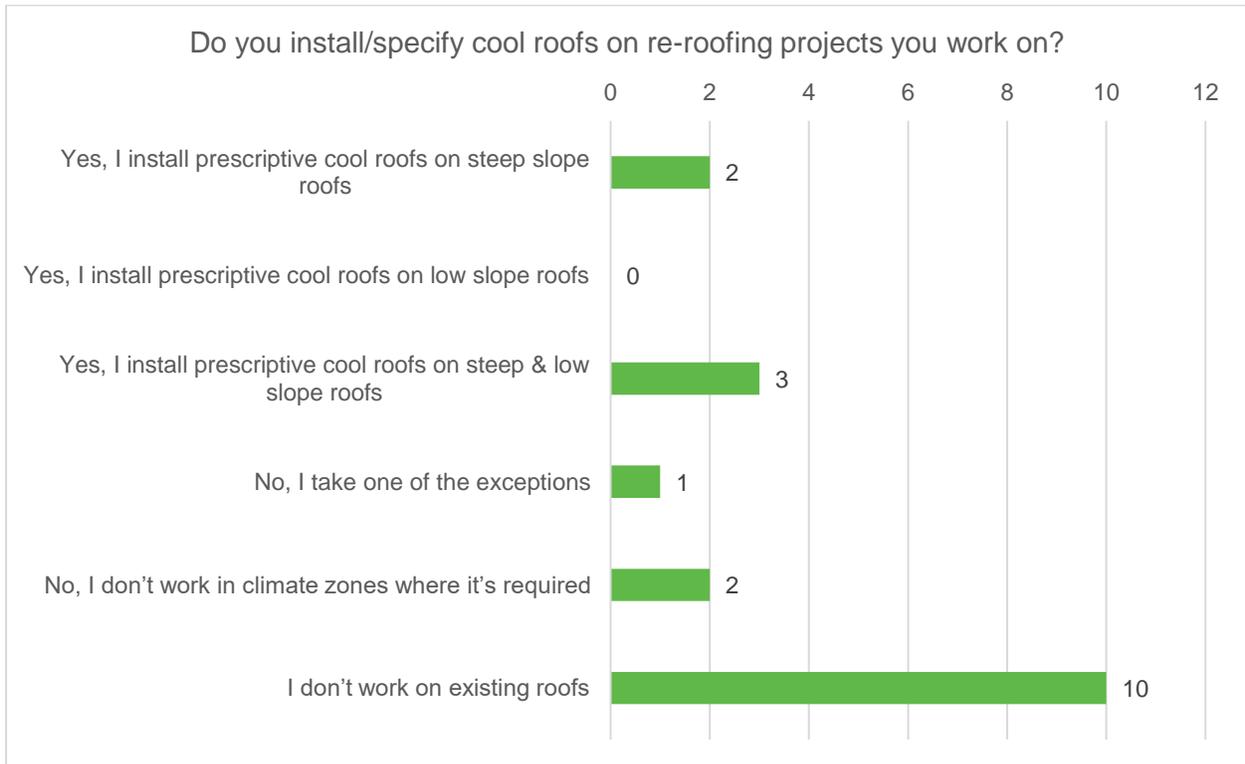
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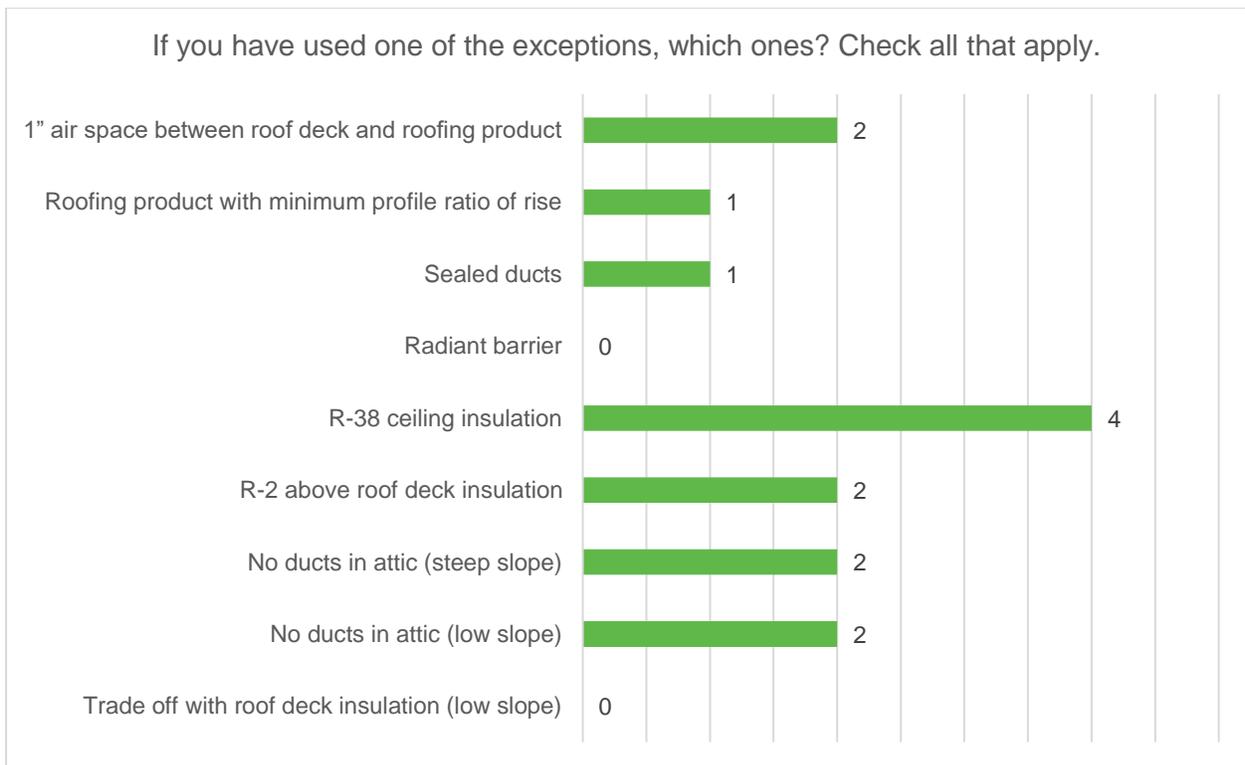
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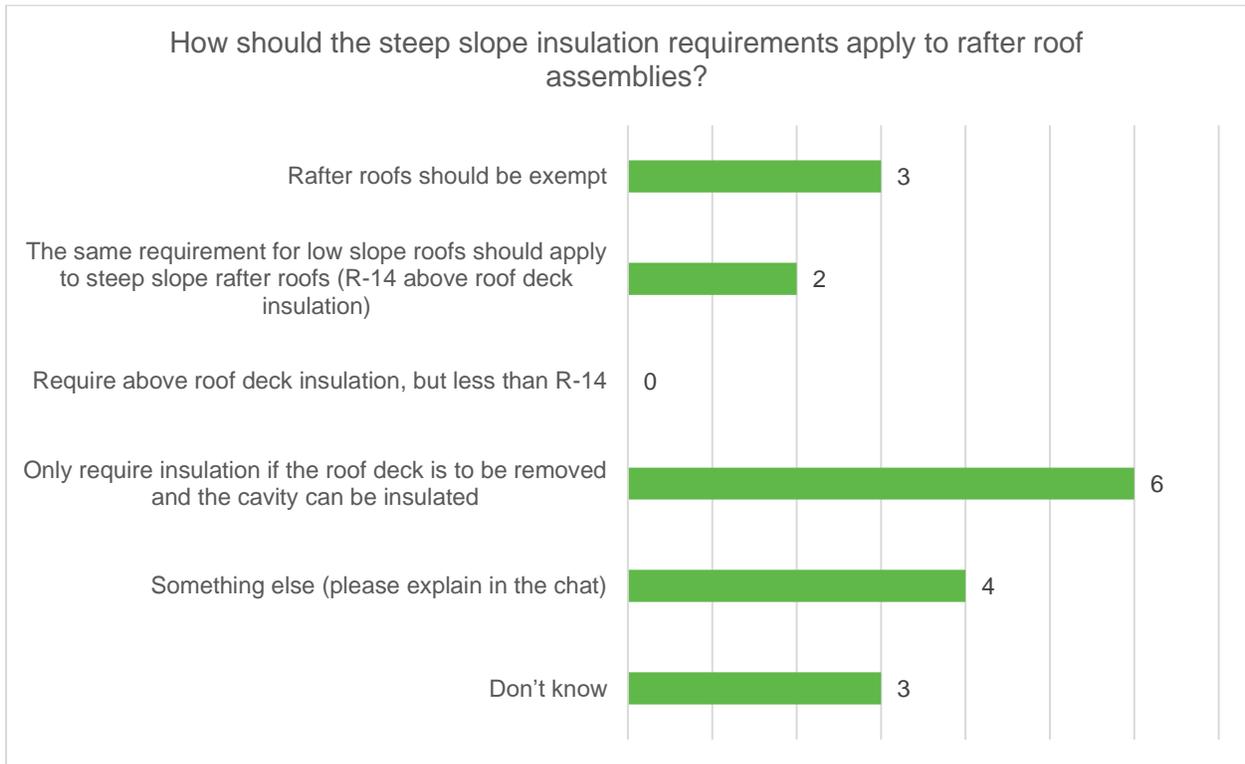
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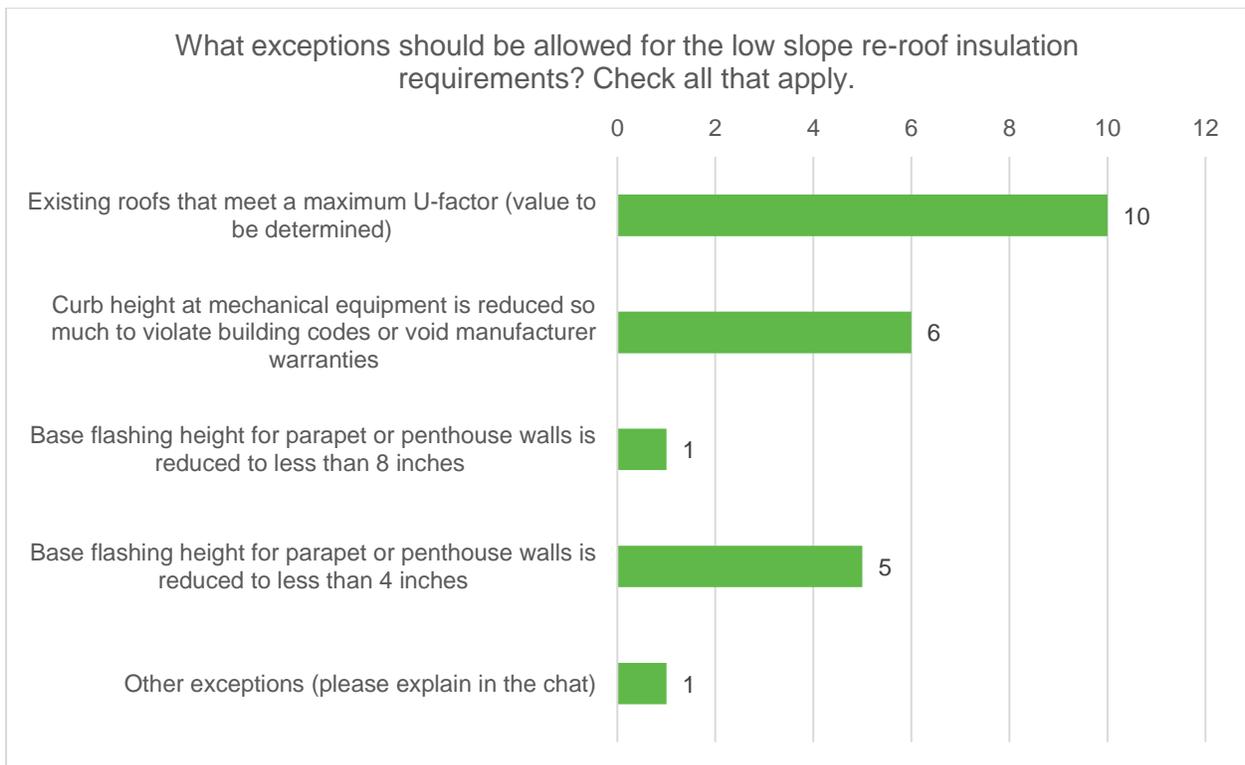
Poll 8:



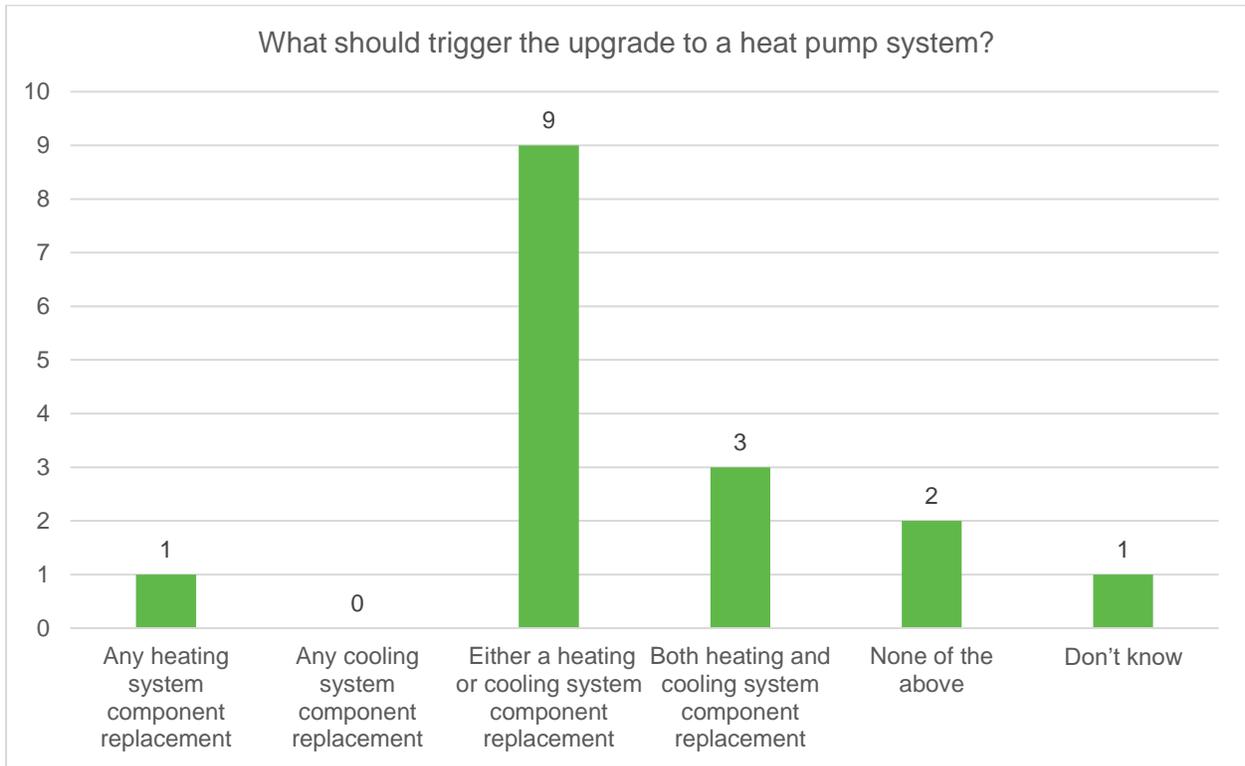
Poll 9:



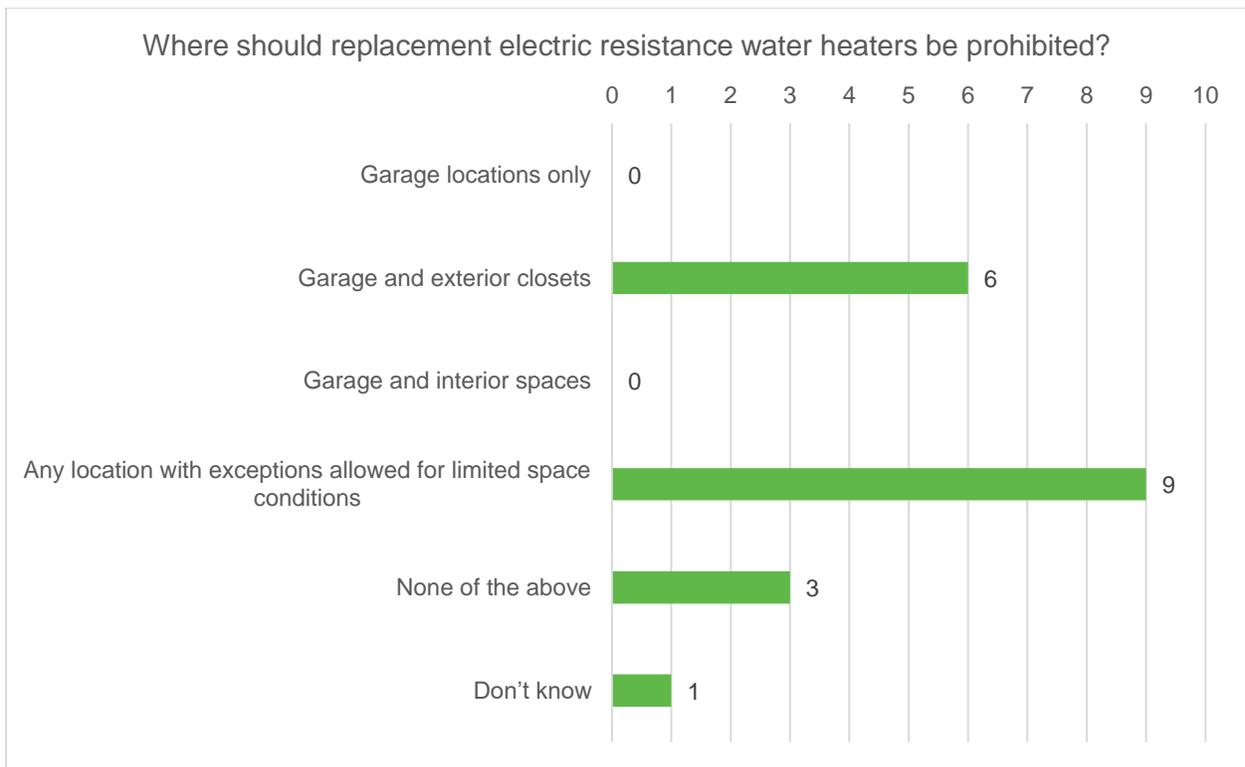
Poll 10:



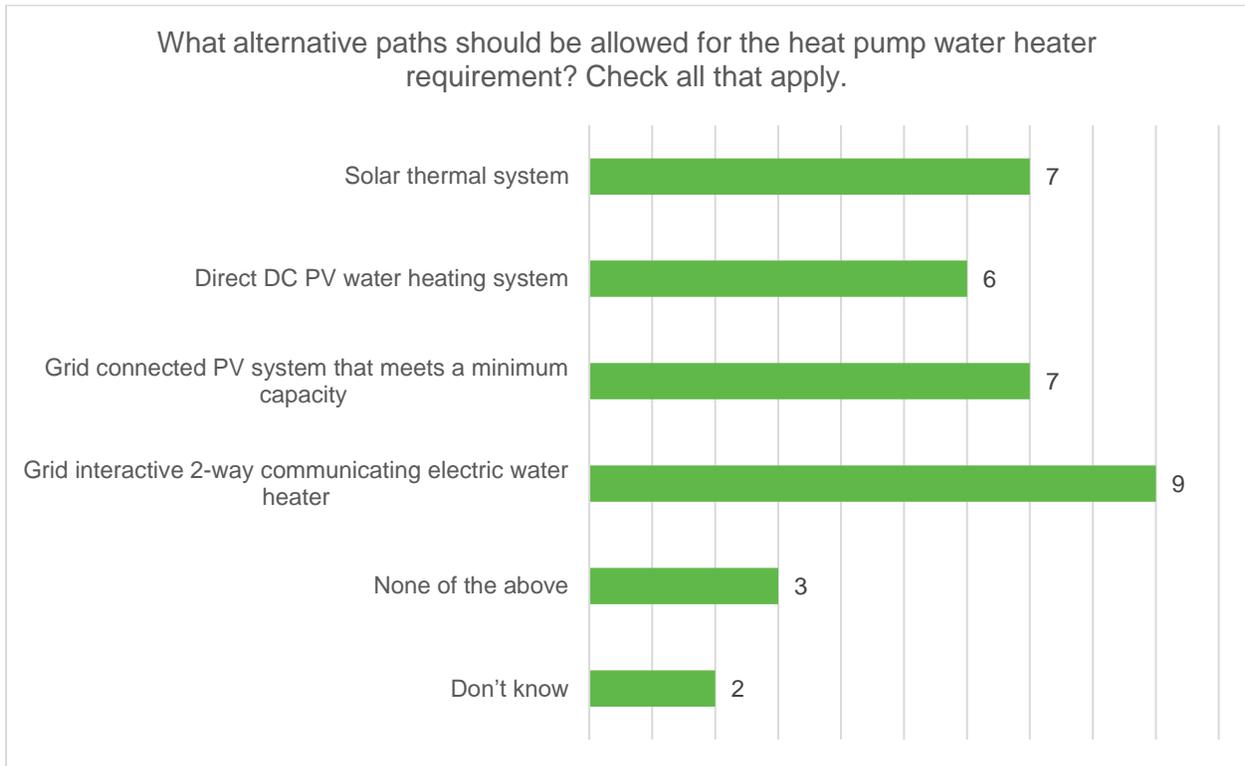
Poll 11:



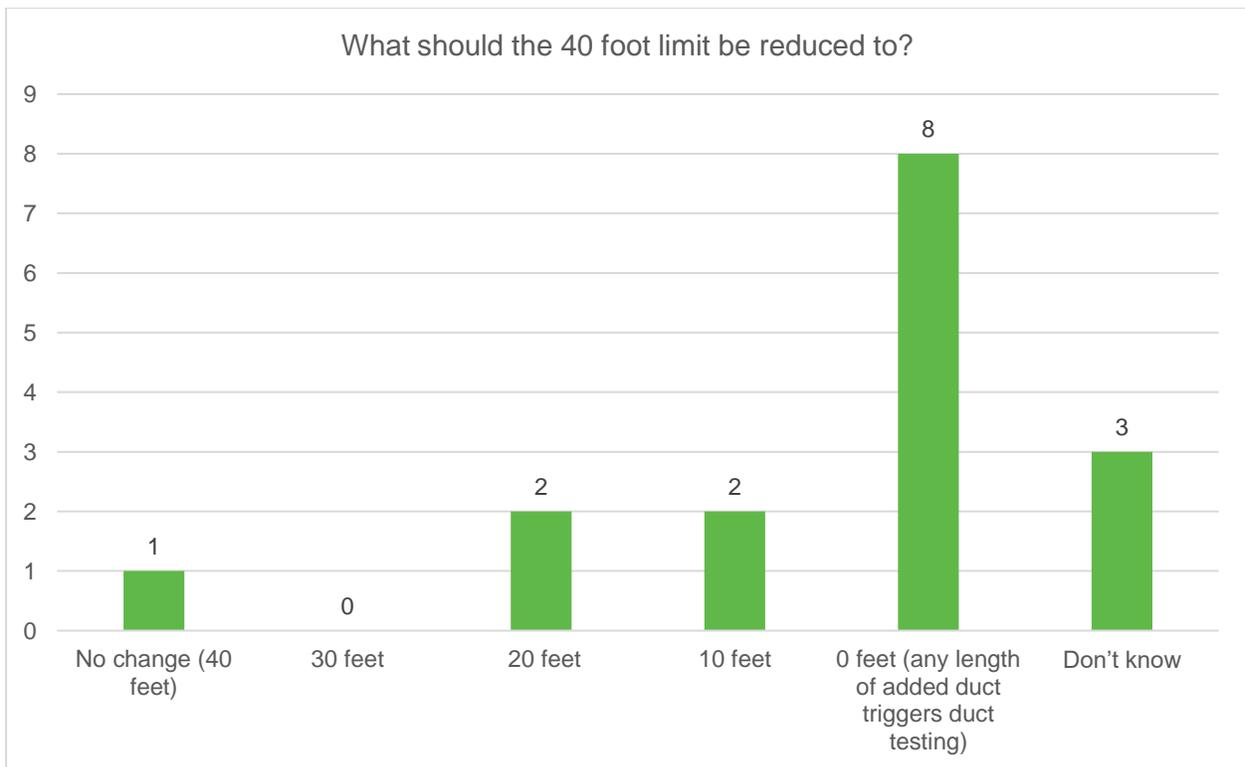
Poll 12:



Poll 13:

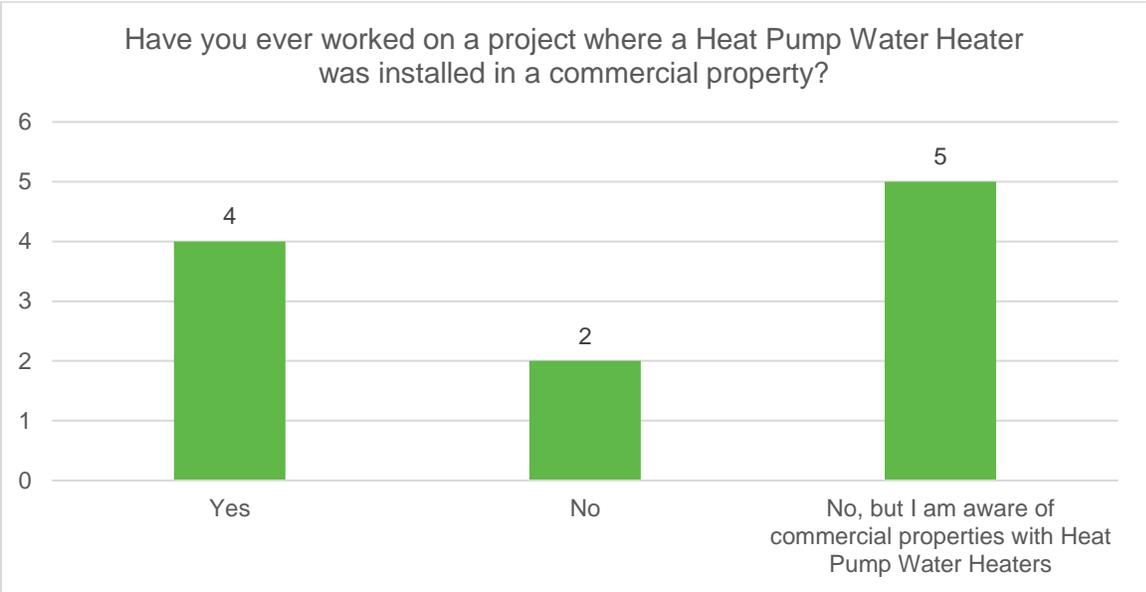


Poll 14:

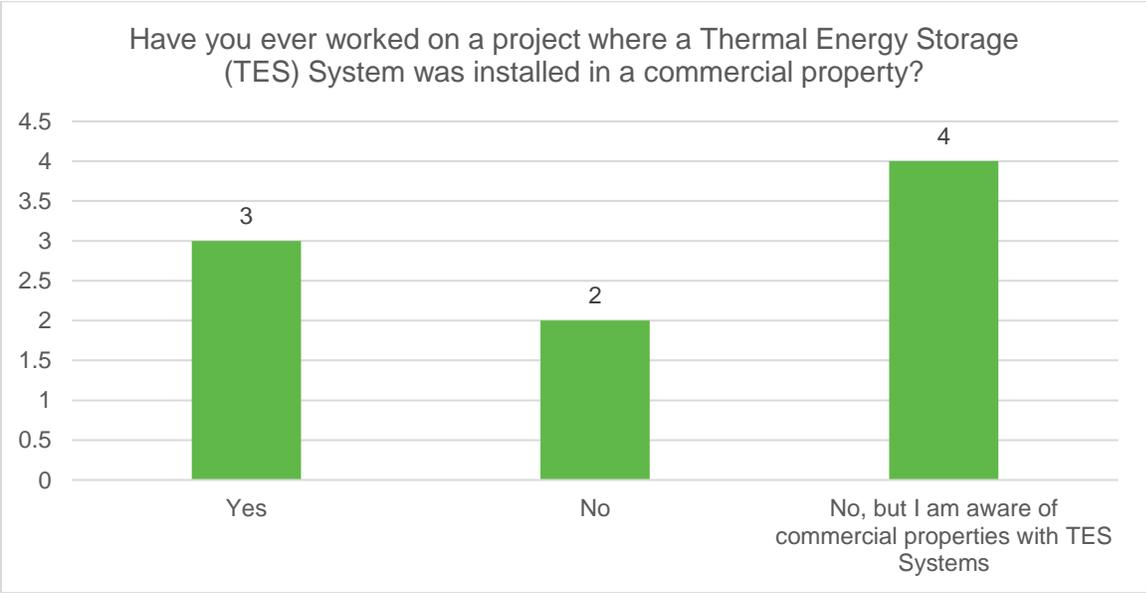


# Appendix B: Nonres Software Improvements Poll Data

Poll 15:



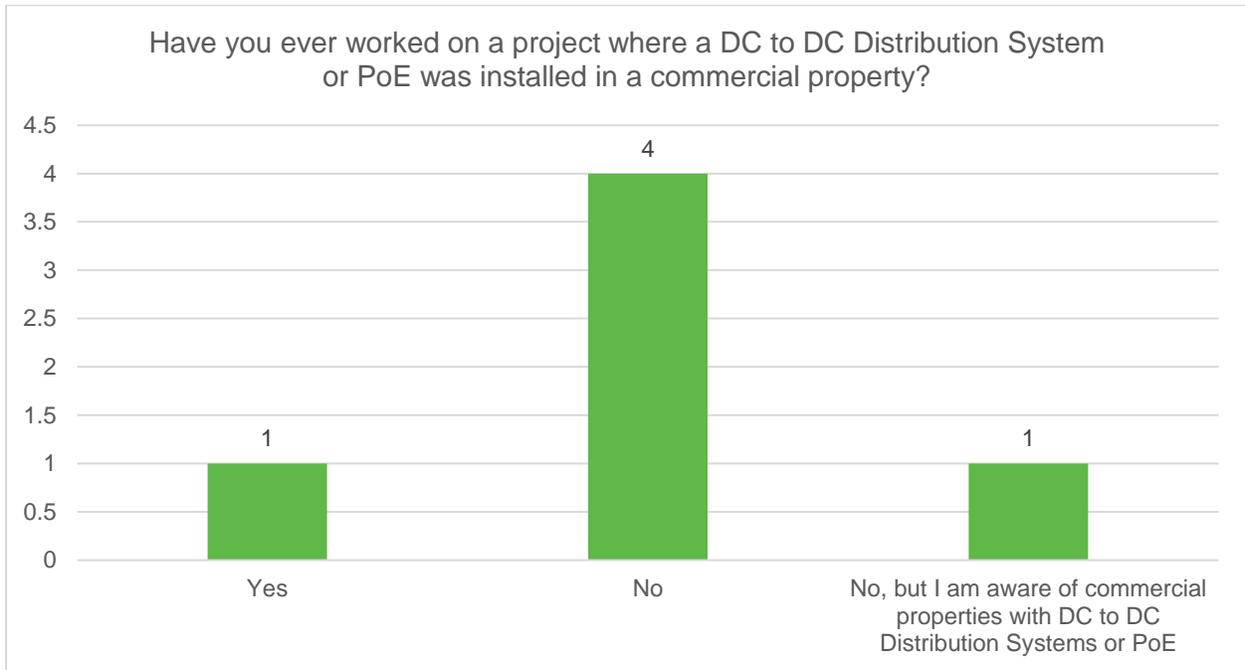
Poll 16:



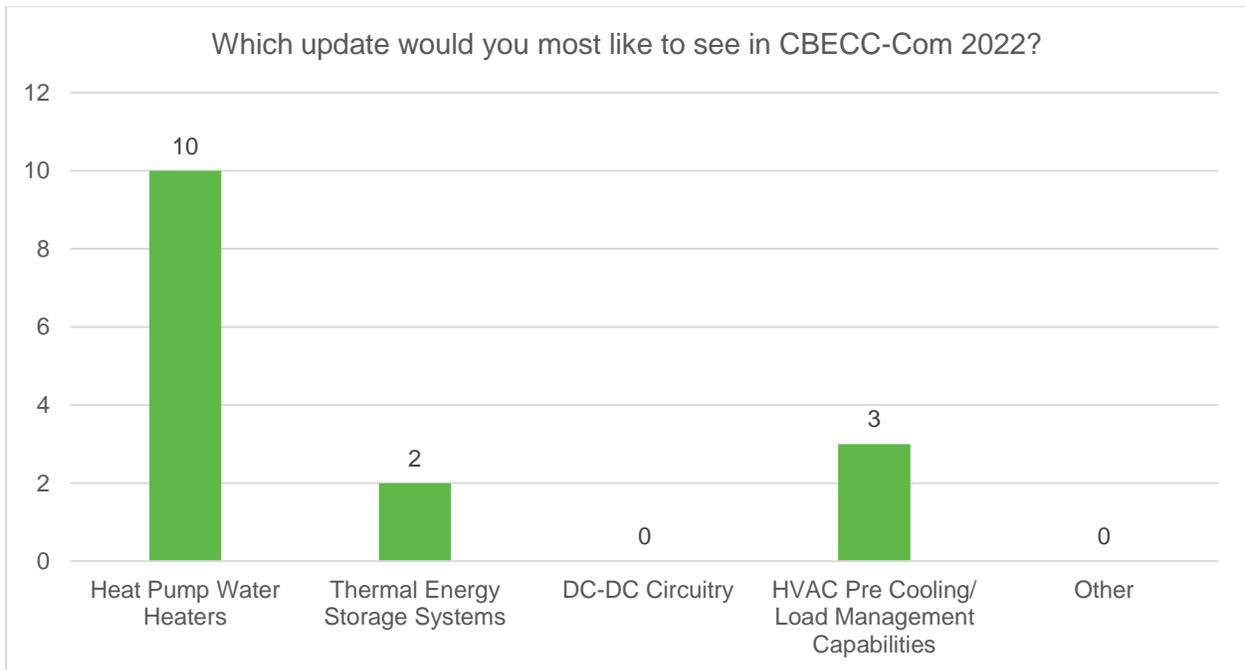
Question: If Yes, What kind of system was installed?

- Ice, chilled water
- heat-recovery chiller with hot and cold water storage tanks
- chilled water, ice
- mid 1980s Utility program incenting chilled water storage, Ice on coil storage and ice in bin storage.

Poll 17:



Poll 18:



Question: If you chose Other, or have another area you would like us to look at, please specify.

- We have HPWH already for Service Water Heating; need this for domestic water heating, and for heating hot water (need heat-recovery chillers and air-source heat pumps for space heating systems)
- Demand response being part of load management