

Meeting Notes

Posted 3/2/2023



Notes from 2025 Title 24, Part 6 Code Cycle Utility-Sponsored Stakeholder Meeting for:

Residential HVAC Performance

Meeting Information

Meeting Date: 1/24/2023

Meeting Time: 8:30 am – 11:45 am

Meeting Host: California Statewide Utility Codes and Standards Team

Meeting Agenda

Time	Topic	Presenter
8:30 AM	Welcome and Meeting Directions	Cosimina Panetti Javier Perez Kelly Cunningham
8:50 AM	Design (Load Calculation, System Selection) and Supplementary Heating	Kristin Heinemeier
9:10 AM	Discussion	Kristin Heinemeier
9:25 AM	Defrost and Crankcase Heaters	Kristin Heinemeier
9:45 AM	Discussion	Kristin Heinemeier
10:00 AM	Break	Kristin Heinemeier
10:15 AM	Refrigerant Charge Verification and Zoned Systems	Kristin Heinemeier
10:35 AM	Discussion	Kristin Heinemeier
10:50 AM	Cost, Energy Impacts, Compliance, and Enforcement	Kristin Heinemeier
11:10 AM	Discussion	Kristin Heinemeier
11:25 AM	General Discussion and Wrap-Up	Cosimina Panetti
11:45 AM	Meeting Adjourned	

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Meeting Participants (available upon request by emailing info@title24stakeholders.com)

Action Items from Meeting

- The Statewide CASE TEAM followed up on all questions or comments that required a response and were not discussed during the meeting.

Key Points from Meeting

This proposal for HVAC systems in both SF and MF residences is important because:

- The performance of furnaces, ACs, and heat pumps is crucial to reducing energy use.
- With the expected increase in the installation of Heat Pumps it is essential that installers take the required actions to make sure that they are working correctly before the certificate of occupancy is issued.
- Electric resistance is less efficient than the heat pump that it is supplementing, and its use may increase peak demands on winter mornings, so it is important that its use is carefully controlled.

- For all of these reasons, system design is very important.
- New measures have been proposed that aim to place attention on the least expensive system attributes and on the practices that are key to improving performance.

MEETING NOTES

During the meeting, questions and comments were submitted in three distinct formats which are provided in these meeting notes in these [hyperlinked for quick access] sections:

1. **In-Meeting Questions / Comments:** Questions and comments submitted verbally during the meeting via the ‘raise hand’ function in GoTo Webinar, where participants were unmuted to speak, or in some cases, comments submitted in writing were discussed verbally during the meeting (in which case the person that commented may not be identified in these notes).
2. [Questions / Comments Submitted Via Mentimeter](#)**Error! Reference source not found.:** This section includes questions and comments anonymously submitted via Mentimeter.
3. [Error! Reference source not found.:](#) See this section for questions and comments submitted in written format via the GoTo Webinar question pane.

Not all written questions and comments were discussed during the meeting but all have responses available in these meeting notes.

In-Meeting Questions / Comments

1. **Question submitted in Mentimeter anonymously: What is rationale for allowing like-to-like equipment replacements to avoid a Manual J?**
 - a. CASE Team response (Kristin Heinemeier): The exception for like-for-like replacements would not allow designers to avoid Manual J calcs, but just to use simplified inputs, to make the process easier/faster. In like-for-like replacements, where the occupant has lived with the existing system for a while, comfort concerns with sizing errors are probably less of an issue.
2. **Comment submitted in Mentimeter anonymously: “Many people don’t understand what their CZ type is and it can cause a lot of confusing; this whole process adds confusion.”**
 - a. CASE Team response (Kristin Heinemeier): These requirements do not refer to the climate zone, but to the relative size of the Manual J calculated loads for heating and cooling. It is a simple matter to determine for a particular home in a particular climate zone whether it has a larger heating or cooling load, which will determine the requirements. Many designers may find that all the homes they design fall into one or the other condition.

3. **Question submitted via GoTo Webinar Question pane by Amy Dryden: “Can you explain how crankcase heating load is included in the modeling software and what operational assumptions are included in software?”**
 - a. CASE Team response (Kristin Heinemeier): The previous version of the compliance software assumed something like 40 watts, and assumes it’s running all the time when the compressor is off [someone else commented that the algorithm is 40 watts – when temp is less than 50 degrees]. Modeling to look at the savings from this will need to show whether it’s cost-effective and there are energy savings. The baseline will assume it’s running all the time and an improved performance where it’s either off when compressor is on or when temp is above 50 degrees. What the baseline should be and how it should be modeled are currently under consideration. Note also that the assumptions depend on the size of the system – if 3 tons or less the limit is 33; if larger then it’s 11 watts per ton. The modeling will assume 33 watts for a system that’s 3 tons or less.

4. **Verbal question asked by Hiroshi Yoh, Daikin: Regarding mandate proposal CCH should be in turn off, once compressor is on, but there are some advance control logic which does not turn off CCH right away when compressor got turned off. So I need to verify a few readings to assure the compressor is properly warmed up a few minutes. The language on Crankcase Heating screen: Proposed Requirements appears that the control logic will not meet those mandatory requirements?**
 - a. CASE Team response (Kristin Heinemeier): We need to learn more about all the different control that manufacturers are using. And that sounds like the kind of control we would be allowing, so if our wording would disallow something like that, we need to adjust our wording. The thing we’re trying to avoid is having the crankcase heater running all the time when the compressor is on. So if a manufacturer has an algorithm or control method that is addressing this issue and preventing that from happening that is something we want to allow. So we’d love to coordinate with you as we move forward to make sure it’s allowed.

5. **Question submitted in Mentimeter anonymously: Is there an adequate supply of systems available statewide?**
 - a. CASE Team response (Kristin Heinemeier): This is something we need to learn more about. Most systems should be available that won’t run when compressor is on; we believe that most systems do that, so we there’s no concern about lack of products. If people find these products are not available statewide, we would love to hear about that. Some of the advanced controls may not be available, and we want to encourage more advanced controls to be available. But to meet the mandatory and basic prescriptive, there are products available.

6. Question submitted in Mentimeter anonymously: Does defrost delay timer change with outdoor air temps?

- a. CASE Team response (Abram Conant): The most common defrost control strategy and heat pumps on market today have a fairly simple timer – there’s a temperature trigger that determines when the timer starts counting down, but the length of the countdown doesn’t change with outdoor temperatures; it’s a constant amount of time usually it’s adjusted with dipswitches on the control board. Once the timer has counted down, then defrost begins. And there’s a temperature trigger to determine when the defrost ends. Hopefully that clarifies that the basic defrost control we’re talking about.

7. Comment submitted in Mentimeter anonymously: Weigh-in is the correct amount only for the “standard” coil; capacity is hard to measure; you need to know the actual flow and obtain the average return and supply temperatures. Alternatives to weigh-in.

Another similar anonymous comment submitted via Mentimeter: Charging by subcooling is more accurate than weighing-in and is friendlier in the field. We specify for charging by sub-cooling when we send units for audit testing.

- a. CASE Team response (Kristin Heinemeier): Great comments; we would love to hear from manufacturers and get broader information about their preferred methods for charge verification. The goal is to do the most accurate thing possible and what’s easiest in the field. If we need to describe how the coil size is to be addressed / if that needs to be part of the weigh-in methodology we’re open to that. The standard charge verification will still be there / we’re not proposing to remove those. Contact the Statewide CASE team at info@title24stakeholders.com if you can provide information.

8. Verbal question asked by Hiroshi Yoh, Daikin: Regarding the Variable Capacity / Zoned Systems: Proposed Requirements slide. If there is a partial load, the air moves very slow and hot air from peak will impact efficiency. The assumption here is that the peak would not be insulated or conditioned. Seems your language is saying ‘it doesn’t matter / the performance deduction for VCMS is going to happen. I think that’s probably too wide; the temperature needs to be high for the penalty to make sense. If an attic is insulated or conditioned, the attic is close to indoor temp so penalty is not good.

- a. CASE Team response (Dave Springer): Variable capacity systems with attic ducts operate for a longer period of time to meet the load and that’s where most losses occur. There’s prolonged exposure of duct air to attic duct temperatures.
- b. Hiroshi Yoh comment: That logic makes sense to me. If the attic is uninsulated and the attic temperature is high, we should consider that. However, if the attic is

insulated or conditioned, the peak temperature and duct air temperature will be mild difference.

- c. CASE Team response (Dave Springer) added: The Software would take care of the penalty issue.

9. Comment submitted in Mentimeter anonymously: New generation of variable speed heat pumps where refrigerant pre-charge can range from 49-98 feet therefore the need for a HERS rater is not required.

- a. CASE Team response (Kristin Heinemeier): We'd like to talk with manufacturers about the limits on that. Should we exempt entirely pre-charged systems? Is there a limit on the lineset length that we think won't affect things much; if it's a very long lineset maybe we do need to verify it — another commenter mentioned that's hard to do. There is another comment about capacity testing... how do we do a capacity test and what should the capacity be? We're not at EER conditions so how do we know it's the right capacity? There are a lot of details here. We're just confirming that it's configured correctly; that there are no kinks in ducts and confirmation that things are set correctly and the system is ready to go. We'd like to collaborate with others on something workable and accurate.

10. Comment submitted in Mentimeter anonymously: What would be the proof needed for self-diagnostics to replace a HERS rater approach to verify accurate refrigeration charge?

- a. CASE Team response (Kristin Heinemeier): There are a lot of ways to do that. It's not something you'd want to solely verify in the field; the manufacturer would have to verify through laboratory test or maybe a collection of field tests showing they came up with the right answer. But since everyone does it differently the test has to be a performance-based test and that can be difficult to come up with a test that can't be gamed. As an example, connected thermostats have to show that in the field they save energy. We'd love to talk with people about what data and alternatives are available; please reach out.
- b. CASE Team response (Dave Springer) added: Related to this topic is confirming refrigerant remotely; send real-time results to a HERS rater.
- c. CASE Team response (Kristin Heinemeier): If we cluster the items that can be verified remotely that's something to consider. I encourage us to look closely at the HERS process and make use of remote devices.

11. Question submitted in Mentimeter anonymously: What about variable capacity measures – and a VRF system with multiple heads?

- a. CASE Team response (Kristin Heinemeier): The team is currently seeking information about the charging requirements for these types of systems and considering special requirements or allowances. Please contact

info@title24stakeholders.com if you have more information that could help in these considerations.

12. Comment submitted in Mentimeter anonymously: Software should untangle what is a “system” considering a many-to-one multi-split heat pump system. Is the ‘system’ the outdoor unit or the indoor fan coil? Efficiency is a property of the heat pump but distribution relates to fan coil.

- a. CASE Team response (Kristin Heinemeier): This is something we’ll look at as we go forward.

13. Verbal question asked by Helen Walter-Terrinoni, AHRI: Comment submitted in Mentimeter anonymously: There are some new technologies since pandemic that look at ways to remotely look at system performance; if they deteriorate over time and understand if refrigerant is the cause; I’m happy to share info on that with you.

- a. CASE Team response (Kristin Heinemeier): We would love to discuss further with a separate meeting maybe with manufacturers to discuss.

Final Discussion:

14. Comment submitted in Mentimeter anonymously: How much defrost and crankcase heating is in the hands of the installer? These are manufacturer programmed regimes.

- a. CASE Team response (Kristin Heinemeier): Not much. Maybe if there are advanced controls there is some in the hands of the installer. For defrost there’s the defrost timer which we’re relying on. I’d love to hear from manufacturers on this.
- b. CASE Team response (Abram Conant) added: As mentioned before, a fairly simple timer that’s adjustable by dipswitches on the control board very commonly is in the hands of the installer.
- c. CASE Team response (Kristin Heinemeier): We’d like to know what the default settings are for defrost delay for units shipped to CA.

15. Comment submitted in Mentimeter anonymously: Underlying the prior question/comment, many of these things are handled at the level of the manufacturer. How energy codes or the performance approach provides incentives for these manufacturers to develop crankcase heating and perhaps defrost?

- a. CASE Team response (Kristin Heinemeier): The market itself won’t result in systems that are efficient; it’s going to take codes. Any requirements at all will get people paying attention and will help move the market. People aren’t demanding a good defrost mode currently so codes are important. DOE allows 33 watts; a new code requirement will start people paying attention to this, and T24 could help move the market.

16. Verbal comments from Laura Petrillo-Groh with AHRI Air Conditioning Refrigeration Institute: I commend the team on reaching out to industry in advance and the open-line of communication and well-run meeting. Some preliminary thoughts:

- Load calcs and system selection ideas and proper system sizing requirements should be easy to implement as there are compliance issues in CA and want to make sure there are no undue issues with permitting.
 - For supplementary heating; good reasons for having it installed with heat pumps (to protect pipes from freezing for example).
 - Crankcase Heaters concern with proposal as-written; test procedures are being looked at by DOE currently – there have been challenges for shoulder season power consumption in federal seasonal metrics so it will be discussed federally.
 - Concerned about the design requirement. Interested in seeing data on your analysis for charge verification if you could please share for cost-justification.
 - Regarding costs; website techcleanca.com has data for almost 10,000 projects by SEER and average cost by time. Can see SEER 14 vs 18 or 18+ heat pump and results are dramatic and can help with installed cost analysis.
- a. CASE Team response (Kristin Heinemeier): We are aware that many manufacturers have innovative technologies regarding refrigerant charge verification, and we would be happy to discuss this with manufacturers. For savings and cost side, we're just starting to look at that and would love your input. For crankcase heater: would love to talk with you further and we're aware of the test procedures.

17. Verbal comment from Laura Petrillo-Groh, Air Conditioning Refrigeration Institute (AHRI): Timing of Feb 7th is in the middle of AHRI Expo so manufacturers are out the next couple of weeks – can we look at end of February for a response?

- a. CASE Team response (Kristin Heinemeier): Comments to the CASE Team on the measures are always welcome, but timing will impact whether or not feedback can be incorporated into the DRAFT case reports that will be published this Spring. Earlier responses are preferred but feedback is always encouraged and considered.

18. Question submitted in Mentimeter anonymously: Was there a time that strip heaters ever not allowed in the past?

- a. CASE Team response (Kristin Heinemeier): We had considered not allowing strip heaters in an earlier possible proposal, and may not have addressed the night-time setback issue (if people set their temp down at night, the temp may not be at a comfortable level for them in the morning because it takes a long time to get up to the desired temperature so conventional thought is you shouldn't set the temp back at night). We want to avoid people using strip heating in the morning if they use night time setback with heat pumps. Contractors say strip heating is not needed and we

want to encourage people to avoid them but if you design well – and blower door is done, you should be able to not install strip heating.

Wrap-Up

- All Draft CASE Reports will be posted March through June at title24stakeholders.com
- Round 2 meetings begin in April
- Many meetings between now and end of February. Keep in touch!
- Meeting adjourned at 11:48 PST

Questions / Comments Submitted Via GoTo Webinar

The questions and comments below are provided verbatim (as-submitted) in the GoTo Webinar Question pane.

Last Name	First Name	Time Asked	Question / Comment	CASE Team Response
Blunk	Scott	09:39:25 AM PST	"Delay timers" Why delay, is this just a timer? You said something like 12 min. Is that 12 min per hour? At what temp, below 40 or? Do the frequency change based on OAT?	The "delay" timer refers to the period of time between when the outdoor coil temperature sensor has reached setpoint and initiation of the defrost cycle, also known as "time and temperature based" defrost. A timer by itself would allow too many unnecessary defrost cycles. The 12 minute period that was cited was an example of a defrost time, not a delay time. Different products use different temperatures to initiate the defrost timer. Keep in mind that different products use different kinds of control, although a delay time is common.
Davis	Wes	09:54:11 AM PST	I need to step away for another commitment. Great stuff so far!!	No response needed.
Dryden	Amy	09:54:03 AM PST	Can you explain how crankcase heating load is included in the modeling software and what operational assumptions are included in software?	The software currently assumes 40 watt crankcase heating only for heat pumps that runs whenever the dry bulb temperature is below 50F. This will likely change.
Haves	Philip	10:45:37 AM PST	General question: what about hydronic heating systems. Are there rules, and new proposals for these systems, including combined DHW and hydronic space conditioning.	The one proposed change that would affect zoned hydronic systems is a revision to the requirement that each air handler must be verified to deliver at least 350 cfm per equipment ton, to the <i>sum</i> of all air handler airflows shall be at least 350 cfm per equipment ton.
Inamdar	Harshad	10:26:15 AM PST	I do not understand how capacity-based verification is easier than measuring subcooling / superheat using a gage-set.	The methods are still being developed, and they will be as simplified as possible.

Last Name	First Name	Time Asked	Question / Comment	CASE Team Response
Inamdar	Harshad	10:27:04 AM PST	Measuring subcooling and superheat is more accurate than weigh-in because it accounts for differences in lineset length better than adding charge weight as a function of lineset length.	It's true that we may have to have more rigor in adjusting for lineset, but there are some systems where charge cannot be accurately verified with SC/SH methods.
Johnson	Dan	09:13:46 AM PST	Is Manual J required for replacements? Most HVAC work is replacements. Existing furnaces are nearly always oversized, and contractors say "like for like" and provide an oversized heat pump (higher cost, reduced performance)	Manual J would be required for all types of projects. The "like for like" exception is only to allow for simplified inputs for these simpler projects. We are considering whether or not to keep this exception. Note that replacing a furnace with a heat pump would not be considered "like for like."
Lan	Lin	08:43:19 AM PST	manufacturing	No response needed.
Mahoney	Gregory	08:49:24 AM PST	Is the CEC planning to reformat the Energy Code to be consistent with typical California Code formatting so that anyone can use the document?	This is a good idea and we will convey it to others on the Statewide CASE Team, and CEC, as it is not directly related to this CASE Report.
Morton	Lucas	09:17:14 AM PST	Which calculations would be required for non-forced air systems? E.g.-- hydronic systems from a central heat pump boiler? I assume that Manual J is universally applicable, but Manual S doesn't seem as much.	Regarding the question about which calculations would be required for non-forced air systems, refer to Manual S as the various system types are mentioned there. Manual S covers hydronic systems.
Morton	Lucas	09:18:56 AM PST	Will the Manual J/S results then be used for compliance analysis? If so, then this is problematic as they are philosophically misaligned.	Title 24 requirements and overall energy efficiency take precedence when determining house features. The heating and cooling loads are then based on those features, whatever they are. Manuals J/S/D focus on comfort. If people are not comfortable, they are not happy, regardless of their energy bills. With heat pumps being so greatly

Last Name	First Name	Time Asked	Question / Comment	CASE Team Response
				emphasized (due to their energy efficiency and GHG reductions) our goal with the equipment sizing measures being proposed is to make sure people are happy with their heat pumps by making sure the systems are well-designed according to the needs of the house.
Morton	Lucas	09:21:57 AM PST	(thank you!! joined late!)	No response needed.
Moua	Cheng	10:47:30 AM PST	The software algorithms account for insulation and location of ducts	No response needed.
Petrillo-Groh	Laura	09:12:24 AM PST	Hello! Is there any information from the NIST study that can be shared? (I.e. number of stages, heating capacity vs. calculated capacity) Perhaps the study is publicly available?	The study is available at: http://dx.doi.org/10.6028/NIST.TN.1848
Proctor	John	08:43:37 AM PST	My Menti is not showing the same question as on the screen	Resolved.
Proctor	John	10:51:45 AM PST	350 CFM is far too low for our climate. 500 to 600 CFM per ton is needed -- has been proven in lab and field tests. Best contractors now do this regularly	Agreed! It is not clear, however, which sub-measure this comment relates to.
Ramirez	Armando	10:14:44 AM PST	Kristin, your file explorer window is on top of the presentation. FYI.	No response needed.
Raymet	Bob	09:16:25 AM PST	Given the increasing temp differentials due to climate change, could the reduction in supplemental heating result in occupant comfort problems in the near future? If the house does not get warm in the winter, occupants will consider that to be a construction defect, right?	This is one of the reasons that a prohibition from installing supplementary heating was eliminated. The current requirements—locking it out when temperatures are more mild and keeping a limit on the size of the supplementary heating—are not likely to create comfort problems.

Last Name	First Name	Time Asked	Question / Comment	CASE Team Response
Rodda	Gina	08:30:35 AM PST	Castro Valley	No response needed.
Rodda	Gina	08:40:53 AM PST	Got it, came on when no one was talking.	No response needed.
Thur de Koos	Arturo	10:38:39 AM PST	New gen heat pumps include a charge for linesets up to 66ft or even 98ft. Smaller systems the charge is good for 49ft. Manf. include this information. Therefore, the need for HERS rating onsite is not required.	This is why we added an exception for precharged systems below a certain length of lineset. It is likely that we will not include a set number of feet, but somehow refer to situations—like the one you cite—where the charge is likely to be correct for the lineset.
Walter-Terrinoni	Helen	10:43:38 AM PST	Did you all have any questions about refrigerants? I hopped on call incase you do?	No response needed.
Walter-Terrinoni	Helen	10:49:33 AM PST	What is the purpose? it would help to determine need to document?	No response needed.
Walter-Terrinoni	Helen	10:53:57 AM PST	There are a number of technologies looking at refrigerant losses/ sufficiency remotely Please see AHRI webinar here for some of the newer technologies. https://www.ahrinet.org/news-events/events/webinars/ahri-refrigerant-webinar-series My email is hwalter-terrinoni@ahrinet.org You may want to watch the webinars	Thanks for the link...we will look into it. IN this round it is likely that solutions will be limited to those that help contractors document their process or results of charge verification, rather than automated technologies. We welcome the industry's thoughts on how to validate available tools in an even-handed way.
Waltner	Meg	09:34:33 AM PST	My hand is raised, but you don't seem to see it...	Resolved in-meeting.

Last Name	First Name	Time Asked	Question / Comment	CASE Team Response
Yoh	Hiroshi	09:57:44 AM PST	I raised my hand but it does not seem registered.	Resolved in-meeting.
Yoh	Hiroshi	09:59:25 AM PST	Some advanced control may have logic that does not turn off CCH right away when compressor turned on. CCH might be turned off once control logic determines the compressor temperature is warm enough. How would this kind of logic be considered?	It is likely that any technology that actively controls the CCH will be allowed. The intent is to prevent CCH from being turned on and staying on for extended periods of time.
Yoh	Hiroshi	10:42:47 AM PST	Hi, this is Hiroshi Yoh again. I just raised my hand but want to put in a comment just in case. The proposed partial load efficiency deduction should not be applicable to building with conditioned or insulated attic.	Resolved in-meeting.
Young	Randy	10:32:50 AM PST	I don't believe based on the recent items uncovered by the CEC surrounding HERS raters, if this is the right entity to verify refrigerant charge. especially now that A2I Refrigerants will be used for human comfort.	This CASE Report proposes verification methods, with an emphasis on making it easier to verify. We do not take a position on who can do the verification.
Surigao	Stephanie	11:35:31 AM PST	where can we find the recorded webinar?	There is not a recording available.

Questions / Comments Submitted Via Mentimeter

Note: all questions and comments submitted via Mentimeter are anonymous. The questions and comments shown are provided below verbatim (as-submitted) via Mentimeter Q&A pane.

Asked on: Slide 1

Side note for Sizing and airflow design – CBECC is currently limited to 550 CFM/ton and there is a slight penalty for increasing CFM/ton. Perhaps a review of CSE algorithms here?

- a. CASE Team response: Agreed -we will consider this input.

Asked on: Slide 9

Manuals J, S, and D are required in the California Mechanical Code.

- a. CASE Team response: Agreed that Manual D is required, but I have not confirmed that manuals J and S are required. In any case, if they have energy consequences, they should be verified in some way, through T24 Part 6.

Asked on: Slide 10

What is the rationale for allowing like for like replacements to avoid the manual J calculation? Is the assumption that a sizing calculation has already been done?

- a. CASE Team response (Kristin Heinemeier): The exception for like-for-like replacements would not allow designers to avoid Manual J calcs, but just to use simplified inputs, to make the process easier/faster. In like-for-like replacements, where the occupant has lived with the existing system for a while, comfort concerns with sizing errors are probably less of an issue.

Does the research on the impacts of sizing take into account the difference between minimum efficiency vs inverter driven equipment? Is this something you are considering?

- b. CASE Team response: This is not a consideration for this CASE Report.

Small additions often have lots of glass. How about conflict with Building Code requirements for load calcs for additions confirming 68 degree F?

- a. CASE Team response (Kristin Heinemeier): Good point. We will consider adding glass area to the 144 sf trigger.

Asked on: Slide 11

Given that Manual J is proven in field tests to overestimate actual sensible load in cooling, setting MJ results to the MINIMUM allowable size will result in oversizing in the vast majority of cases.

- a. CASE Team response (Kristin Heinemeier): Manual S accounts for this by allowing 0.9 sizing factor (can undersize by 10%). NIST study shows that oversizing AC does not have a huge energy penalty as long as ducts are appropriately sized to the

system. There are only so many sizes of equipment available. Some oversizing is unavoidable when the alternative is too much under-sizing.

Asked on: Slide 12

Many don't understand what their CZ type is, this can cause a lot of confusion. This entire process seems to be adding a lot of confusion.

- a. CASE Team response (Kristin Heinemeier): Sizing for the local climate zone is already required. We are setting some more specific bounds around the design process. This should actually make the process easier. We just need to enforce them better.

Asked on: Slide 14

Did I understand correctly that you are proposing to allow single speed systems to be more oversized (by .5 to 1 ton), but variable speed systems are limited to 0.8*calculated load?

- a. CASE Team response (Kristin Heinemeier): No, 0.8 was proposed as a maximum only for the low speed of a multi- or variable-capacity system - to ensure adequate turn down.

Asked on: Slide 17

Will the Manual J/S results then be used for compliance analysis? If so, then this is problematic as they are philosophically misaligned.

- a. CASE Team response (Kristin Heinemeier): Title 24 requirements and overall energy efficiency take precedence when determining house features. The heating and cooling loads are then based on those features, whatever they are. Manuals J/S/D focus on comfort. If people are not comfortable, they are not happy, regardless of their energy bills. With heat pumps being so greatly emphasized (due to their energy efficiency and GHG reductions) our goal with the equipment sizing measures being proposed is to make sure people are happy with their heat pumps by making sure the systems are well-designed according to the needs of the house.

Which calculations would be required for non-forced air systems? E.g.-- hydronic systems from a central heat pump boiler? I assume that Manual J is universally applicable, but Manual S doesn't seem as much.

- a. CASE Team response (Kristin Heinemeier): Regarding the question about which calculations would be required for non-forced air systems, refer to Manual S as the various system types are mentioned there. Manual S covers hydronic systems.

Comment on: Slide 19

Proctor here again Given the over estimation in MJ The oversizing will cause increase in morning winter peak that will bring in NGas generation. It will also make large ducts necessary. Manual S allows sizing to 90% of the load and penalizes oversizing in most cases. There currently is no better option than Manual J. We need training on Manual J so that they do not use safety margins.

Comment on: Slide 24

FYI -- I had my hand up to make that comment but you didn't seem to see it. Thanks, Meg
Replying to John's comment, I think it's unlikely that a proper load calc was done originally and would recommend reconsidering the like for like exception. Meg Waltner (Energy 350 on behalf of NRDC)

- b. CASE Team response (Kristin Heinemeier): Agreed. We will consider this.

Comment on: Slide 28

Regarding load calcs and existing-- I know the CASE team is well aware of the current challenges with permitting on these kinds of jobs. I don't think it will be broadly implemented. but ok

- a. CASE Team response (Kristin Heinemeier): Steps are being taken to make load calcs easier to do. Training of contractors is needed to make them understand the importance of doing load calcs, whether they get a permit or not, especially for heat pumps.

Asked on: Slide 29

does defrost run time, or "delay" timer change with OAT?
why "delay" timer? why not just a timer?

- a. CASE Team response (Kristin Heinemeier): The "delay" timer refers to the period of time between when the outdoor coil temperature sensor has reached setpoint and initiation of the defrost cycle, also known as "time and temperature based" defrost. A timer by itself would allow too many unnecessary defrost cycles.

Asked on: Slide 30

How does defrost change when the system doesn't have strip heat. What if it is single speed vs. VC?

- a. CASE Team response (Kristin Heinemeier): CBECC defrost assumptions are similar to those applied in the HSPF rating calculation for single speed equipment. The same assumptions are currently used for all equipment types.

Comment on: Slide 34

Simplifying assumptions for like-for-like replacements may have the unintended consequence of encouraging the installation of more new gas furnaces that will be in place for the next 15+ years.

- a. CASE Team response (Kristin Heinemeier): Agreed. We may consider removing installation of gas furnaces from the types of projects that are eligible for simplifying assumptions..

Asked on: Slide 36

Is there an adequate supply of compliant product available statewide?

- a. CASE Team response (Kristin Heinemeier): I believe this is in response to the CCH requirements. Yes, many systems do not allow the CCH to run when the compressor is operating.

Asked on: Slide 46

Some manufacturers provide charge charts in heating mode too.

- a. CASE Team response (Kristin Heinemeier): We will consider whether we need to allow for these to be used explicitly, or whether it falls into the category of "following manufacturer procedures."

Weigh in is the correct amount only for the "standard" coil. **Capacity is hard to measure, You need to know the actual flow and obtain the "average" return and supply temperatures.**

- a. CASE Team response (Kristin Heinemeier): We will consider these factors in developing the detailed requirements.

Asked on: Slide 47

We provide a "CHARGE MODE" in our variable-speed systems where the system speed is locked, and one variable is eliminated from the system operation during refrigerant charging. Charging by subcooling is more accurate than weighing in and is friendlier to the field. We specify charging by subcooling when we send units for audit testing.

- a. CASE Team response (Kristin Heinemeier): We will consider these factors in developing the detailed requirements.

The Yull report was based on the charge to obtain peak capacity at one set of conditions, Whereas the T24 specifications are from the manufacturers.

- a. CASE Team response (Kristin Heinemeier): We are reaching out to manufacturers to get their thoughts on the adequacy of the existing methods.

Asked on: Slide 48

Strongly suggest you get up to speed on HERS program changes being proposed by CEC before changing/adding verification procedures

- a. CASE Team response (Kristin Heinemeier): Regarding the HERS program comment. Thank you, we are following the proceedings and working closely with the CEC on this measure.

Comment on: Slide 53

Since VCHP's are growing rapidly in installation, I think this is a great measure and should continue to evolve with other VCHP measures. More performance maps, more nuance

- a. CASE Team response (Kristin Heinemeier): Thank you for sharing.

Comment on: Slide 54

All systems, including zoned systems should be provide the appropriate airflow for our climate -- 500 to 600 CFM. Lab tests have proven the efficacy of these higher airflows for our climates.

- a. CASE Team response (Kristin Heinemeier): Thank you for sharing.

Asked on: Slide 62

It's important that RES thermostat settings and outside air ventilation assumptions be corrected to be more realistic; 3 studies show CBECC_RES dramatically underpredicts cooling energy, not accurate

- a. CASE Team response (Kristin Heinemeier): We are considering looking into this.

Asked on: Slide 65

Please look at making the base case an inverter-drive heat pump; you'll need an algorithm for this; single-speed should be a compliance option that takes a penalty (assuming inverter is cost effective

- a. CASE Team response (Kristin Heinemeier): This is not within the scope of this CASE Report.

Comment on: Slide 84

Thank you

Mentimeter Poll Questions / Responses

Asked on Menti poll question: What do we have right or wrong about sizing & supplementary heat? How can we improve this proposal? Do you have info or data that could help?

- RE: Strip heating-- I think it would appropriate to have this as a compliance option in CBECC, Currently its assumed regardless of whether or not its present (which is reasonable in a way)
 - a. CASE Team response (Kristin Heinemeier): Strip heat is implicit in the HSPF rating and is implemented in CBECC in a way that is consistent with the HSPF calculation assumptions.

Asked on Menti poll question: What do we have right or wrong about defrost or crankcase heating? How can we improve this proposal? Do you have info or data that could help?

- Defrost is common when not necessary (shown in monitoring). Delay is not sufficient.
- Pressure drop across the outside coil is necessary to eliminate unnecessary use.
 - a. CASE Team response (Kristin Heinemeier): Regarding comment on defrost delay not being sufficient, we agree that more advanced controls are possible. At present, the prevalent control strategy available in heat pumps is a timer.

Asked on Menti poll question: We want to hear from you! Share questions and ideas now via Menti.com (or raise your hand in GoTo meeting)

- unless it's dual fuel, strip heat (whether integrated or not) is a good assumption for backup heating. When it's a cold snap, a space heater is an easy solution.
- Some the changes could be easily achieved in manufacturing side not installation or design, isn't it?
 - a. CASE Team response (Kristin Heinemeier): That is correct. Advanced controls can be quite beneficial, although in some cases the controls have to be configured optimally.

Asked on Menti poll question: What do we have right or wrong about charge verification and VC/Zoning? How can we improve this proposal? Do you have info or data that could help?

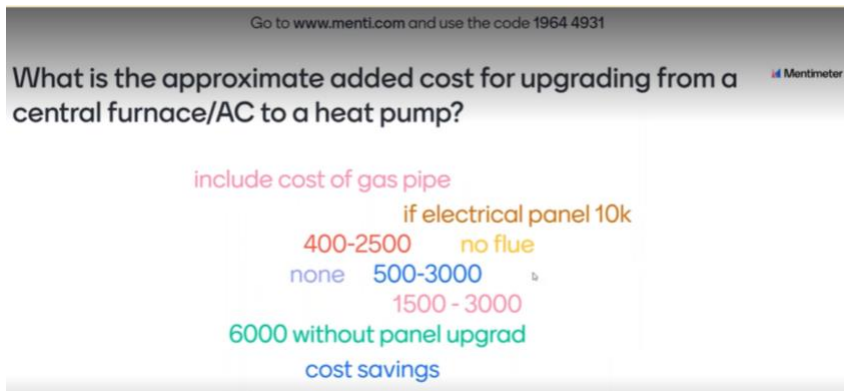
- 350 CFM is far too low for our climate. 500 to 600 CFM per ton is needed -- has been proven in lab and field tests. Best contractors now do this regularly - John Proctor
 - a. CASE Team response (Kristin Heinemeier): Agreed! It is not clear, however, which sub-measure this comment relates to.
- Specific example of VCHP and sizing-- how systems respond to low-load situations when only 1 of many zones is calling. Also-- continuous fan operation vs. intermittent. Also-- there are some nuances to VCHP that are non-linear with regards to sizing. I'm sure the team is aware of this. But I think I've heard that it's somewhat manufacturer-specific.
 - a. CASE Team response (Kristin Heinemeier): Thanks for the comment. We are considering many of these issues.

Asked on Menti poll question: What is the approximate **added**** cost for upgrading from the 3-ton standard heat pump to a 4-ton heat pump?**

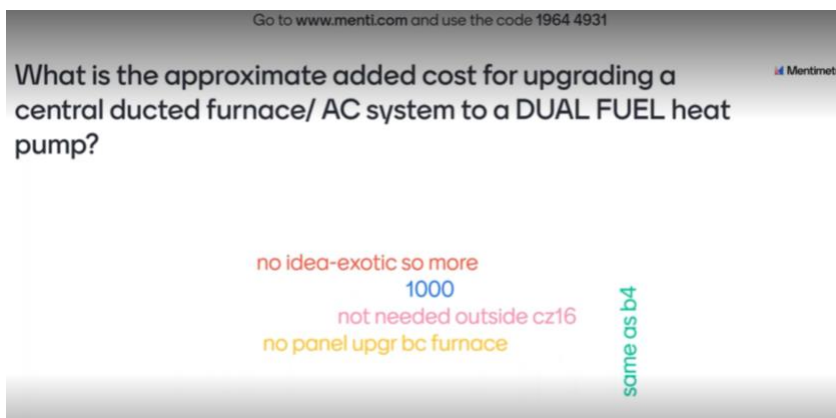
- a. CASE Team response (Kristin Heinemeier): Regarding the question about heat pump as the new base case. The CEC is working on the heat pump baseline measure, this is not in scope for the CASE Team.

Visual Mentimeter Polls & Responses (e.g., word cloud formats)

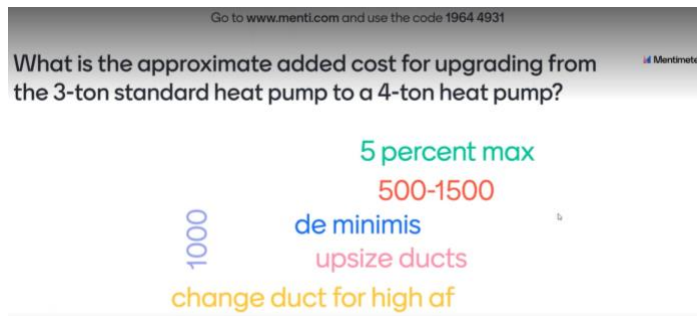
MENTI.com POLL: What is the approximate cost for upgrading from a central furnace/AC to a heat pump (assume new construction, production builder, 3-ton, single speed, no strip heat, and code minimum efficiency). Responses shown below.



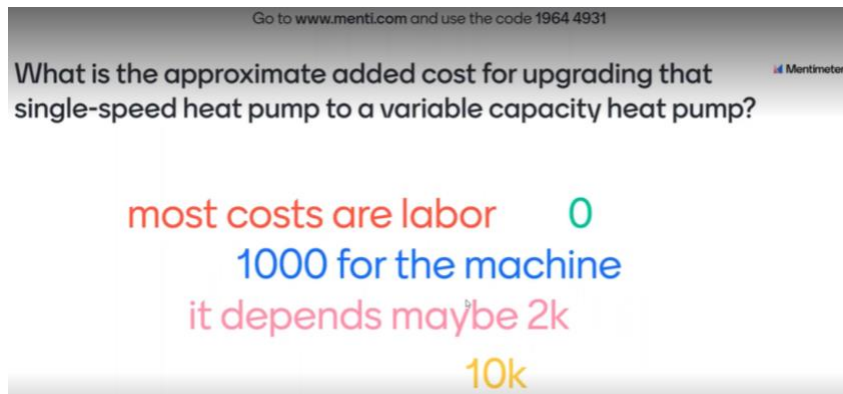
MENTI.com POLL: What is the approximate added cost for upgrading from a central furnace/AC system to a DUAL FUEL heat pump (assume new construction, production builder, 3-ton, single speed, no strip heat, and code minimum efficiency). Responses shown below.



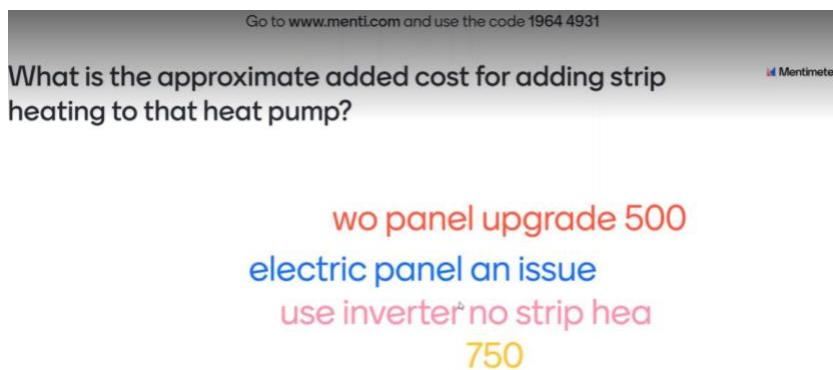
MENTI.com POLL: What is the approximate added cost for upgrading from the 3-ton standard heat pump to a 4-ton heat pump? (assume new construction, production builder, 3-ton, single speed, no strip heat, and code minimum efficiency). Responses shown below.



MENTI.com POLL: What is the approximate added cost for upgrading that single-speed heat pump to a variable capacity heat pump? (assume new construction, production builder, 3-ton, single speed, no strip heat, and code minimum efficiency). Responses shown below.



MENTI.com POLL: What is the approximate added cost for adding strip heating to that heat pump? (assume new construction, production builder, 3-ton, single speed, no strip heat, and code minimum efficiency). Responses shown below.



MENTI.com POLL: What is the approximate added cost for adding a thermostat with an OAT sensor to that heat pump? (assume new construction, production builder, 3-ton, single speed, no strip heat, and code minimum efficiency). Responses shown below.

