DOCKETED	
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Project Title:	Residential Alternative Calculation Method Variable Capacity Heat Pump Modeling Approach
TN #:	230511
Document Title:	Variable Capacity Heat Pump (VCHP) Compliance Option Comment Log
Description:	This document records the substantive public comments received by the Energy Commission on the Variable Capacity Heat Pump (VCHP) Compliance Option proceeding, as well as staff's consideration of and responses to the received comments
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Commenter	Summary of the comment	Response to the comment	Link to docket item
Bobby Hahn (Carrier)	Maybe we can meet somewhere in the middle, maybe 90 percent towards the CEC way, 10 percent towards our way and propose that anything under 16 SEER will not be allowed, and abide by AHRI's rulings about our testing procedures for everything else. So we do not allow anything under 16 SEER, again, and then we allow the AHRI standards. (page 55)	Staff finds that the tested 14.6 SEER system outperformed systems up to 26 SEER, and that the worst performing systems were 16 and 19 SEER systems. Staff therefore does not find that a 16 SEER threshold would be appropriate given that poorly performing units may still receive an inappropriate amount of credit, and conversely that a higher (24+) threshold would exclude too many systems that are none the less more efficient than the standard design [despite their SEER ratings not being accurate predictors of their in-situ performance.]	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bobby Hahn (Carrier)	On the dropdown box, Mr. Wilcox, for the equipment, I didn't see a heat recovery system in there. Was there an option for that? Because a lot of manufacturers are going single-phase heat recovery. As part of a VRF system, a mini-VRF system. (page 123-124)	MR. WILCOX: This is not a VRF system. This is -- these are VCHP systems. (page 124)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bobby Hahn (Carrier)	MR. HAHN: Okay. There are -- pretty much all the manufacturers make a single-phase VRF (heat recovery) system, so it's just two pipes from the condenser out. And certain -- there's a manufacturers that have simultaneous heating and cooling, so -- and Carrier being one of them. And it's very efficient but I didn't see it on the dropdown boxes. (page 124)	MR. WILCOX: Yeah. Well, first I've ever heard anyone was marketing those for residential. We haven't tested them and there's nothing in the standards at this point. (page 124-125)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bobby Hahn (Carrier)	And back to just a suggestion again, in lieu of the 14 SEER cap, we're hoping that we could come to some kind of resolution and perhaps just not allowing any equipment that's under 16 SEER, for example, being a possible solution. (page 125)	Staff's findings are that SEER ratings are not a reliable predictor of VCHP system performance. CVRH research determined that VCHPs of any SEER rating have a 90% probability of providing cooling performance that is 5% better than the minimum federal efficiency of SEER 14, and that VCHPs of any HSPF rating have a 90% probability of providing heating performance that is 12% better than the minimum federal efficiency of HSPF 8.2. Staff finds that 5% credit for cooling and 12% credit for heating as compared to federal minimum efficiency is an appropriate, if conservative, compliance credit for VCHPs.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bobby Hahn (Carrier)	It was mentioned that in the case studies there was contact with the manufacturers. I previously worked for Mitsubishi for 20 years, so I got to meet Mr. Pennington for the first time today. But I don't recall with my time at Mitsubishi and here at Carrier ever being consulted about equipment being selected. So I am curious what manufacturers were involved. I know there was mention of Mitsubishi perhaps. (page 125-126)	MR. WILCOX: In 2015 we reached out to the AHRI Mini-Split Committee qnd Paul Doppel. We had meetings here. And they actually helped us develop the specifications for the experiments that year. And the manufacturers volunteered to participate and provide equipment. And Mitsubishi was involved. And Carrier was involved. There was a Carrier guy on the committee, Rubin Willmarth, and they weren't involved in, as we said earlier, I don't want to argue this again, but they were involved in selecting equipment, all that stuff. So after that one year, we moved on and tested different things that were of interest, so they weren't involved much after that. So that's the connection. (page 126-127)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Brian Bogdan	For the baseline ducted unit, was the duct work in the conditioned space? I believe it was. (page 101)	MR. CONANT: Yes. For all of the baseline systems and the VCHP systems the ductwork was in the conditioned space, with the exception of the one house that had duct work in the crawl space during one year. (page 101)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Brian Bogdan	For the variable speed ductless split systems, were the thermostats in the same room as the indoor units or were they relying on transfer fans? (page 101-102)	MR. CONANT: The thermostats were in the same locations. So they were actually bundled together. And we have a little fan moving air across them, so they're seeing the exact same air, the reference system thermostat and the VCHP thermostat. (page 102)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	Are you including data from, you know, 2014 -2015 test cycles in those ten case studies? Does that also include like the Mayfair and the Grange? The Grange house that you found had refrigerant charge issues, I assume that was thrown out; right? (page 27)	MR. CONANT: Yeah. So the rows that are grayed out here, and I apologize if the gray color is difficult to see, the grayed out rows are excluded from our analysis. And so the unit that you asked about is this top row here, it is excluded. We didn't include the undercharged unit in our analysis.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	My understanding was that you had at some point included transfer fan watt draw in the total fan power on some of these cases. Was any of that data or any of those case studies included in the ten reports that you're using as the basis for rating the equipment? (Page 29)	MR. CONANT: So if you look in the two reports that I mentioned at the beginning, the two that are on the emerging technologies website, you'll see a discussion of the transfer fan energy that you're asking about. But for this analysis, we excluded all tests that used transfer fans. And the reason for that is because we decided that the requirement should be that all spaces are directly conditioned. Transfer fans don't fit with that and so we excluded all of those test cases.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	So on Mayfair in 2014, and I think in 2015, as well, you were intentionally undersizing the system. That was something that you didn't include in your discussion. In fact, you called it a head-to-head comparison system with the reference system. And, in fact, the reference system was a two-ton ducted 14 SEER single-stage Amana, I believe. And the system that you installed in Mayfair was a one-ton system that had half the capacity. (page 28)	MR. CONANT: So to clarify, sizing in the experiment that you were talking about was determined entirely by the manufacturer. We didn't specify the sizing. That was entirely up to the manufacturers to specify and install the VCHP system that they wanted. We did provide Manual J calculations and the manufacturers installed the machine that they felt would work the best.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	We argued vehemently against putting in a system that in that house, the initial load calculations were between 18,000 and 19,000 BTUs an hour. I believe that was in heating mode; cooling was very similar. And we were arguing to put a two-ton system in there because that looked like what would handle it. (page 29-30)	Staff notes that Mr. Wilcox has responded to other comments in the record stating the facts are that the subject system was installed as part of a year that the AHRI Mini-Split Committee managed the project. And the chairman of that committee worked for Mitsubishi. And the manufacturer reps were the ones who determined where systems were installed and how the systems were tested. Staff notes that Mr. Conant has responded to other comments in the record to say that sizing of the system in question was subsequently studied, and results found that there was virtually no difference in cooling energy use between the two systems. There was some benefit to peak demand on really hot afternoons from the larger size but overall cooling energy use was not different, so found no evidence that installing a larger size system during the year that was just being discussed would have improved energy use. To the contrary, it would have resulted in increased heating energy use.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	it's completely unfair to say that we conceded to that. And in fact, that decision was discussed with director-level people at Mitsubishi Electric and they objected to it. The only reason that we conceded unwillingly at the end was because it was clear we weren't going to change your mind. And secondly, we were guaranteed that you were not going to compare the performance of a one-ton system to a two-ton referenced system. We were guaranteed that that was not going to happen and that you were just conducting an experiment to see what happens. (page 30-31)	Staff notes that Mr. Wilcox has responded to other comments in the record stating the facts are that the subject system was installed as part of a year that the AHRI Mini-Split Committee managed the project. And the chairman of that committee worked for Mitsubishi. And the manufacturer reps were the ones who determined where systems were installed and how the systems were tested. Staff notes that Mr. Conant has responded to other comments in the record to say that sizing of the system in question was subsequently studied, and results found that there was virtually no difference in cooling energy use between the two systems. There was some benefit to peak demand on really hot afternoons from the larger size but overall cooling energy use was not different, so found no evidence that installing a larger size system during the year that was just being discussed would have improved energy use. To the contrary, it would have resulted in increased heating energy use.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	I have a feeling that there's been a massive breakdown in communication about who said what when, and that it really goes to the core of whether or not the data is credible. (page 31)	Staff notes that Mr. Wilcox has responded to other comments in the record stating the facts are that the subject system was installed as part of a year that the AHRI Mini-Split Committee managed the project. And the chairman of that committee worked for Mitsubishi. And the manufacturer reps were the ones who determined where systems were installed and how the systems were tested. Staff notes that Mr. Conant has responded to other comments in the record to say that sizing of the system in question was subsequently studied, and results found that there was virtually no difference in cooling energy use between the two systems. There was some benefit to peak demand on really hot afternoons from the larger size but overall cooling energy use was not different, so found no evidence that installing a larger size system during the year that was just being discussed would have improved energy use. To the contrary, it would have resulted in increased heating energy use.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	(We need) a test protocol that is going to account for the modulation of controls and really allows the control to modulate the system under different conditions. (page 31)	The CVRH research project has installed VCHPs in a highly instrumented test facility and monitored VCHP system performance as the system controls modulated the system capacity and airflow in response to the changing building loads caused by changing outdoor temperatures over the course of a heating season and a cooling season. The CVRH projects determined that the AHRI ratings for VCHP systems do not reliably predict the expected energy performance and indoor comfort performance of VCHP systems which attests to the need for rating these VCHP systems utilizing a dynamic load-based test protocol such as CSA EXP07, consistent with the commenter's recommendation. Staff therefore finds that a rating protocol such as CSA EXP07 that measures a system's performance as the system's control algorithms modulate the capacity and airflow rate to meet a number of temperature setpoints would be desirable; a rating protocol such as CSA EXP07 that measures a system's performance as the system's control algorithms modulate the capacity and airflow rate to meet a number of temperature setpoints would potentially allow for a future improvement to performance modeling. Staff does not find this to be a reason to delay the current "first step" in advance of said possible future changes in test methods.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	I have a feeling that the people that had the conversations in the field with our staff were not the same people that ended up writing the final report. And for the report to come out and say that the manufacturers specified the system is just absolutely completely false. (page 32)	Staff notes that Mr. Wilcox has responded to other comments in the record stating the facts are that the subject system was installed as part of a year that the AHRI Mini-Split Committee managed the project. And the chairman of that committee worked for Mitsubishi. And the manufacturer reps were the ones who determined where systems were installed and how the systems were tested. Staff notes that Mr. Wilcox is a CVRH project report author.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	The final report come out and then final conclusions start comparing a one-ton low ESP system that was installed in a crawlspace to a two-ton system that was completely installed within the building envelope under the drywall, not even in the attic, you know, not in a sealed attic, not really in conditioned space, as you would normally see in a real house, it's like hanging from the ceiling in the middle of a living room, it's completely an unfair comparison. (page 32)	Staff notes that the CVRH research projects have been configured to compare systems with ducts in conditioned space, so has located both the reference system and the VCHP system in conditioned space. Additionally, in order for the research to be relevant to the methodlogy used for CBECC performance compliance, a reference system representative of a minimally compliance "standard design" split system is installed, and a flip-flop comparison with the "proposed" VCHP system is monitored. See also MR. Wilcox response below regarding the AHRI managed project year participation including system selection. Staff notes that Mr. Conant has responded to other comments in the record to say that sizing of the system in question was subsequently studied, and results found that there was virtually no difference in cooling energy use between the two systems. There was some benefit to peak demand on really hot afternoons from the larger size but overall cooling energy use was not different, so found no evidence that installing a larger size system during the year that was just being discussed would have improved energy use. To the contrary, it would have resulted in increased heating energy use.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	To say that you're going to base the algorithm on the 0.35 watt draw that that system had as a reference instead of the 0.58 that's required by code, I mean how do you come up with changing the playing field here? Its not a level playing field. (page 32-33)	Staff notes the proposed VCHP algorithm provides a credit with respect to the 0.58 w/cfm standard design value by calculation of the proposed VCHP fan energy using a value of 0.35 w/cfm.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	We want transparency. We want to be able to have dialogue with your staff about the next system you're installing, how you're doing it. We want to participate. We weren't given a seat at the table. (page 33-34)	Staff finds that CVRH project researchers have utilized VCHP manufacturer input as one component in planning CVRH research activities, but CVRH project managers are free to conduct this research independently, and independent research would not be deemed to be less valid or accurate. The CVRH project research designs are appropriate for clarifying the energy impacts of VCHP systems in comparison to reference systems representative of the prescriptive standard design.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	There's no test protocol in the world, I recognize, that follows what you've done with an unoccupied house and simulating occupants and what have you. N ormally, that kind of a test protocol evolves with an ASHRAE committee or and HRI committee that sits down and works out the details. And there's some degree of consensus about how variables are going to be controlled. There was no such discussion. (page 33-34)	There is no requirement that the Energy Commission's building energy research be coordinated with ASHRAE or AHRI - the State of California routinely utilizes independent building energy research in the public interest to justify improvements to the energy code. Staff finds that the CVRH research project methodology is appropriate for clarifying the energy impacts of VCHP systems in comparison to reference systems representative of the prescriptive standard design.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	We'd like to see is a no-nonsense approach that looks at real science in a way that we can control variables and agree on how those variables are going to be controlled. (page 34)	Staff finds that the CVRH project research designs are appropriate for clarifying the energy impacts of VCHP systems in comparison to reference systems representative of the prescriptive standard design.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	There's clearly cause for concern about what may have caused the (cooling load) outlier systems to show up the way they did, just because I'm really uncertain about even what houses we're talking about. There's no correlations here. We don't know what the variables were. We don't know if that system was undersized or oversized. We don't know what the basis of the fan watt draw was. (page 34-35)	Staff finds that the CVRH project reports describe monitored VCHP performance characteristics in detail for each house monitored. The performance data from monitored systems indicate SEER/EER/HSPF ratings are not representative of actual space conditioning performance for these systems. Information detailing the building internal heat gains and the building heating and cooling loads is included in the project reports along with information on the models installed, thus information has been made available to assess sizing. Fan power was one of the project's monitored data points.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	It's unfair to us as an industry to take generalizations from ten systems tested over a period of a few years under varying conditions and then make generalizations about 10,000 different models that are in the field. (page 35)	Staff finds that CVRH research is not the only source that has determined that equipment ratings based on tests of variable capacity equipment at locked speed settings do not accurately predict the actual efficiency of the equipment that will be found when the system operates using variable speed and the system control algorithms in response to building loads. The reporting viewable at the following URLs attest to this. https://aceee.org/files/proceedings/2016/data/papers/1_836.pdf https://www.ijaiem.org/Volume4Issue8/IJAIEM-2015-08-07-8.pdf Staff considers this VCHP compliance option to be an interim credit that will be replaced by load-based ratings such as CSA EXP07 when available. Staff finds that a higher level of credit that that proposed by this compliance option would greatly increase the odds of a consumer not receiving the benefit modeled for the equipment, and would allow the potential deficit between projected and actual performance to be larger; staff notes that because this credit would be used to forego efficiency features elsewhere in the building, this creates an avoidable risk of significantly increasing the total cost of ownership or tenancy. For this reason, staff does not find that a larger credit value would be appropriate.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	(You will) basically lock out the entire industry from having access to the California market because it all comes down to how, you know, CBECC gives you compliance credit. If you can't get compliance credit, you're out, you're out of this market. ()pagew 35)	Staff finds that the proposed VCHP compliance credit provides a substantial ACM calculation benefit for performance compliance. Refer to Appendix A of the staff report posted to the docket for Comparison of the VCHP credit with the Standard Design Split Heat Pump	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	People who have used our systems in homes and raved about the energy savings but they can't get compliance credit through CBECC, so they're forced to put in a radiant heating system which CBECC does not require, even having full slab insulation underneath the slab. And if you do the heat calcs, it's pretty easy on a calculator, and in two minutes you can figure out that you're losing a whole bunch of BTUs to ground. But that's what CBECC demands that that architect do. (page 35)	Staff is glad to know that builders and homeowners appreciate the performance of VCHPs. CVRH research determined that VCHPs of any SEER rating have a 90% probability of providing cooling performance that is 5% better than the minimum federal efficiency of SEER 14, and that VCHPs of any HSPF rating have a 90% probability of providing heating performance that is 12% better than the minimum federal efficiency of HSPF 8.2. Staff finds that 5% credit for cooling and 12% credit for heating as compared to federal minimum efficiency is an appropriate compliance credit for VCHPs. Staff is not considering the energy benefits of radiant floors for this compliance option, but will be open to revisiting the radiant floor calculations in future Energy Code update cycles or based on future, separate compliance option applications.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	This is a form of bureaucratic schizophrenia. The State of California is trying to electrify the residential market. On the one hand, people are talking SB 100, we've got these goals. And on the other hand, CBECC is holding the door shut to this technology, and this is the best technology in the world. (page 36)	Staff is proposing a substantial credit for VCHPs which is expected to be useful for introducing use of VCHPs to California builders.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	There's clear correlations here if you take out the outliers. The 33 SEER system has 28 percent energy savings over your base case 14 SEER single-stage ducted system. And yet, you're telling us that there's, you know, no correlation and that you're going to minimally rate that unit, just as you're going to minimally rate the 19 SEER unit that's the outlier and you're going to give us a 15.5 SEER cap until CSA test protocols are put in place. (page 36-37)	Staff's findings are that AHRI ratings for variable capacity heat pumps are not a reliable predictor of VCHP system performance. CVRH research determined that VCHPs of any SEER rating have a 90% probability of providing cooling performance that is 5% better than the minimum federal efficiency of SEER 14, and that VCHPs of any HSPF rating have a 90% probability of providing heating performance that is 12% better than the minimum federal efficiency of HSPF 8.2. Staff finds that 5% credit for cooling and 12% credit for heating as compared to federal minimum efficiency is therefore an appropriate compliance credit for VCHPs, and preferable to the risk of harm created if trust is placed in SEER values that have been shown to be unreliable.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	This is totally an inequitable situation. It's an unjustified prejudice. It's arbitrary. And it's not really taking into account how these systems are performing, even according to your own data which is questionable. (page 37)	Staff finds that the CVRH project reports describe monitored VCHP performance characteristics in detail for each house monitored over the course of 4 years. The performance data from monitored systems indicate SEER/EER/HSPF ratings are not representative of actual space conditioning performance for these systems. CVRH research determined that VCHPs of any SEER rating have a 90% probability of providing cooling performance that is 5% better than the minimum federal efficiency of SEER 14, and that VCHPs of any HSPF rating have a 90% probability of providing heating performance that is 12% better than the minimum federal efficiency of HSPF 8.2	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	You're really refusing to work with us. We need open dialogue about these things, about how the systems were tested. (page 37-38)	Staff finds that CVRH project researchers have utilized VCHP manufacturer input as one component in planning CVRH research activities, but CVRH project managers are free to conduct this research independently, and independent research would not be deemed to be less valid or accurate. The CVRH project research designs are appropriate for clarifying the energy impacts of VCHP systems in comparison to reference systems representative of the prescriptive standard design. Staff notes the research papers for all four research years used to develop the proposed VCHP performance compliance credit are available for public viewing. See the references section of the docketed Staff Report for the Variable Capacity Heat Pump Performance Compliance Option for URL references to the reports. The reports detail the methods used in the monitoring of the systems and presents analysis of the monitored data. Additionally, public workshops were held that solicited comments which the Energy commission staff have taken into consideration in formulating the VCHP proposal; staff does not find that maintaining a level of independence represents a refusal to work with stakeholder or consider their input.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	The greatest benefit of your research is to show that AHRI really needs to move in the direction of a more transparent system. (page 39)	Staff acknowledges and appreciates the supportive comment.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	I'm very anxious to see the CSA test protocol take effect. Let's work together to solve the proble-)ms, do it quickly, get CSA implemented quickly, but don't kill us in the meantime. Don't shut the door on our face. (page 38-39)	Staff's findings are that AHRI ratings for variable capacity heat pumps are not a reliable predictor of VCHP system performance. CVRH research determined that VCHPs of any SEER rating have a 90% probability of providing cooling performance that is 5% better than the minimum federal efficiency of SEER 14, and that VCHPs of any HSPF rating have a 90% probability of providing heating performance that is 12% better than the minimum federal efficiency of HSPF 8.2. Staff finds that 5% credit for cooling and 12% credit for heating as compared to federal minimum efficiency is an appropriate compliance credit for VCHPs. Staff looks forward to working with VCHP stakeholders to incorporate use of CSA performance ratings in the future. The CSA test protool may be viewed on the CSA website. https://store.csagroup.org/ccrz__ProductDetails?viewState=DetailView&cartID=&portalUser=&store=&cclcl=en_US&sku=CSA%20EXP07%3A19	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	You could easily look at this chart and prorate the efficiencies based on AHRI and maybe not give us the 28 percent for the 33 but come to close to that. You know, take a look at the ways in which AHRI curves do align. (page 39)	Staff's findings are that AHRI ratings for variable capacity heat pumps are not a reliable predictor of VCHP system performance. Given the observed absence of correlation, staff does not find that a credit presuming a correlation would be appropriate.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	Charlie Stevens has shared some of his preliminary data with me on some of his testing with our equipment. And he's telling me that the curves are so close between our manufacturer performance curves and what he's seeing in his preliminary test data that they're crossing at various points. The basic data of what he showed us was very close alignment with what we were publicly documenting. (page 40)	Staff have reviewed plots of performance from preliminary CSA testing which confirm the AHRI locked test ratings are not a reliable indicator of actual installed system performance, including when the system is operated in variable speed mode using the VCHP system control algorithms in response to a cooling or heating load.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	I don't believe it because the variables were not controlled. You can't vary, you know, the capacities of the systems as an experiment to see what happens and then use that same data to rate the performance of those systems that may or may not have been designed relative to the algorithms to perform in that way under those set of controls. It's not fair to the manufacturer to do that kind of thing. And then to include that kind of data in this research without disclosing that those kinds of variables were tampered with is just unimaginable. (page 41)	Staff notes that Mr. Conant has responded to other comments in the record to say that sizing of the system in question was subsequently studied, and results found that there was virtually no difference in cooling energy use between the two systems. There was some benefit to peak demand on really hot afternoons from the larger size but overall cooling energy use was not different, so found no evidence that installing a larger size system during the year that was being discussed would have improved energy use. To the contrary, it would have resulted in increased heating energy use. Staff notes that the CVRH project research design intentionally did not impose "variables" or "locked" system operational constraints upon the system controls as does the current AHRI rating tests. The CVRH projects endevoured to monitor and understand how the VCHP systems performed when subjected to a typical dynamic load imposed by the changing outdoor temperature during a cooling and heating season, and in comparison to reference systems representative of the CBECC prescriptive standard design. Staff's findings are that AHRI ratings for variable capacity heat pumps are not a reliable predictor of actual installed VCHP system performance.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
Bruce Severance (Mitsubishi Electric)	But let's change the rules to the game and let's work together to create what those rules are so there's consensus. When we're putting stuff through test labs elsewhere, our staff has some kind of say. (page 41)	Staff finds that CVRH project researchers have utilized VCHP manufacturer input as one component in planning CVRH research activities, but CVRH project managers are free to conduct this research independently, and independent research would not be deemed to be less valid or accurate. The CVRH project research designs are appropriate for clarifying the energy impacts of VCHP systems in comparison to reference systems representative of the prescriptive standard design. Staff notes the research papers for all four research years used to develop the proposed VCHP performance compliance credit are available for public viewing. See the references section of the docketed Staff Report for the Variable Capacity Heat Pump Performance Compliance Option for URL references to the reports. The reports detail the methods used in the monitoring of the systems and presents analysis of the monitored data. There is no requirement for these public interest field studies to be peer managed or for the reports to be peer reviewed. Public workshops ave solicited comments which the Energy commission staff have taken into consideration in formulating the VCHP proposal.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
Bruce Severance (Mitsubishi Electric)	I've had one researcher in your group that said to me, "Well, we don't want to have an engineer come in here and install this thing because in the real world an unqualified contractor might install that." (page 42). Another person on your research team said to me, "Yeah, we didn't like the way your specification book was written and so we didn't bother to read that section." (page 42)	MR. WILCOX: Well, you know, I think that I understand that Mitsubishi doesn't like our proposal. Beyond that, it's not completely clear what's going on. I don't think it will be productive to argue about email chains from four years ago in a public hearing ad hoc. But the facts are that the system he was talking about was installed as part of a year that the AHRI Mini-Split Committee managed the project. And the chairman of that committee worked for Mitsubishi. And so to (say) we weren't open, we didn't have these guys involved is just crazy because they were the ones who determined the test protocols -- not the protocol but where systems were installed and how we tested them. I don't think we want to argue about the history of the committee process here. I don't think that's going to help much. To my personal knowledge, we've been as fair and open as possible. We have not disclosed manufacturers names. We have tried not to publish results that were specific to manufacturers, and we did that on purpose because the point of this project was not to isolate manufacturers but to go look for an overall approach that could work for this type of equipment. But that doesn't mean we're not being fair and open in the process. And you know, sort of ad hoc quotes from members of the research team is, you know, way out of line, I'd say. (page 43-44)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	Very clearly, when the one-ton system was not able to meet set point, Mitsubishi Electric and the AHRI was not involved in this. But at the point in time, midpoint in the season of testing where it was clear that a one-ton system, you know, 12,000 BTUs was not able to meet set point in a house that had heating and cooling loads in the neighborhood of 17,000 to 18,000, we recommended that that system be replaced with at least an 18,000 BTU system. And we were told that we could not do that because it was the middle of the test cycle and it would interrupt your data. We were only given one option to try to meet set point and this was not our recommendation. Our recommendation was to change out the system and size it correctly. We were refused the opportunity to do that. (page 49-50)	Staff notes that Mr. Wilcox has responded to other comments in the record stating the facts are that the subject system was installed as part of a year that the AHRI Mini-Split Committee managed the project. And the chairman of that committee worked for Mitsubishi. And the manufacturer reps were the ones who determined where systems were installed and how the systems were tested. Staff notes that Mr. Conant has responded to other comments in the record to say that sizing of the system in question was subsequently studied, and results found that there was virtually no difference in cooling energy use between the two systems. There was some benefit to peak demand on really hot afternoons from the larger size but overall cooling energy use was not different, so found no evidence that installing a larger size system during the year that was just being discussed would have improved energy use. To the contrary, it would have resulted in increased heating energy use.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	The bottom line is that we were told that you were going to, you know, maximize, lock out the fan speed on the indoor unit. And then, because it was maxed out, it wasn't capable of dehumidification. That overrode all dehumidification programming in the algorithm. It also, basically, invalidated anything that would resemble a variable capacity system because it's locked out on maximum. (page 50)	Staff notes that MR conant has stated elsewhere in this record: "So I just wanted to reiterate that our research team did not specify the fan speed setting on that unit, first of all. We specifically conducted a sizing experiment to address the sizing concerns that were raised. And as I stated earlier, our results were contrary to what is being claimed; a large size machine is not likely to have improved energy performance based on the results of our sizing study. What we saw was that it actually made heating energy performance worse. (page 53-54)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	The data that you gathered was under a test condition that, A, no average HVAC contractor would have installed a system that was, you know, 50 percent smaller than the heat load calc. And B, with the indoor unit locked out on high, I mean, it's -- and then for you to, you know, say that these systems weren't performing well because the indoor units were locked out on high. This is not fair. (page 50-51)	Staff notes that MR conant has stated elsewhere in this record: "So I just wanted to reiterate that our research team did not specify the fan speed setting on that unit, first of all. We specifically conducted a sizing experiment to address the sizing concerns that were raised. And as I stated earlier, our results were contrary to what is being claimed; a large size machine is not likely to have improved energy performance based on the results of our sizing study. What we saw was that it actually made heating energy performance worse. (page 53-54)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	I think this was an extremely difficult project to manage because you were making up a new test procedure. And I think that there are many aspects of that test procedure that are very, very credible, the way that you simulated indoor gains. And you know, I've looked at the data and it seems to me to be very much in line with what occupants, you know, the loads that occupants would have added to the home. There's a lot about it that makes sense to me. Overall, this was a very smart program. And a few loose variables have really called it into question. (page 51-52)	Staff appreciates the supportive comments. Staff is not aware of any "variables" that that would call the CVRH project results into question. Staff finds that the CVRH project reports describe monitored VCHP performance in detail for each house monitored. The performance data from monitored systems indicate AHRI ratings for SEER/EER/HSPF for the VCHP systems are not representative of actual space conditioning performance for these systems.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	This last year, I made it clear that we wanted to weigh in on the system that went into the case study house in 2018 and, you know, no response, no response, no response. And then we hear that it's already been selected and it was already installed. And when we went in for a tour, you were already gathering data and, well, this is what we're already doing. You know, so that's not dialogue. That's not like including us in the process. (page 52)	Staff finds that the field research activities in the CVRH projects has generally been responsive to manufacturer inputs in an effort to better understand how manufacturers expect the systems to be installed and operated in the field, and also to accurately monitor the installed VCHP performance in order to accurately report the actual performance of the VCHP systems in comparison to reference systems representative of the prescriptive standard design.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	It's not testing the equipment under the Manual D -- J load calcs and holding that variable constant to see what -- how it's -- the system performs under those conditions. (page 52)	MR. CONANT: So I just wanted to reiterate that our research team did not specify the fan speed setting on that unit, first of all. We specifically conducted a sizing experiment to address the sizing concerns that were raised. And as I stated earlier, our results were contrary to what is being claimed; a large size machine is not likely to have improved energy performance based on the results of our sizing study. What we saw was that it actually made heating energy performance worse. (page 53-54)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	A lot of the work that the CEC has done is so cutting edge, it should be integrated into national testing protocols. So this is not wasted effort to me, you know?	Staff is additionally participating in separate federal efforts to refine and update test procedures for VRF equipment, consistent with the commenter's recommendation.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	I would like to see the fruits of your labor input at a national level in some instances, but let's create a level playing field here. Let's not let these variables enter the picture when we're trying to test performance.	Staff is not aware of any "variables" that that would call the CVRH project results into question. The CVRH projects are not intended as tests for rating VCHP systems. The CVRH projects have endevoured to monitor the performance of VCHP systems in order to understand how the manufacturer's control algorithms vary the airflow and capacity, to understand how the systems perform to provide comfort, and how the energy use of VCHP systems compare to a minimally compliant split heat pumps. Staff finds that the CVRH project reports describe monitored VCHP performance in detail for each house monitored. The performance data from monitored systems indicate AHRI ratings for SEER/EER/HSPF for the VCHP systems are not representative of actual space conditioning performance for these systems.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	Reiterates complaints about transparency and validity of the science and the experiment as expressed previousy by him and David Paschall. Nothing new to my reading but I've highlighted the section. (page 71)	The comments referenced by the commenter are included and responded to within this comment log.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	I do agree with what Bobby Hahn with Carrier was suggesting, that there should be some compromise position. I think you're hearing that from other people. (page 72)	To the extent that the "compromise position" is a proportional credit based on SEER, staff's reasoning for pursuing a flat credit rather than a proportional one are documented in response to associated comments. Staff otherwise is fully committed to working with stakeholders on continuing to progress and iterate on VCHP modeling within the compliance software.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	If you look at, you know, the data, nowhere does it indicate on your different charts showing different test cases and what the performance was does it say which of those test cases, we don't need to know the manufacturer, but which of those test cases were undersized or oversized? There was never any mention in your presentation about systems being intentionally undersized or oversized, or fans being locked in high speed, or transfer duct wattage being included in the performance or the equipment. (page 72)	Staff notes that the equipment that was monitored is described in the research reports for each of the research years along with the results of the monitoring of the performance of the systems, including energy use of transfer fans if they were included in the experiment. Staff notes that Mr. Conant has responded to other comments in the record to say that the research team was not responsible for setting the speed of the fans for the system being discussed, and sizing of the system in question was subsequently studied for which results found that there was virtually no difference in cooling energy use between the two systems. There was some benefit to peak demand on really hot afternoons from the larger size but overall cooling energy use was not different, so found no evidence that installing a larger size system during the year that was just being discussed would have improved energy use. To the contrary, it would have resulted in increased heating energy use. Subsequent research years investigated use of fan settings to improve VCHP performance, and the results of the monitored performance for those experiments are reported in the 2017-2018 research year report.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	So show us a graph where we see what systems were properly sized relative to the heat load calc, within five percent of that, whatever it is, and then let's include that data on what we decide is going to be a level playing field for the 10,000 other systems out there that are being judged on the basis of these case studies.	MR. CONANT: So Bruce asked if there were any sizing experiments included in the data that we talked about today? The answer is, yes. In the last year of the data that's included there's a sizing experiment at two houses. I mentioned those results earlier. They showed that there was essentially no difference in cooling energy use between the larger and smaller sized machines. Those are two machines from the exact same product line that were in the same house at the same time. We switched back and forth between them. There was no difference in the cooling energy use. The heating energy use was worse for the larger sized machine. We got the same results at two different houses, two different manufacturers' product lines. (page 73-74)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	There's no other test protocol in the world that does any of the things that are being done just in how you did a standard deviation to derive what -- you know, how the entire industry should be rated based on the data that you have. And we're not allowed to see the actual data and we don't know what the controls were. (page 74)	Staff notes that statistics are widely used for interpreting the impact of a population of data. The VCHP compliance option proposal has used observational data accumulated over 4 years of monitoring of various VCHP systems to draw conclusions about how these systems operate in response to changing loads, thus the data can be used to determine a reasonable level for performance compliance credit. The monitored data and the descriptions of the performance of the VCHP systems is detailed in the reports for each of the research years. Refer to the URL links to these research reports in the references section of the Staff Report for the VCHP Performance Compliance Credit.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	We do have firsthand knowledge that there were a number of case studies that you conducted where you were intentionally varying sizing. And we have no idea if that's included in your final analysis here. (page 74)	Staff notes that at the time of the February 2019 workshop, the report for the 2017-2018 research year had not yet been published. However the report was published in May of 2019 and a URL link to that report can be found the references section of the Staff Report for the VCHP Performance Compliance Credit.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	So put our minds at ease and show us the data and, you know, give us a summary that includes a discussion of those variables. And if systems were sized of undersized, those are important things to say. In your final conclusions, if you're comparing, you know, a one-ton or a ton-and-a-half system to a two-ton reference system, it should say in the final conclusions that, well, you know, in this particular experiment, we did bury something, you know? (page 75)	MR. CONANT: So I just want to point out that I started my presentation by saying that there's two publicly available reports with all the information. I don't have time today to show all of the details for four years' worth of research. (page 75) Staff notes that research reports are available for all four research years that are the basis for this proposed VCHP compliance credit. See the references section of the staff report for the Variable Capacity Heat Pump Performance Compliance Option posted to the docket.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	I've read those (reports). And it's hard to figure out from that. This report that has these slides was only released on February 6th and I've read that report. And that report has no correlation with -- you know, the chart on page six doesn't show you what the system sizes are, you know? And then there's -- I can go -- I've written a number of notes about what it is that seems to be missing that would allow me to understand how you were deriving the conclusions you were deriving. (page 76)	Staff notes that at the time of the February 2019 workshop, the report for the2014-2015 and 2017-2018 research years had not yet been published. However, the research papers for all four research years used to develop the proposed VCHP performance compliance credit are currently available for public viewing. See the references section of the docketed Staff Report for the Variable Capacity Heat Pump Performance Compliance Option for URL references to the reports. Each report provides detail about system size. Each report provides analysis and conclusions.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	So when you do give us a final report, I ask that all the science is laid out clearly, that we -- so, you know, we need to be able to feel comfortable that you've done something that's verifiable here. If we were going to reproduce the same test and do it the same way, we would come up with a similar result. You know, that's what science is about. So give us that, you know? (page 76)	Staff notes that at the time of the February 2019 workshop, the report for the2014-2015 and 2017-2018 research years had not yet been published. However, the research papers for all four research years used to develop the proposed VCHP performance compliance credit are currently available for public viewing. See the references section of the docketed Staff Report for the Variable Capacity Heat Pump Performance Compliance Option for URL references to the reports. Each report provides detailed description of the monitoring plan and the instrumentation, along with analysis and conclusions.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	And ducts in conditioned space credit, we've deserved that all along.	Variable Capacity Heat Pump (VCHP) systems are an emerging technology in California and the rest of North America even though they are common in many other parts of the world. VCHP systems are not currently credited with improved energy performance in the California Title 24 building standards due to uncertainty regarding their installed performance. VCHP systems that use the proposed VCHP performance compliance credit will receive credit for ducts in conditioned space.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	We shouldn't have to defend AHRI ratings from the standpoint of their credibility. It happened to be the one level playing field that we have to test one make and model against another make and model. That's the reason we have a lab test, is to create a level playing field. (page 76-77)	There are many reasons why variable speed systems installed in occupied houses might perform differently from what their AHRI ratings would predict, and some of those reasons are discussed in these reports: https://aceee.org/files/proceedings/2016/data/papers/1_836.pdf https://www.ijaiem.org/Volume4Issue8/IJAIEM-2015-08-07-8.pdf AHRI rating tests for VCHP systems lock the systems at constant speeds that are unlike the way they operate to provide conditioning in variable speed/capacity mode in response to changing temperatures. That's why lab studies or very controlled field studies like CVRH are needed. The CVRH research CVRH research determined that VCHPs of any SEER rating have a 90% probability of providing cooling performance that is 5% better than the minimum federal efficiency of SEER 14, and that VCHPs of any HSPF rating have a 90% probability of providing heating performance that is 12% better than the minimum federal efficiency of HSPF 8.2. Staff finds that 5% credit for cooling and 12% credit for heating as compared to federal minimum efficiency is an appropriate compliance credit for VCHPs.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
Bruce Severance (Mitsubishi Electric)	To say that we have to come up with science that disproves what you guys are coming up with here is really not fair when all the details haven't really been disclosed in the final report. It's really clear to me that this equipment in the field performs better than what you're finding in some of these cases and that many of the faults that you're pointing to have to do with controls, you know? And I think the industry is going to get smarter and learn something from you and the product will get much better. (page 77)	The reports for all four of the research years that are the basis for this proposed VCHP performance compliance option are available for viewing. The reports provide detail description of the equipment monitored and the data collected, along with detailed description of the performance characteristics of the monitored equipment, analysis of the data, and recommendations for further study. Refer to the references section of the staff report posted to the docket for URL links to each of the reports. Staff agrees that VCHP system operation is highly dependant on the proprietary control algorithms embedded in these VCHP systems. AHRI rating tests for VCHP systems override the manufacturer's controls and lock the systems at constant speeds that are unlike the way they operate according to the manufacturer's control algorithms to provide conditioning in variable speed/capacity mode in response to changing temperatures. That is why lab studies or very controlled field studies like CVRH are needed.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	There's many aspects of what you've done that are going to be fruitful for the industry, are going to be fruitful for the state and for consumers, so I'm not discrediting that. (page 77)	Staff acknowledges and appreciates the supportive comment.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	There should be a compromise of not putting a 15 SEER cap on all equipment in the entire industry on the basis of probabilities that are projected on ten cases. This is just never done anywhere in the entire world. This is not done. This is not how equipment is rated. (page 77-78)	MR. WILCOX: This project got started because the DOE minimum single-speed heat pump is a SEER, what, 14. In the performance standard, we wanted to include mini-splits. if the mini-split uses half as much energy, then they can take out all the insulation and the good windows and all that stuff in our tradeoff procedure. We were trying to defend the high-performance envelopers here. And how does that lovely AHRI rating really turn out? Do these systems use half as much energy? No, you test it out of the box. A lot of them used more energy than the single-speed system. And so you know, we stand on our heads and do all this experimentation and stuff and come up with this, what I think is, you know, a modest credit going the right direction and so forth. But now your argument is that we should go back and use the SEER, I think that's what you're arguing, some version of the SEER, when the SEER is obviously completely wrong. You don't save half the energy with a mini-split. Show any data that shows that. Okay, that's the bottom line here. (page 80)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
Bruce Severance (Mitsubishi Electric)	Bring us a CSA test standard immediately. Let us have that so that we can kick the tires. (page 78)	The CSA test protool may be viewed on the CSA website. https://store.csagroup.org/ccrz__ProductDetails?viewState=DetailView&cartID=&portalUser=&store=&cclcl=en_US&sku=CSA%20EXP07%3A19	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	I did not say that we should use SEER. I think I said that AHRI ratings were imperfect. You know, your data has helped inform the industry of that. And what I said was we need a compromise position. If SEER 33, for example, is giving us 28 percent energy savings, give us 20 of that. Give us 20 of that. Prorate it on that basis until we have a CSA standard. (page 80-81)	Staff's findings are that AHRI ratings for variable capacity heat pumps are not a reliable predictor of VCHP system performance. Given the observed absence of correlation, staff does not find that a credit presuming a correlation would be appropriate.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	We have a year in the meantime (before the CSA test protocol can produce results). Don't shut the industry out of the California market for another year. That's what I'm asking for, is give us a compromise. And we deserved the ducts in conditioned space five years ago. So giving us that now is not enough. You know, having a black eye on two or three models and, you know, projecting that onto the rest of the industry is just not fair. (page 81)	Staff finds that a flat credit is an appropriate response to the problem of inconsitency between SEER rating and in-situ performance. To the extent that the CVRH project was necessarily limited in funds and therefore in scope, should stakeholders be willing to contribute resources toward additional research staff is willing to continue working with stakeholders both on future research and future modeling iterations based on that research.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	Is there a timeline on how soon the residential VCHP modified CSA test procedure (that NEEA has been working on for ten years) is going to be available? (page 127)	MR. WILCOX: Unfortunately, the California Energy Commission is not sponsoring or managing the development of the CSA test procedure. It's -- you know, CSA is like an ASTM body in Canada. And so they're -- it's a consensus committee. And my understanding, I'm not involved in it, my understanding is that there are laboratories all over North America who are testing that procedure now, trying to figure out -- answer your questions about repeatability and et cetera. But it's -- that's a standard that's not for public review. : It's not published; right? So there's kind of (no way of knowing) how long it's going to take. (page 131-132)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
Bruce Severance (Mitsubishi Electric)	Has anybody at CEC or any associated consulting groups that are working on this (the residential VCHP modified test procedure), have any of you been given a promise of when that's going to be delivered? (page 127)	MR. WILCOX: Unfortunately, the California Energy Commission is not sponsoring or managing the development of the CSA test procedure. It's -- you know, CSA is like an ASTM body in Canada. And so they're -- it's a consensus committee. And my understanding, I'm not involved in it, my understanding is that there are laboratories all over North America who are testing that procedure now, trying to figure out -- answer your questions about repeatability and et cetera. But it's -- that's a standard that's not for public review. : It's not published; right? So there's kind of (no way of knowing) how long it's going to take. (page 131-132)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	Does CEC have a timeline or a projection on how long it will take to kind of kick the tires on that procedure and verify repeatability? (page 127)	MR. WILCOX: Unfortunately, the California Energy Commission is not sponsoring or managing the development of the CSA test procedure. It's -- you know, CSA is like an ASTM body in Canada. And so they're -- it's a consensus committee. And my understanding, I'm not involved in it, my understanding is that there are laboratories all over North America who are testing that procedure now, trying to figure out -- answer your questions about repeatability and et cetera. But it's -- that's a standard that's not for public review. : It's not published; right? So there's kind of (no way of knowing) how long it's going to take. (page 131-132)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	Do you have a plan or a program to reach out to manufacturers to get manufacturers to participate in that kind of beta test of the procedure? (page 127-128)	MR. WILCOX: Unfortunately, the California Energy Commission is not sponsoring or managing the development of the CSA test procedure. It's -- you know, CSA is like an ASTM body in Canada. And so they're -- it's a consensus committee. And my understanding, I'm not involved in it, my understanding is that there are laboratories all over North America who are testing that procedure now, trying to figure out -- answer your questions about repeatability and et cetera. But it's -- that's a standard that's not for public review. : It's not published; right? So there's kind of (no way of knowing) how long it's going to take. (page 131-132)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
Bruce Severance (Mitsubishi Electric)	So (the VCHP modified CSA test proceedure is) basically a lab test that includes the modulation of the controls, which I think is probably the, you know, smoking gun and the main reason why AHRI, you know, curves haven't perfectly matched, you know, some of the other data. I would say controls are probably more than three-quarters of that deviation. You know, Abram is kind of shaking his head yes. I think, you know, people I've talked to, there's a lot of consensus about that. I keep going back to that because I think that's going to be the way that we kind of resolve all arguments here. (page 129)	MR. WILCOX: Unfortunately, the California Energy Commission is not sponsoring or managing the development of the CSA test procedure. It's -- you know, CSA is like an ASTM body in Canada. And so they're -- it's a consensus committee. And my understanding, I'm not involved in it, my understanding is that there are laboratories all over North America who are testing that procedure now, trying to figure out -- answer your questions about repeatability and et cetera. But it's -- that's a standard that's not for public review. : It's not published; right? So there's kind of (no way of knowing) how long it's going to take. (page 131-132)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	My hope is that you're, you know, talking to manufacturers in advance and bringing them to the table and finding out who wants to schedule lab test time in order to just help you kick the tires and kind of do a beta test of that procedure, make sure it's repeatable, it's cost effective, all the things that it needs to be in order to be implemented. And my guess is that's going to take a year. (page 130-131)	Once it is published, any consideration of the updated CSA test procedure will be conducted via an open public process that will include outreach to potentially affected stakeholders.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	So what I'm not clear on is, because you've mentioned all these things kind of at the same time, is if some of these other contingencies, like verification of the fan controls and to make sure that the fan is not operating continuously, is that part of the CSA added on to the CSA test when it's implemented, or you're wanting us to do that, you know, like next week, before we try to sell anything in California? (page 133)	MR. WILCOX: Well, the proposal here is on the table. And if the Commission decides to go ahead with it, it could -- I not exactly sure how soon it can happen, but maybe for the approval of the software in June. [...] In my mind, if the Commission decides to go ahead with some version of this compliance option, that doesn't necessarily get replaced by the CSA procedure. We've proposed that the CSA procedure would be voluntary and manufacturers could do it if they wanted to. And it's definitely going to cost a lot more money than your current laboratory test. And so you may only want to do it if you've got high performance systems that you want to market in California. And that, see, that's a very soft landing; right? You can do it on your schedule. And when you've got the test results, you can submit them with the Commission and end up in the software then. This is based, to some fairly large degree, on a very successful program that NEEA has been running for heat pump water heaters in the Pacific Northwest where there's a voluntary test standard. And the manufacturers test and submit their results and NEEA certifies them. And there's a list of machines that have been tested and what their characteristics are. We're cooperating with NEEA on that program. And we have that list of heat pump water heaters in CBECC-Res right now and it's being used for compliance. (page 133-135)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	And my understanding is that's just a box that you check that you're going to, you know, try for a voluntary measure, and then it opens up the possibility of adding the equipment rating for those heat pump hot water heaters? (page 136)	MR. WILCOX: We got a list of all the NEEA certified heat pump water heaters in CBECC-Res right now. (page 136)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	So you just pull down, select the model that you're using and all the data drops in? (page 136)	MR. WILCOX: That's right.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	You would do something similar if we had a similar test from NEEA we would be able to get our equipment rated under that and there would be a dropdown menu and we would get the higher SEER that we test for, or EER or whatever it is, under that test protocol? (page 136-137)	MR. WILCOX: That's what our proposal is. That's what we meant with what we said there. I don't know, I just turned off the mike or something. MR. BOZORGCHAMI: Sorry -- so if you look at -- so if you look at -- if you have access to our CBECC-Res program right now that's out there, the alpha version, and just tab over to the Water Heating section, you will see what Bruce is really talking about is the checkbox that we have for NEEA Tier 3, isn't it? MR. WILCOX: No, just NEEA rated. MR. BOZORGCHAMI: NEEA rated.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	So it is a box that you have to check. And then that dropdown menu becomes an option. Yeah. That's what I had understood. So what you're suggesting then is that there's some sort of interim certification of separate certification of our equipment that would -- we would certify that it's not -- the algorithms are not running indoor fans continuously. And what -- how is that represented? Is that a letter from, you know, the vice president of engineering of Mitsubishi Electric and it says that we certify that our algorithms don't run the indoor fans continuously? (page 138)	MR. MILLER: Yeah, essentially. Staff will create a document that you would certify those, that your equipment conforms to this. (page 138)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	And so you have a protocol for how the HERS Rater is supposed to verify that in the field? And you know, would they have to watch the equipment run for three hours to figure out . . . (page 138)	MR. WILCOX: No, no, they just -- they look it up on the list and if that model number is listed, then you're in.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	So that's all that he HERS Rater needs to verify? (page 139)	MR. WILCOX: And this is done for lots of different equipment actually. MR. MILLER: So we are proposing, though, that a HERS Rater would observe the operation of the equipment in the field to see if it runs continuously in between calls for conditioning.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	So they would have to be at the house for a period of time to watch it cycle.	MR. WILCOX: I've never heard this before. MR. WILCOX: I think you made that up.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	So I'm just trying to get clear here because these are important details. And you know, I guess what I'm after is between now and when we have a dropdown menu where we actually get our real efficiency rating, we're trying to find a solution that actually, you know, makes sense and doesn't lock us out of the market for the interim year to two years, however long that takes.	MR. WILCOX: One other point here is that it's not clear to me, as I started to say earlier, that the CSA procedure would necessarily replace this compliance option we're talking about now; right? They could coexist easily.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	So you would still need a letter certifying that the algorithms aren't running continually, the fan isn't running continuously? (page 141)	MR. WILCOX: If you're going to submit your CSA test results, you're going to need more than a letter.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	My point is if we have CSA test results, I mean, that's a certified result. And according to CSA, they're -- it's a time conducted -- it's a time -- you know, a test over a period of time without locking capacity in at different settings which, you know, of course, I think we all agree is an artificial device that was used to find an effective way to try to rate equipment at different capacity settings. And now we see that that's not accurate because of the controls issue. But you know, if we're rating under CSA, there's really no reason to require an additional letter from the vice president certifying that the fan doesn't run continuously because a CSA test is going to run this in this much greater range of conditions. We're going to be spending a lot of money to get that certified. And the operation of the system under a much broader range of test conditions is going to be in the clear day; right? Everybody can see that data. We all know that it's efficient. So we shouldn't have to jump through additional, you know, requirements to get the equipment rated. (page 142)	MR. WILCOX: At this point the CSA option is kind of a concept because it's at the stage . . . Well, because the standard is not approved yet. And in fact you're the first manufacturer I've ever heard say anything positive about it.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	The point is that that's a very rigorous test standard (the VCHP modifed CSA test). And I don't understand why the state would demand that we also meet other hurdles separately from that and require a HERS Rater to verify that the fan is not running continuously. You know, we're not Volkswagen. We're not going to put, you know, one algorithm in there and delivery a different algorithm in the equipment. I've had people say that AHRI is intentionally misleading, and I don't believe that's true. I think it's an imperfect lens. It was the best they could come up with in the timeframe that they did, you know, 15, 20 years back. And you know, I will be the first to admit that AHRI and ASHRAE committees move at a glacial pace. I find it frustrating. So that's just the world we live in. You know, I'm being very open and honest about wanting to embrace a better test procedure. (page 143-144)	Staff notes that consideration of the updated CSA test is discussed in the context of a compliance option and not a requirement. Manufacturers would not be required to perform this test, but could potentially elect to do so to receive additional compliance credit for the specific performance of their system (assuming that the results of the CSA test are shown to correlate to in-situ system performance and an associated compliance option is approved by the Energy Commission based on this showing).	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	My next question really is, you know, we've got -- you're requiring a 350 CFM per ton standard on low ESP systems. And I want to know if you've conducted a survey of specifications on a wide range of model numbers that fall into that category? Because my understanding is that low ESP systems are inherently a lower CFM per ton, and as the color came in, you know? So did you conduct a survey of a bunch of different models or . . . (page 144-145)	MR. WILCOX: I did not conduct a survey. The assumption we're operating under is that installed correctly, those systems will deliver airflow, just like any other system. (page 145)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	Low ESP systems are running at 0.1 to 0.2 inches of water column. Generally, their airflows are lower. And part of the efficiency of them is that reduced air speed across the coil, you know, is better for heat transfer. So they're designed to operate in a completely different way than conventional high static pressure systems. And to apply the standard, if you haven't done a survey of, you know, what the conventional ESP, let's say the mean number is across the industry, where did that number come from? Is that an arbitrary number? Because my guess is it's going to lock out over 90 percent of the product in that category, it's going to lock it out, and that doesn't make sense. Can somebody conduct a survey of that please? I'm just asking if you're going to create a standard, can we at least reference a body of model numbers that represent, you know, 80 or 90 percent of the market and come up with a number that's in the middle of that range, instead of inventing a different number. (page 145-147)	MR. WILCOX: I don't think that's true. We know that there are systems out there that will meet this requirement because I showed you pictures of them. So a survey? We could certainly do that. Personally, I have not done that survey. I didn't think it was an issue. (page 146-147)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	These systems generally perform better than high static ducted systems, you know, fully centralized air handler systems, generally they do. Your own data shows that. And they generally run on much lower static pressure. (page 145-146)	MR. WILCOX: And that's absolutely true.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	The next point I want to make is I'm all for larger return grill sizes. I really believe in Chitwood's methodology of doing things. I've followed his prescription in many conditions and seen enormously beneficial results from a lot of Rick Chitwood's methods. So I understand the reasoning behind wanting to do larger filter grills. I saw a picture in the presentation, and I, of course, think this is a great idea on many levels, but there's some ambiguity about what the intent is relative to what is shown in the picture and what we're talking about on paper. So you have two, what are they, 20 by 30 filter grills that act as also second -- you know, double as a hatch to get access to a sealed ducted mini-split compartment in a hallway. Is that what we're looking at? (page 147-148)	MR. WILCOX: Yeah, that's right. (page 148) MR. MILLER: Just to clarify, what you saw in the photographs was a sheet metal plenum that it was built around. So the return air path was not into an encourage made of sheetrock. It was the sheet metal. (page 151)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	So is that a piece of hardware that is, you know, just a standard filter grill or is there anything special about that that makes it double as a hatch? (page 148)	MR. WILCOX: No. I believe it's a standard piece of equipment[.] (page 148) Staff additionally notes that examples of manufacturer standard product air filter grilles for soffet-mounted air-handling units that accomodate dual 20"x30" filters were referenced in the staff report. Also at the February 15, 2019 workshop, photographs of a representative dual 20"x30" return grille installation for a low-static VCHP was presented by Bruce Wilcox. https://efiling.energy.ca.gov/getdocument.aspx?tn=227124	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	The question I have is: Is there ducting between that filter grill and the return side of the ducted mini-split behind it? (page 148-149)	MR. WILCOX: My understanding is it's not. Staff additionally notes that at the February 15, 2019 workshop photographs of a representative dual 20"x30" return grille installation for a low-static VCHP was presented by Bruce Wilcox. The indoor unit is encased in an airtight sheet metal enclosure in a dropped ceiling that has an access hatch that doubles as air filter grills. The indoor unit draws air from within the sheet metal enclosure, but there are no ducts attached directly to the return grille of the indoor unit. https://efiling.energy.ca.gov/getdocument.aspx?tn=227124	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	I don't have a problem with that, provided that that enclosed compartment that it's in is completely airtight, and we should probably be part of a leak test. I don't -- that hasn't been discussed. You know, but obviously, you wouldn't want the return side to have any leakage to the attic above that, you know? What's the test procedure for doing that? (page 149)	Staff notes that ducted VCHP systems will be required to verify that the system including ducts are located entirely in conditioned space as verified according to the field verification protocol in RA3.1.4.3.8.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	Secondly, in the standard, you say that these systems have to be fully ducted. In conditioned space, you're still holding us to duct leakage numbers; right? (page 149)	MR. WILCOX: No, there's no duct leakage requirement. There's a requirement to have no duct leakage outdoors but there's no overall duct leakage. Staff notes system must be verified according to the field verification protocol in RA3.1.4.3.8 which uses both a visual verification and a leakage to outside measurement.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	So as long as there were ducts in this conditioned space, there's not duct leakage requirement; is that what you're saying? (page 149-150)	MR. WILCOX: I believe that's the case. Staff notes that measurement of total duct leakage is not required, however the field verification protocol in RA3.1.4.3.8 uses both a visual verification that ducts are in conditioned space and a leakage to outside measurement.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	I think that (no duct leakage requirement) should be in writing somewhere. It's very important because, you know, I mean, we might understand this but the contractor in the field is not necessarily going to understand it. And if they think it has to a duct leakage tested system fulling enclosed, they would assume that there would have to be ducting from the return side of that air handler and the filter grill and there is none. So I don't have a problem with the configuration. I just want a specification with, you know, a clear diagram explaining that to the contractor of a standard applications manual that the CEC, you know, comes out with.	Staff notes that the Staff report for the VCHP performance compliance option posted to the docket specifically states in Appendix B Eligibility Requirements: in SC3.4.4.3: Compliance with Section 150.0(m)11 (Duct System Sealing and Leakage Testing) is not required for systems that use this VCHP performance compliance option, however there are requirements to verify that VCHP system indoor unit ducts are located entirely in conditioned space that are specified as eligibility requirements for this compliance option. And in section SC3.4.4.3(d): Low leakage ducts located entirely in conditioned space verification. Ducted indoor units shall be verified in accordance with the Verified Low Leakage Ducts in Conditioned Space procedure in Section RA3.1.4.3.8.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	I've seen a very similar picture in just the last couple of days of an installation done by one of the CEC researchers in his own home. And I believe it was a sheetrock compartment. So if that's part of your specification? (page 151)	MR. MILLER: The standards don't allow that. (page 151)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	So I guess what I'm saying is that just, if it's okay to have the return side of the air handler open to the filter grill with the air handler actually in the return plenum, the entire air handler is in the return plenum, right, is basically what -- that needs to be described somewhere. I haven't seen that on paper anywhere. And if that's the prescription for how to do ducts in conditioned space with one of these low ESP systems . . . (page 151)	MR. WILCOX: There's no intent that this is a prescription or a requirement. I was trying to show an example of what these kind of systems might be. (page 151-152)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	And you're also asking for oversized return grills to make sure that you've got, you know, low static pressure and proper filtration. And I just would like to see a guideline that makes how to do that clear to the contractor in the field, and that's all I'm asking for. Otherwise, I think there will be a lot of confusion about how to interpret the document. (page 152)	Staff notes that publication of filter grille sizing guidelines are outside of the scope of the compliance option under consideration; nonetheless, staff will direct the request to appropriate internal staff.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	So you know, I guess the only question I had is if you could explain the reasoning for -- or just explain to me, I want to make sure I understand, it sounded to me from your presentation that the algorithm that was being used for the variable capacity heat pumps in CBECC was somehow using the 0.35 watts per CFM performance of the CVRH reference system as the benchmark or the standard case. Is that correct? Is that what that algorithm is doing? (page 152)	MR. WILCOX: No, no. What's being done is we're adjusting because that -- the standard design does not have a 0.35. The standard design has 0.58 watts per CFM. And so it turns out that because we couldn't hold Rick Chitwood down, he ended up building those reference systems with a lower fan power. And so we're giving an extra credit to bring that up to equality. (page 153)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	I guess the only other thing that I'd like to point out is that the CEC's listing website, the MAEDBS website, has not been updated for a lot of variable capacity heat pump system due to some sort of inconsistency in the way the spreadsheets are run. And AHRI data is coming in with like one more field. This is what I've heard secondhand. And I've tried to have an ongoing conversation with some folks at California Energy Commission about trying to fix this problem because what's occurring is many, many systems are not showing up on the state's website that are actually approved. This is a problem that I think came up in 2011 and hasn't been fixed yet. (page 153-154)	Staff notes that the topic of the completeness of the MAEDBS product listings is not related to the question of how to model VCHP systems; staff additionally notes that where listings are not present within MAEDBS but are present within the AHRI database, the AHRI listings are able to be used to demonstrate compliance. None the less, staff will direct this feedback to appropriate internal staff.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	I would like to suggest is until you can fix this problem, if your IT guy could just put a little notice on every one of those 1,400 pages that says, by the way, if it's on AHRI's website it's approved under Title 20 for the time being, until we can fix this problem. And if you want to know for sure, go to the bulletin section and click on this to find the letter that says so. (page 155)	MR. BOZORGCHAMI: So, well, what I can do is we'll contact -- communicate with our Appliance Office unit office manager. The Acting Manager is Patrick Saxton at this time. And we'll communicate that with him and see if we could resolve the situation. (page 155-156)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	My only ask in parting is that we figure out a way to bring a group of manufacturers to the table, and maybe AHRI, and I think AHRI would have to be there because there's antitrust rules that prevent any of us from meeting otherwise and sit down and have interfaces with your staff regarding things like how we can organize tradeoffs on shell measures. (page 156)	Staff is open to future discussions with stakeholders on the issue of HVAC tradeoffs and with regard to impacts to the building envelope for the performance compliance approach.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	I personally feel that we should not be trading off many shell measures for system performance. And this argument has been made as if we're the culprits because somebody can put a piece of equipment in there and do lower performing building shell, and that's not what we want. We feel our equipment does better in high-performing shells and that it's cost effective to do many of these shell measures and they shouldn't be compromised. There needs to be some dialogue between industry and CEC staff on some of these points. And these arguments cannot be used to suppress the actual rating of the equipment. (page 156-157)	Staff notes that the concern regarding tradeoffs is a general concern with awarding excessive performance credit that is not specific to VCHP; it has been noted here in relation to some units achieving extremely high SEER ratings (28+) under laboratory conditions because underperformance of the VCHP system would be exacerbated by poorer insulation (and vice versa). That is, the potential harm created by the lack of correlation between SEER and performance is magnified by the ability to use credit awarded for a high SEER rating to reduce envelope performance. However, the harm exists irrespective of this interactive effect, and this interaction is not the justification for a flat rather than proportional credit (which is justified by the lack of correlation between SEER and in-situ performance).	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Bruce Severance (Mitsubishi Electric)	And I'm not saying AHRI is actual, just so I'm clear. But at the point where we have a test procedure that we believe is 90 percent on the target at least, or 95 percent correct, there's never going to be a perfect test standard but, you know, we always want to make them better. We don't want to see our equipment derated because of these kind of building shell arguments. It's not appropriate. And what it's doing is it's preventing the highest performing technology from getting to the market under a fair and competitive set of market conditions. And it's not conducive to the state's own SB 100 climate objectives. (page 157)	Staff is open to consideration of a proportional credit to the extent that a reliably predictive test statistic is developed; staff is happy to continue working with stakeholders on this topic an to continue to iterate in future rulemaking proceedings and compliance option proposals.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	let's have some kind of forum to discuss these kinds of things and let industry participate in that conversation. That's what I ask for today is bring us to the table. Let us discuss these things in a rationale manner. (page 157)	Staff is open to future discussion on this topic; staff does not find that delaying the current proposal is necessary to pursuing future discussion.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Bruce Severance (Mitsubishi Electric)	Lack of Peer Review on Research Underlying the VCHP Compliance Option: A careful review of all of the CVRH reports does not yield clear data for all ten of the test scenarios that are said to provide the basis of the VCHP Compliance Option requirements. There is reason for substantial concern that this research has never been adequately peer reviewed by anyone inside or outside the CEC, and given the authority with which the research findings are being used to support the VCHP Compliance Option requirements, such peer review is warranted.	Staff finds that peer review of field research project reports utilized for California Energy Code development is not a requirement, nor is it a general expectation of this type of data collection and performance verification. In addition, the public review and comment period provides a similar opportunity for input and critique as a peer-review process.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602
Bruce Severance (Mitsubishi Electric)	Lack of Peer Review on Research Underlying the VCHP Compliance Option: When various members of the CEC team were asked to provide all of the test scenario data on one chart, including system capacity, calculated load, AHRI ratings, and measured SEER and HSPF, our office was told "the data is not available'. This answer is inadequate when equipment performance is being judged statewide on this basis, and if the data is truly not available, it is clear the research was never independently peer reviewed.	Staff notes that research reports are available for all four research years that are the basis for this proposed VCHP compliance credit. See the references section of the staff report for the Variable Capacity Heat Pump Performance Compliance Option posted to the docket.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602

Commenter	Summary of the comment	Response to the comment	Link to docket item
Bruce Severance (Mitsubishi Electric)	MERV 13 Filtration Requirement for Low-static Ducted Systems: Recent emails and conversations with CEC staff and CVRH research staff state that they fully intend to require MERV 13 filtration on low-static systems under the new VCHP compliance option.	Standards Section 150.0(m)12 states mechanical space conditioning systems that supply air to an occupiable space through ductwork exceeding 10 ft in length shall be provided with air filters having a designated effiency equal to or greater tha MERV 13. The VCHP compliance option proposes to require ducted VCHP systems with any length of duct to comply with the air filter requirements, and also requires air filters to meet a maximun clean filter presure drop of les than or equal to 0.1 inch w.c.. (To be clear, this requirement does not apply to non-ducted systems.) The Staff Report posted to the docket provides further clarification of these air filter requirements necessary for eligibility for the VCHP compliance option.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602
Bruce Severance (Mitsubishi Electric)	MERV 13 Filtration Requirement for Low-static Ducted Systems: Although this passage [“Variable Capacity Heat Pump Proposed Compliance Option” (pg.22, submitted 2-6-19)] says nothing directly about MERV 13 filtration, the authors and CEC staff interpret this to mean MERV 13 filtration is required on low static systems under this compliance option. The CEC code section 150.0(m)12.B referenced above pertains to filter sizing and pressure drop and does not require MERV 13 filtration which is referenced in 150.0(m) 12.C. The only phrase in the passage above that may hint at applicability to low-static systems is the reference to “systems that use any length of duct”, because there is an exclusion under Section 150.0(m)12.A.i that excludes systems with under 10’ of duct, an exclusion meant to be applicable specifically to low-static systems. Even if this phrase said “low-static system” in place of “any length of duct” the phrasing would remain ambiguous because the code section cited (150(m)12.B) only pertains to filter grill sizing and not MERV filtration values. Regardless of how you read it, there is nothing in this reference that actually reverses the exclusion under Section 150.0(m)12.A.i which clearly states that systems with under 10’ of ducting, and by implication, all low-static systems, are exempt from the MERV 13 requirements defined in 12C. [...] Intentional or not, the MERV 13 filtration requirement is a “curve ball”.	Staff finds that all Title 24, Part 6 standards requirements that are applicable to space conditioning systems shall also be met by VCHP systems that use the proposed VCHP compliance option, unless those Title 24 Part 6 standards requirements are amended or excepted by the eligibility requirements specified by the proposed VCHP compliance option. The proposed VCHP compliance option eligibility requirements have specified that ducted VCHP systems shall not be exempt from the applicable air filtration requirements given in 150.0(m)12 when the system duct length is less than 10ft, and also specifies that the maximum allowable clean-filter pressure drop shall not be greater than 0.1 inch w.c. regardless of air filter depth. MERV 13 is the only available value for air filter efficiency compliance for the 2019 Energy Code.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602

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Bruce Severance (Mitsubishi Electric)	MERV 13 Filtration Requirement for Low-static Ducted Systems: When asked for any test data on how MERV 13 filtration may impact the other VCHP compliance requirements such as ESP and airflow, the CEC admitted it has NO test data which demonstrates how to make low-static systems conform with the MERV 13 requirement. This is entirely unfair.	For the rulemaking proceedings for the 2019 Energy Code update, research papers were posted to the docket that indicated that there is no significant correlation of system pressure drop to MERV level between the ranges of MERV 6 to 13. Staff accordingly does not expect any special design or steps to be necessary for low-static systems to comply with updated air filtration requirements. Examples of manufacturer standard product air filter grilles for soffet-mounted air-handling units that accomodate dual 20"x30" filters were referenced in the staff report. Also at the February 15, 2019 workshop, photographs of a representative dual 20"x30" return grille installation for a low-static VCHP was presented by Bruce Wilcox. https://efiling.energy.ca.gov/getdocument.aspx?tn=223260	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602
Bruce Severance (Mitsubishi Electric)	MERV 13 Filtration Requirement for Low-static Ducted Systems: Not only is the requirement ambiguous, they have no testing, no set of system design guidelines or even a place to begin. I do not currently know of any systems that have been tested and sold by a manufacturer that already complies with this standard, and most importantly, the CEC doesn't have a clue if it is possible to install MERV 13 filtration on low-static systems without impacting their other requirements: 350-400cfm/ton, maximum static pressure of .35 w.c., and a maximum clean filter pressure drop of .1 w.c.	For the rulemaking proceedings for the 2019 Energy Code update, research papers were posted to the docket that indicated that there is no significant correlation of system pressure drop to MERV level between the ranges of MERV 6 to 13. Staff accordingly does not expect any special design or steps to be necessary for low-static systems to comply with updated air filtration requirements, and the commenter presents no evidence that use of appropriate filters would pose any sort of unusual challenge. Filter sizing methodology is given in Standards Section 150.0(m)12B, and in the staff report for the VCHP performance compliance option in Appendix B: SC3.1.4.7 Verification of Air Filter Sizing According to Face Velocity Specification.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602

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Bruce Severance (Mitsubishi Electric)	MERV 13 Filtration Requirement for Low-static Ducted Systems: There is a high likelihood that this set of interacting requirements structured around tight tolerances will create an obstruction rather than a path to compliance. It is almost incomprehensible, that staff would impose such stringent requirements without having tested the impacts of these very interactive variables.	Staff finds that ducted VCHP systems that use the VCHP compliance option will have fewer performance verifications than conventional split systems, since measurement of fan efficacy (W/cfm) is not required for the compliance option. The air filter sizing and air filter pressure drop elegibility requirements for the VCHP compliance option will ensure that filters of any MERV rating do not restrict the system airflow. Field inspections that are required for elegibility such as providing conditioned air to all rooms, providing ducts located in conditioned space, or providing wall mounted thermostats will not affect the system's ability to meet airflow and refrigerant charge verification criteria. The extra credit available for non-continuous fan operation is contingent on a simple field observation that the fan does not operate when the system is not providing comfort conditioning. Staff find that these elegibility requirements are not excessively stringent.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602
Bruce Severance (Mitsubishi Electric)	MERV 13 Filtration Requirement for Low-static Ducted Systems: One must ask if the ambiguities in this document are intentional. Other stakeholders who have read this document also do not believe it requires MERV 13 on low-static systems. The text seems clear that it does not require compliance with 12C, only 12B, and yet CEC maintains otherwise.	Staff does not intend the VCHP requirements to be ambiguous. Staff finds that all Title 24, Part 6 standards requirements that are applicable to space conditioning systems shall also be met by VCHP systems that use the proposed VCHP compliance option, unless those Title 24 Part 6 standards requirements are amended or excepted by the eligibility requirements specified by the proposed VCHP compliance option. The proposed VCHP compliance option eligibility requirements have specified that ducted VCHP systems shall not be exempt from the applicable air filtration requirements given in 150.0(m)12 when the system duct length is less than 10ft, and also specifies that the maximum allowable clean-filter pressure drop shall not be greater than 0.1 inch w.c. regardless of air filter depth. MERV13 is the only available value for air filter efficiency compliance for the 2019 Energy Code. A staff report has been posted to the docket that further clarifies the elegibility requirements for the VCHP compliance option.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602

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Bruce Severance (Mitsubishi Electric)	MERV 13 Filtration Requirement for Low-static Ducted Systems: When I asked one CEC official to send out a memorandum to industry stakeholders clarifying the CEC's intent to require MERV 13 on low-static, he said that it was up to industry to comment on the VCHP Compliance Option as is. The refusal to clarify such a completely misinterpreted passage leads one to think that some CEC staff prefer this to remain ambiguous to keep the industry response and resistance to a minimum.	Staff notes that publishing supplemental memoranda for a document during a public comment period on said document is not standard practice as it risks creating confusion regarding the material the public is asked to review; staff does not find the document to be unclear such that this unusual step would be warranted, given that a careful reading of the publication is plain in its specification. Separately, if there are passages that a stakeholder finds to be confusing we do ask that their concern be submitted to us as a public comment so that staff are made aware of the concerns and so that revisions to the document can be considered.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602
Bruce Severance (Mitsubishi Electric)	MERV 13 Filtration Requirement for Low-static Ducted Systems: It is improbable that manufacturers are generally aware of the CEC's intent to interpret the current VCHP Compliance Option to impose the MERV 13 requirement. The ambiguous statements in the VCHP Compliance Option may take many of them by surprise, which will leave manufacturers scrambling to comply, and few, if any, may be prepared when the VCHP Compliance Option takes effect next year.	Staff does not intend the VCHP requirements to be ambiguous. Staff finds that all Title 24, Part 6 standards requirements that are applicable to space conditioning systems shall also be met by VCHP systems that use the proposed VCHP compliance option, unless those Title 24 Part 6 standards requirements are amended or excepted by the eligibility requirements specified by the proposed VCHP compliance option. The proposed VCHP compliance option eligibility requirements have specified that ducted VCHP systems shall not be exempt from the applicable air filtration requirements given in 150.0(m)12 when the system duct length is less than 10ft, and also specifies that the maximum allowable clean-filter pressure drop shall not be greater than 0.1 inch w.c. regardless of air filter depth. MERV13 is the only available value for air filter efficiency compliance for the 2019 Energy Code. A staff report has been posted to the docket that further clarifies the elegibility requirements for the VCHP compliance option.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602
Bruce Severance (Mitsubishi Electric)	No Central VCHP Compliance Option: The CVRH research project did not set out to test central high-static VCHP heat pumps and as a result, the VCHP Compliance Option has no provision for them, yet this is one of the most affordable types of VCHP systems on the market.	Staff finds that the compliance option is necessarily limited by its underlying research; staff notes that the research conducted was aligned to the equipment that was most common or popular at the time the study was drafted, with input from stakeholders. Staff does not find that establishing additional provisions in the absence of research data would be appropriate, though staff is also open to working with stakeholders to develop additional provisions as additional data becomes available.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602

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Bruce Severance (Mitsubishi Electric)	No Central VCHP Compliance Option: Perhaps (the lack of a Central VCHP Compliance Option) is due to the bias for putting all ducts in conditioned space (DCS) in new construction, but there are problems with that as well, unless you also require all ducts in conditioned space to be hard metal ducting sealed in mastic – so it will never fail. Otherwise, flex ducts will start to leak in twenty or thirty years and residents will be reticent to repair them if drywall must be removed.	Discussion of the merits of the ducts in conditioned space compliance credit allowed use of flex duct vs metal or rigid duct is outside the scope of this VCHP compliance option proposal. Staff nonetheless observes that duct leakage into interstitial spaces within the thermal envelope has a smaller energy consequence than leakage to outside (as occurs from ducts routed through vented attic spaces). That is, moving the ducts into the conditioned space represents a savings of energy even when assuming higher leakage rates.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602
Bruce Severance (Mitsubishi Electric)	No Central VCHP Compliance Option: When CEC staff was asked if there was any clear data measuring BTUs lost through the ducting in both a DCS condition and when ducts are deeply buried in a high performance attic (HPA), they did not have clear data.	Staff finds that VCHP air handler leakage and duct leakage is not accounted for by burying the indoor unit and associated ducts in attic insulation, as this leakage still represents leakage to outside rather than into the conditioned space. For this reason the VCHP compliance option eligibility requires the duct system including the air handler to be located entirely in conditioned space. (Duct losses for mid-static and high-static central systems are not considered by this compliance option given that such systems are outside the compliance option's scope.)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602
Bruce Severance (Mitsubishi Electric)	No Central VCHP Compliance Option: Provided all supply grills are located near interior walls, and ducts are deeply buried, and attics are well ventilated to prevent high attic temperatures (over 110 °), loss through the duct wall is minimal. This is easily calculated and the energy savings are not reflected in CBECC, which doesn't have an option for short-ducts in HPA. The CEC has known this for some years, but has not generated installation guidelines for "short-ducting" central systems.	Staff finds that the commenter is incorrect: the CBECC compliance software accounts for duct surface area when a verified duct design compliance path is chosen, thus it is already possible to model a "short duct" system.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602
Bruce Severance (Mitsubishi Electric)	No Central VCHP Compliance Option: Key advantages (to "short-ducting" central system) are significant total project cost reduction and energy savings when R-50 to R-60 is blown to deeply bury ducts, compared to the typical R-38 with a DCS condition created with a hall drop ceiling. It is hard to justify that DCS actually provides a better energy savings value than short ducts in an HPA would.	Staff finds that the CBECC compliance software currently accounts for duct surface area and duct leakage in an attic for conventional systems that have the capability to verify performance in the field using approved HERS verification, so short duct systems can receive credit by use of the verified duct design compliance path. Thus for systems that do not use the proposed VCHP compliance option, it is currently possible to model a "short duct" system design or a design that has ducts entirely in conditioned space. The user may choose whichever compliance path results in the preferred compliance result.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602

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Bruce Severance (Mitsubishi Electric)	No Central VCHP Compliance Option: Central high-static VCHP heat pumps deserve better ratings and a path to higher compliance credit than the minimal 14 SEER cap that is currently imposed upon them by the CEC.	Staff finds that the compliance option is necessarily limited by its underlying research; staff notes that the research conducted was aligned to the equipment that was most common or popular at the time the study was drafted, with input from stakeholders. Staff does not find that establishing additional provisions in the absence of research data would be appropriate, though staff is also open to working with stakeholders to develop additional provisions as additional data becomes available.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602
Bruce Severance (Mitsubishi Electric)	In-Slab Hydronic Systems Get Credit for DCS in CBECC: In-slab hydronic systems are not required to have full under-slab insulation while these systems enjoy DCS credit. The state's CBECC software doesn't even allow an option for full slab insulation, and only requires four feet of horizontal perimeter insulation in CZ16.	Staff finds that discussion of credits for hydronic systems is outside the scope of this VCHP performance compliance option. The proposed VCHP compliance option includes credit for ducts in conditioned space.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602
Bruce Severance (Mitsubishi Electric)	In-Slab Hydronic Systems Get Credit for DCS in CBECC: Running heat load calcs indicates that there is as much heat lost to ground in the absence of full slab insulation as there is through long R-6 ducts in an unimproved attic. So what is the scientific basis for giving hydronic systems DCS credit?	Staff finds that discussion of credits for hydronic systems is outside the scope of this VCHP performance compliance option. The proposed VCHP compliance option includes credit for ducts in conditioned space.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602
Bruce Severance (Mitsubishi Electric)	In-Slab Hydronic Systems Get Credit for DCS in CBECC: There is no allowance for VCHP high-static air handlers with deeply buried ducts in a deeply buried condition. And there is substantial evidence from work and data gathered by Rick Chitwood, that this is extremely cost effective on retrofit projects.	Staff finds that the compliance option is necessarily limited by its underlying research; staff notes that the research conducted was aligned to the equipment that was most common or popular at the time the study was drafted, with input from stakeholders. Staff does not find that establishing additional provisions in the absence of research data would be appropriate, though staff is also open to working with stakeholders to develop additional provisions as additional data becomes available. (Staff notes that "cost effective" presumes the delivery of efficiency gains estimated by SEER and similar ratings, and that the absence of ability to rely on such ratings for VCHP equipment is the core concern staff has with regards to this compliance option.)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602

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Bruce Severance (Mitsubishi Electric)	In-Slab Hydronic Systems Get Credit for DCS in CBECC: The CEC has not given the central VCHP alternative fair hearing. (The lack of an allowance for VCHP high-static air handlers with deeply buried ducts in a deeply buried condition) just testifies to the extent that the code requirements, and preference given to one technology over another are governed by bias in the absence of scientific research and hard data. Bias also arises from what the CEC's research teams choose to study or not study.	Staff finds that the compliance option is necessarily limited by its underlying research; staff notes that the research conducted was aligned to the equipment that was most common or popular at the time the study was drafted, with input from stakeholders. Staff does not find that the commenter's concern posits a reason for delaying consideration of the current compliance option, but seems instead to be a request for an additional compliance option. Staff is fully willing to work with stakeholders on additional compliance options following the proceeding for the current compliance option.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602
Bruce Severance (Mitsubishi Electric)	Conflict of Interest in CBECC: The CVRH research that has provided the basis of the VCHP Compliance Option, has been conducted by research contractors who also write the algorithms for the State's approved compliance modeling software. There is an inherent conflict of interest in this arrangement that manifests itself in less transparency regarding errors in the HVAC field test procedures as well as inaccuracies built into the CBECC model.	Staff does not find any conflict of interest in the researchers tasked with generating performance data for use in computer simulation software also being tasked with then translating that data into simulation instructions: it is more accurate to understand the computer simulation as the final product being requested, and the generation of performance data a necessary step toward creating that final product.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602

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Bruce Severance (Mitsubishi Electric)	Conflict of Interest in CBECC: The research team was so interested in experimenting with efficiency that they removed the factory motors and installed much higher performance motors that used about 40% less energy (average of .35W/cfm instead of .58W/cfm). Nevertheless, the CVRH research referred to the reference system as "14 SEER" throughout their reports and used the factory performance data as the benchmark, fully aware that this was inaccurate and an unfair representation that would make VCHP performance look worse in the public facing reports. The report did include footnotes about the reference system modifications. However, adjustments for this error were later made, not by mathematically estimating the actual SEER of the reference systems in the reports, which would be awkward, but by altering the algorithms in the CBECC software, where the error is less scrutinized and if found appears to be a generous "boost" to how VCHP's are modeled. The result is that CBECC now has an artificially high fan Watt draw rating built into the VCHP modeling. The CVRH researchers have built erroneous data into their software to mask their errors, and consequently the software is wrong. Any future software editors will have to unwind such errors if they are working from correct filed test data.	Staff understands the research team did not change the manufacturer's fan motors or modify the existing fan motors in the CVRH reference systems, and only monitored the performance of the installed air handlers as they were installed with properly designed duct systems attached, and reported the W/cfm used by each. Fan Efficacy (W/cfm) is affected by the combination of the air handling unit fan efficiency and the quality of the duct system attached to the air handler. Installed systems perform at a wide variety of W/cfm values that may be greater than or less than 0.58 W/cfm, not specifically at 0.58 W/cfm. For reference see the field measured values for W/cfm reported on Page 30 of this report: https://ww2.energy.ca.gov/2012publications/CEC-500-2012-062/CEC-500-2012-062.pdf Since the VCHP compliance option credit was calculated by comparison to the reference systems in the CVRH project, VCHP compliance option will model a 0.58 w/cfm "standard design" airhandling system, and a "proposed" VCHP with fan energy of 0.35 w/cfm based on the average of the monitored fan energy use of the reference systems in the CVRH project. This is a fan energy credit for the VCHP that accounts for the difference between the actual monitored W/cfm of the CVRH reference systems and the CBECC standard design specification of 0.58 w/cfm.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602
Bruce Severance (Mitsubishi Electric)	Conflict of Interest in CBECC: The research team was able to use a 14 SEER benchmark when the systems were more likely operating at the 15 or 16 SEER level, and the team was able to minimally rate VCHP technology for last five years based on this minimal rating.	As stated elsewhere in this record, staff understands that the CVRH project did not modify the reference systems to cause them to operate at efficiency levels greater than their AHRI rated efficiency. CVRH project only monitored the performance of the systems as they were installed with properly designed duct systems attached, and reported the performance of each. Since the VCHP compliance option credit was calculated by comparison to the reference systems in the CVRH project, VCHP compliance option will model a 0.58 w/cfm "standard design" airhandling system, and a proposed VCHP with fan energy of 0.35 w/cfm based on the average of the monitored fan energy use of the reference systems in the CVRH project. This is a fan energy credit for the VCHP that accounts for the difference between the actual monitored W/cfm of the CVRH reference systems and the CBECC standard design specification of 0.58 w/cfm.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602

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Bruce Severance (Mitsubishi Electric)	Conflict of Interest in CBECC: This minimal rating is now used as leverage to induce manufacturers to comply with the VCHP Compliance Option requirements, because they can't market their products without getting a minimum level of "compliance credit" which directly translates into cost-competitiveness.	Staff's findings are that AHRI ratings for variable capacity heat pumps are not a reliable predictor of VCHP system performance. CVRH research determined that VCHPs of any SEER rating have a 90% probability of providing cooling performance that is 5% better than the minimum federal efficiency of SEER 14, and that VCHPs of any HSPF rating have a 90% probability of providing heating performance that is 12% better than the minimum federal efficiency of HSPF 8.2. Staff finds that 5% credit for cooling and 12% credit for heating as compared to federal minimum efficiency is an appropriate compliance credit for VCHPs. Staff finds that a higher level of credit would greatly increase the odds of a consumer not receiving the benefit modeled for the equipment, and would allow the potential deficit between projected and actual performance to be larger; staff notes that because this credit would be used to forego efficiency features elsewhere in the building, this creates an avoidable risk of significantly increasing the total cost of ownership or tenancy. For this reason, staff does not find that a larger credit value would be appropriate.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602
Bruce Severance (Mitsubishi Electric)	Conflict of Interest in CBECC: CEC's research must be adequately peer reviewed.	Staff finds that the Energy Commission routinely utilizes field research conducted in the public interest to support further development of the building standards. Staff additionally finds that peer review of field research project reports utilized for California Energy Code development is not a requirement, nor is it a general expectation of this type of data collection and performance verification. The public review and comment period provides a similar opportunity for input and critique as a peer-review process; staff notes that the commenter does not explain why peer review is either required for this proceeding or would provide an opportunity for review by experts not already provided by the public comment period/.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602
Bruce Severance (Mitsubishi Electric)	Conflict of Interest in CBECC: Software development should not be led by the research teams.	Staff finds that CVRH research and development of the CBECC software are both in the public interest, and that conceptually the generation or compilation of data is a necessary step internal to the production of a computer simulation model. Staff does not find a conflict of interest in creating a computer model by first compiling data then programming a model from that data.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602

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Bruce Severance (Mitsubishi Electric)	Conflict of Interest in CBECC: The inaccuracies (of the research team) have hurt the VCHP manufacturers, and they have hurt the public interest.	Staff finds that the CVRH project research designs are appropriate for clarifying the energy impacts of VCHP systems in comparison to reference systems representative of the prescriptive standard design. Staff does not find either the research or its conclusions to be inaccurate.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=229204&DocumentContentId=60602
Bruce Severance (Mitsubishi Electric)	We are concerned about the specification misalignments built into the current draft of the VCHP Compliance Option. Only in the last few weeks has the CEC staff confirmed in writing that the VCHP Compliance Option requires MERV 13 filtration,	Staff notes that confirmation was provided to Bruce Severence in writing in March of 2019 and in August of 2019 that the VCHP compliance option proposal requires compliance with the air filter regulations in Section 150.0(m)12 regardless of the duct length. Section 150.0(m)12 requires filters to be MERV 13 air filters. The VCHP compliance option proposal also requires air filters to meet a maximun clean filter presure drop of less than or equal to 0.1 inch w.c.. (To be clear, the air filter requirements do not apply to non-ducted systems) The Staff Report posted to the docket provides further clarification of these air filter requirements necessary for eligibility for the VCHP compliance option.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230093&DocumentContentId=61616
Bruce Severance (Mitsubishi Electric)	No CEC test data is available to substantiate the ability of low-static systems to provide MERV 13 filtration while also meeting the flow and static pressure requirements of the compliance option.	For the rulemaking proceedings for the 2019 Energy Code update, research papers were posted to the docket that indicated that there is no significant correlation of system pressure drop to MERV level between the ranges of MERV 6 to 13. Staff accordingly does not expect any special design or steps to be necessary for low-static systems to comply with updated air filtration requirements. Examples of manufacturer standard product air filter grilles for soffit-mounted air-handling units that accommodate dual 20"x30" filters were referenced in the staff report. The air filter research information was also provided to Bruce Severance in March 2019. Also at the February 15, 2019 workshop, photographs of a representative dual 20"x30" return grille installation for a low-static VCHP was presented by Bruce Wilcox. https://efiling.energy.ca.gov/getdocument.aspx?tn=223260	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230093&DocumentContentId=61617

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Bruce Severance (Mitsubishi Electric)	While there are reports of some contractors configuring low-static systems with MERV 13 filtration, it is not at all clear that the rest of the VCHP Compliance Option requirements can be met while also meeting this requirement.	Staff does not expect any special design or steps to be necessary for ducted low-static systems to comply with MERV 13 air filtration requirements than would be required for air filtration at lower (e.g. MERV5, 6, 7, 8) levels. However, in order to ensure that ducted low-static systems will operate to provide the required airflow rates, and will not consume fan energy in excess of the fan energy consumed by systems monitored in the CVRH project the VCHP compliance option specifies that any air filter used for a ducted VCHP system shall be sized such that the pressure drop across the air filter will be less than or equal to 0.1 inch w.c.. These air filters are expected to be labeled by the manufacturer to disclose the presure drop characteristics of the air filter product (3-M products currently have these labels). Thus system designers/installers, and system owners will be enabled to select replacement filters that meet the minimum 0.1 inch w.c. presure drop specification.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230093&DocumentContentId=61618
Bruce Severance (Mitsubishi Electric)	The high-MERV requirement combined with the low-static pressure provided by these systems is inherently contradictory and difficult for these systems to meet.	Staff finds that as long as the air filter is sized properly to meet the 0.1 inch static pressure drop requirement, ducted low-static systems are expected to operate to provide the required airflow rates.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230093&DocumentContentId=61619
Bruce Severance (Mitsubishi Electric)	We encourage the Commission to consider including mid-static ducted systems (up to 0.65 inch w.c. ESP) within the VCHP compliance option before the final vote in November. The current draft of the compliance option excludes mid-static systems that provide the static pressure required to more efficiently deliver MERV 13 filtration while serving several rooms or an entire home with one unit.	Staff finds that the compliance option is necessarily limited by its underlying research; the compliance option does not "exclude" mid-static systems so much as those systems have simply been outside of the original project scope. Staff notes that the research conducted was aligned to the equipment that was most common or popular at the time the study was drafted, with input from stakeholders. Staff does not find that establishing additional provisions in the absence of research data would be appropriate, though staff is also open to working with stakeholders to develop additional provisions as additional data becomes available.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230093&DocumentContentId=61620

Commenter	Summary of the comment	Response to the comment	Link to docket item
Bruce Severance (Mitsubishi Electric)	These mid-static systems can have the same compact air handler design as our low-static products so they can easily fit in a drop ceiling, but are far better suited for this high-MERV application. It appears that the elimination of this more suitable technology was the result of a misassumption that the mid-static systems are less efficient, when this is not the case.	Staff finds that the compliance option is necessarily limited by its underlying research; the compliance option does not "eliminate" mid-static systems so much as those systems have simply been outside of the original project scope. Staff notes that the research conducted was aligned to the equipment that was most common or popular at the time the study was drafted, with input from stakeholders. Staff does not find that establishing additional provisions in the absence of research data would be appropriate, though staff is also open to working with stakeholders to develop additional provisions as additional data becomes available.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230093&DocumentContentId=61621
Bruce Severance (Mitsubishi Electric)	Mitsubishi Electric's mid-static PEAD-model systems are more efficient than our low-static systems, and the installed efficiency of our low static systems are likely to be negatively impacted by the restricted air flow that MERV 13 filtration imposes. They are clearly not designed for this application. We have cause to question the reasons for excluding mid-static air handlers and hope that you consider allowing them to receive EDR credit through the VCHP Compliance Option, because they are more appropriately matched to the specifications you are requiring.	Staff finds that there is no significant correlation of system pressure drop to MERV level between the ranges of MERV 6 to 13. Staff does not expect any special design or steps to be necessary for ducted low-static systems to comply with MERV 13 air filtration requirements than would be required for air filtration at lower MERV levels. The proposed VCHP compliance option is only applicable to the system types studied in the CVRH projects (low static), so in order to draw the distinction between low-static and conventional systems, the proposed VCHP compliance option has used the definition for low static system given in the 2017 Department of Energy (DOE) final rule on test procedures for central air conditioners and heat pumps: Low-static systems “produce greater than 0.01 in. wc. and a maximum of 0.35 in. wc. external static pressure when operated at the cooling full-load air volume rate not exceeding 400 cfm per rated ton of cooling".	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230093&DocumentContentId=61622

Commenter	Summary of the comment	Response to the comment	Link to docket item
Bruce Severance (Mitsubishi Electric)	The VCHP Compliance Option requirements in their current form represent a misalignment with low-static systems in several ways. It would be best to consider minor revision to a few specifications to better align the compliance option with the high-efficiency product currently available. Certainly, some low static systems will happen to have the right combination of cfm/ton, ESP and have fan speed jumper settings that allow them to be certifiable low-static equipment while also providing MERV 13 filtration. Many low-static systems on the market will not meet this narrow set of requirements which we do not believe promote higher installed efficiencies. We believe the specification misalignment will unfairly disqualify a range of products on the market, or require manufacturers to redesign product to meet narrow specifications which do not promote higher delivered efficiency.	Staff finds that ducted low-static VCHP systems need to be designed to deliver 350 cfm/ton and operate within the manufacturer specifications in order to comply with the California Energy Code. Staff is not recommending that people install VCHPs into undersized and overly restrictive duct systems and then try to compensate by pushing the air handler beyond its capabilities. Staff is recommending to design the system, including ductwork, properly so the system can function properly. Staff has examined the engineering data and fan performance curves for 82 different ducted, low-static pressure VCHP models. Staff found that over 90% of the units investigated had airflow ratings capable of delivering 350 CFM/ton. Staff therefore finds it to be reasonable for VCHP systems to meet this airflow rate requirement.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230093&DocumentContentId=61623
Bruce Severance (Mitsubishi Electric)	(asks CEC to consider) Allow mid-static air handlers (up to .65 in w.c.) to qualify for the VCHP compliance credit provided they meet a higher minimum SEER/HSPF. Doing so would avoid implementation of the MERV13 requirement only on low-static systems, for which there will be unresolved questions for engineers, architects and their system designers regarding return grill areas and compliance with ESP and flow requirements. Allowing mid-static product to qualify under the compliance option avoids training, support and installation problems which are likely to arise from the lack of field test data to confirm whether the VCHP Compliance Option will work across a range of low-static systems.	Staff finds that the compliance option is necessarily limited by its underlying research; staff notes that the research conducted was aligned to the equipment that was most common or popular at the time the study was drafted, with input from stakeholders. Staff does not find that establishing additional provisions in the absence of research data would be appropriate, though staff is also open to working with stakeholders to develop additional provisions as additional data becomes available.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230093&DocumentContentId=61624

Commenter	Summary of the comment	Response to the comment	Link to docket item
Bruce Severance (Mitsubishi Electric)	(asks CEC to consider) Clarify the definition of certified low-static equipment in the current draft of the VCHP Compliance Option. Some products cross over between low-static and mid-static flow and static pressure definitions due to adjustable global fan speed settings (jumpers or dip-switches). Does a certified low static product exclude product that crosses these definition thresholds due to speed settings provided it is configured to meet the low-static definition as installed; or, do certified low-static productsonly include products that meet the low-static criteria in all of their possible speed settings? If the VCHP Compliance Option requires HERS verification of compliance with flow and ESP requirements, is it not reasonable to include products that can operate as mid-static product provided they are commissioned and HERS verified to meet the VCHP requirements?	Staff finds the proposed VCHP compliance option is only applicable to the system types studied in the CVRH projects (low static), so in order to draw the distinction between low-static and conventional systems, the proposed VCHP compliance option has used the definition for low static system given in the 2017 Department of Energy (DOE) final rule on test procedures for central air conditioners and heat pumps: Low-static systems “produce greater than 0.01 in. wc. and a maximum of 0.35 in. wc. external static pressure when operated at the cooling full-load air volume rate not exceeding 400 cfm per rated ton of cooling". Systems that operate outside these static pressure boundaries may perform differently in terms of energy efficiency compared to those that were studied by the CVRH projects. Thus these systems are not eligible for use of the VCHP compliance credit. However, conventional ducted air-source AC/HP systems may receive credit for efficiency based on the system's SEER/HSPF/EER. These systems must be capable of complying with all required HERS field verification requirements in order to receive better than minimum credit.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230093&DocumentContentId=61625

Commenter	Summary of the comment	Response to the comment	Link to docket item
Bruce Severance (Mitsubishi Electric)	(asks CEC to consider) Allow the current air-flow specification of 350-400cfm/ton a broader tolerance of 350 to 475cfm/ton in recognition of Rick Chitwood's data indicating that higher flows (up to 600cfm/ton) are more effective in California's mostly dry climate where latent loads are minimal and dehumidification plays a less significant role in residential applications. It may be very difficult for low static systems to be adjusted to fall within the narrower tolerance while also meeting other VCHP compliance option requirements.	Given the commentor's stated concerns about whether low-static systems would be capable of attaining 350 cfm/ton, staff notes the inconsistency in this proposal for credit for airflow greater than 350 cfm/ton. Staff investigation of manufacturer literature for airflow capabilities of low-static systems found that systems specifications for airflow generally ranged from 350 to 550 cfm/ton. The proposed VCHP compliance option credit is based directly upon the monitored performance of the systems installed in the CVRH project dwellings over the course of a season. The CVRH research did not conduct experiments to determine the basis for an energy credit for increased system airflow at high speed rates greater than 350 cfm/ton. Since variable capacity equipment does not operate at high speed constantly, there is cause to question whether it is reasonable to give the same credit for higher than 350 cfm/ton airflow rates to variable speed systems as is given to constant speed systems that operate continuously at high speed. Thus staff finds that until further research is conducted to evaluate the energy effects of high fan speeds in VCHP systems, the proposed VCHP compliance option will not offer extra credit for airflow rate greater than 350 cfm/ton at high speed.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230093&DocumentContentId=61626
Bruce Severance (Mitsubishi Electric)	(asks CEC to consider) Offer a level playing field for DICS credit and grant the same EDR compliance credit as is afforded any technology that eliminates ducts in the attic. There is no reason that DICS credit should be coupled or contingent upon the rest of the VCHP Compliance Option requirements, and such coupled requirements are not required of other technologies that receive DICS compliance credit. A level playing field for VCHP technology is reasonable.	Staff finds VCHP systems are an emerging technology in California and the rest of North America even though they are common in many other parts of the world. VCHP systems have not currently been credited with improved energy performance in the California Title 24 building standards due to uncertainty regarding their installed performance. In response to industry requests for a compliance credit, and based on the research performed in the CVRH projects, VCHP systems that use the proposed VCHP performance compliance credit will receive credit for ducts in conditioned space, thus the systems will be required to verify that the VCHP systems ducts and indoor unit are located entirely in conditioned space. The VCHP compiance option eligibility requirement to have all ducts entirely in conditioned space is justified by the CVRH research basis.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230093&DocumentContentId=61627

Commenter	Summary of the comment	Response to the comment	Link to docket item
Bruce Severance (Mitsubishi Electric)	(asks CEC to consider) The underrating of variable capacity equipment efficiencies and the difficulty obtaining compliance credit over the past several years have made VCHP equipment far less competitive against gas appliances. It puts VCHP product at a disadvantage due to misassumptions and conclusions that merit further evaluation. The VCHP Compliance Option misalignment raises critical issues in need of careful evaluation and corrective action. It is our hope that CEC staff remains open to this feedback, which we have consistently expressed over the months since the draft VCHP Compliance Option was first released in February 2019.	Staff finds the proposed VCHP compliance option credit of 5 percent as compared to a single speed SEER 14 / EER 11.7 system for cooling, and 12% as compared to a single speed HSPF 8.2 system for heating, and the eligibility requirements for systems to receive the proposed VCHP credit as detailed in the staff report posted to the docket, are justified based on the CVRH project results. Staff does not consider the proposed compliance option to be missaligned. VCHP systems are an emerging technology in California and the rest of North America even though they are common in many other parts of the world. VCHP systems have not currently been credited with improved energy performance in the California Title 24 building standards due to uncertainty regarding their installed performance as compared to the current AHRI ratings. Staff anticipates improved methods for rating VCHP systems such as CSA EXP07 will be utilized for rating VCHP systems in the near future, and staff looks forward to working with VCHP stakeholders to incorporate such performance based ratings into the ACM performance compliance approach.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230093&DocumentContentId=61628
Bruce Severance (Mitsubishi Electric)	(asks CEC to consider) In the absence of data showing that MERV 13 filtration can be combined with a range of low-static systems while still meeting the ESP and flow requirements of the VCHP Compliance Option, a rush to approve a misaligned standard could create many unnecessary policy implementation headaches, including difficulty training system designers on untested configurations, and HERS verification problems arising from a lack of supporting data. Contractors, trainers and system designers may be entirely unprepared as they attempt to implement this compliance option in January without a framework for doing so. If the CEC provided field test data to support the proposed compliance option, many concerns would be alleviated.	For the rulemaking proceedings for the 2019 California Energy Code update, research papers were posted to the docket that indicated that there is no significant correlation of system pressure drop to MERV level between the ranges of MERV 6 to 13. Staff accordingly does not expect any special design or steps to be necessary for low-static systems to comply with updated air filtration requirements. Examples of manufacturer standard product air filter grilles for soffit-mounted air-handling units that accommodate dual 20"x30" filters were referenced in the staff report. Staff does not consider the proposed VCHP compliance option to be misalligned as suggested by the commenter. Staff notes that air filter sizing has long been an integral component of duct system design, thus is not a new untested concept. Duct system design and air filter pressure drop requirements have been a part of the CA Energy Code since the 2013 Title 24 update. Staff will provide assistance to the public during implementation of the VCHP compliance option if the compliance option is approved.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230093&DocumentContentId=61629

Commenter	Summary of the comment	Response to the comment	Link to docket item
David Paschall (Mitsubishi Electric)	My initial question was what about the different capacities of the systems in the other house? I was told, I was personally told they were not being compared against the other homes. (page 44)	Staff finds that the CVRH project research designs are appropriate for clarifying the energy impacts of VCHP systems in comparison to reference systems representative of the prescriptive standard design. Staff notes that Mr. Wilcox has responded to other comments in the record stating the facts are that the subject system was installed as part of a year that the AHRI Mini-Split Committee managed the project, and that the chairman of that committee worked for Mitsubishi. Additionally, manufacturer reps were responsible for determining where systems were installed and how the systems were tested.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
David Paschall (Mitsubishi Electric)	I then asked about the difference in sizing of the reference system and was personally told they were not being compared against that. (page 44-45)	Staff finds that the CVRH project research designs are appropriate for clarifying the energy impacts of VCHP systems in comparison to reference systems representative of the prescriptive standard design. The CVRH project reports describe monitored VCHP performance characteristics in detail for each house monitored, and the performance data from monitored systems indicate SEER/EER/HSPF ratings are not representative of actual space conditioning performance for these systems. Information detailing the building internal heat gains and the building heating and cooling loads is included in the project reports along with information on the models installed, thus information has been made available to assess sizing.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
David Paschall (Mitsubishi Electric)	When I asked for an explanation of what was being compared, it was defined to me as there were a number of retrofits to a certain -- to one of these homes and they were trying to see how a lower capacity unit than what Manual J requested would take care of that house. I was also advised that the previous system installed in that house was even lower than what we had installed. (page 45)	Per the response provided by Mr. Wilcox at the public workshop, the subject system was installed as part of a year that the AHRI Mini-Split Committee managed the project, and the chairman of that committee worked for Mitsubishi. Manufacturer reps determined where systems were installed and how the systems were tested.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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David Paschall (Mitsubishi Electric)	The Manual J load calculation required 17,000 in cooling, 18,000 in heating. Me, as the manufacturer rep, suggested 24,000 BTUs, a two-ton system. We were then offered a 9K. We had to negotiate our way back to a 12K. So all (I'm) saying is if the CEC understands that a Manual J load calculation is the only way to correctly size a ductless or ducted multi-split system than to install a system that is not Manual J, meeting that requirement, should throw this entire thing out. (page 45)	MR. CONANT: At the start of my presentation, I mentioned that there's a third report that's not publicly available yet. Part of that study was specifically on sizing. And in the same house that we were just talking about we tested both a one-ton and a one-and-a-half ton system from the exact same product line. Our results found that there was virtually no difference in cooling energy use between the two systems. There was some benefit to peak demand on really hot afternoons from the larger size system because it was running at a lower speed but overall cooling energy use was not different. And the smaller size system had significantly lower heating energy use, in the order of 20 percent of so. So we found no evidence that installing a larger size system during the year that was just being discussed would have improved energy use. To the contrary, it would have resulted in increased heating energy use. (page 48)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
David Paschall (Mitsubishi Electric)	There was a breakdown, there was a miscommunication. (page 46)	Per the response provided by Mr. Wilcox at the public workshop, the subject system was installed as part of a year that the AHRI Mini-Split Committee managed the project, and the chairman of that committee worked for Mitsubishi. Manufacturer reps determined where systems were installed and how the systems were tested.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
David Paschall (Mitsubishi Electric)	The way the test was performed was inadequate in mind. And I'm not a scientist but I do know that you are supposed to control the variables when you do an experiment. (page 46)	Staff finds that the CVRH project research designs are appropriate for clarifying the energy impacts of VCHP systems in comparison to reference systems representative of the prescriptive standard design. Staff notes that the CVRH project is not an experiment but an observational study: units are installed into a representative setting and observed. Inasmuch as the same setting was used for the duration of the study, the only variable in the study was the equipment installed into the CVRH.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
David Paschall (Mitsubishi Electric)	We installed this lower-than-required system. Again, it was supposed to be a 24; we ended up putting a 12,000 in there. This system then had to run at full speed to approach set point, and even that wasn't enough. We were then asked to change the fan speed, lock it in at high speed. We were then asked to increase the static pressure to the highest static pressure on the system. We changed where the system was sensing. There were numerous changes made to this system during the test project. (page 46)	MR. CONANT: The way it was described sounded like our research team directed Mitsubishi to make changes to that system. What actually happened was that we notified Mitsubishi of the way the system was operating and Mitsubishi determined what changes they wanted to make to improve the performance. (page 47-48)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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David Paschall (Mitsubishi Electric)	If what we were testing was to see how a correctly-sized system, how efficient or effective it would be, we missed the mark 100 percent. There is no -- there can be no doubt about that because we did not do what the requirements for the industry say. (page 46)	Staff notes that Mr. Conant has responded to other comments in the record to say that sizing of the system in question was subsequently studied, and results found that there was virtually no difference in cooling energy use between the two systems. There was some benefit to peak demand on really hot afternoons from the larger size but overall cooling energy use was not different, so found no evidence that installing a larger size system during the year that was just being discussed would have improved energy use. To the contrary, it would have resulted in increased heating energy use.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
David Paschall (Mitsubishi Electric)	I've been misrepresented a few times. I've heard it today again. At no time did Mitsubishi say it was okay to put a 12,000 to take care of 18,000, and that needs to be on record. (page 46-47)	Per the response provided by Mr. Wilcox at the public workshop, the subject system was installed as part of a year that the AHRI Mini-Split Committee managed the project, and the chairman of that committee worked for Mitsubishi. Manufacturer reps determined where systems were installed and how the systems were tested.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
David Paschall (Mitsubishi Electric)	And then the final thing I want to say about that is it's unfair to not just the manufacturers, but it's unfair to the end users. It's unfair to the end users to not give us the credit that our systems have been designed with and that they actually show. (page 47)	Staff's findings are that AHRI ratings for variable capacity heat pumps are not a reliable predictor of VCHP system performance. CVRH research determined that VCHPs of any SEER rating have a 90% probability of providing cooling performance that is 5% better than the minimum federal efficiency of SEER 14, and that VCHPs of any HSPF rating have a 90% probability of providing heating performance that is 12% better than the minimum federal efficiency of HSPF 8.2. Staff finds that 5% credit for cooling and 12% credit for heating as compared to federal minimum efficiency is an appropriate compliance credit for VCHPs.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
David Paschall (Mitsubishi Electric)	If you were to redo this test, use correct systems in there, correct sizing and take that into consideration, I can almost guarantee that you will see a large difference here in increase in your savings or in your efficiencies. (page 47)	Staff notes that Mr. Wilcox and Mr. Conant have responded to other comments in the record to say that sizing of the system in question was subsequently studied, and it was determined that sizing was not a significant factor for the subject concern about system performance.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
David Paschall (Mitsubishi Electric)	Just to be clear then, so what you're saying is that your research team did not make the -- or did not suggest the changes. And if I'm saying that we didn't suggest the changes, then there's a third-party in here that somebody's not mentioning.	Per the response provided by Mr. Wilcox at the public workshop, the subject system was installed as part of a year that the AHRI Mini-Split Committee managed the project, and the chairman of that committee worked for Mitsubishi. Manufacturer reps determined where systems were installed and how the systems were tested.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
David Paschall (Mitsubishi Electric)	The way our systems were operating, they were approaching set point using -- and you guys had even told me during that time that the indoor fan speed couldn't show up on the chart you were trying to gage. I'm not sure who it was. Have the emails though. And then asked that we did something to make the system reach set point. That's when Bruce is talking about we suggested replacing it to the 18K at that time, and that was turned down as an option. And so these other things were done at the request of this third-party then. Since it wasn't your team and it wasn't me, there's a third-party in here. (page 54-55)	Per the response provided by Mr. Wilcox at the public workshop, the subject system was installed as part of a year that the AHRI Mini-Split Committee managed the project, and the chairman of that committee worked for Mitsubishi. Manufacturer reps determined where systems were installed and how the systems were tested.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
David Paschall (Mitsubishi Electric)	We need to be on record, in a standard operation in the field, you will not see -- you will not see a 12,000 BTU system taking care of an 18,000 BTU load. It's just not going to happen. This is not the standard of what's in the industry or what the end users will see.	Staff notes that Mr.Wilcox and Mr. Conant have responded to other comments in the record to say that sizing of the system in question was subsequently studied, and it was determined that sizing was not a significant factor for the subject concern about system performance.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Doug Maddox	What was the range of indoor fan power and watts per CFM for the VCHP systems? (page 101)	MR. CONANT: I don't have that information in my head. It is in the reports that are referenced at the beginning of the presentation. (page 101)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Douglas Tucker (Mitsubishi Electric)	Permanent building measures should be subject to minimum, mandatory values to avoid the trading off of those permanent measures for VCHP compliance credits, and reducing the compliance credit that VCHP systems are due is suppressing a technology that, for example, supports Senate Bill No. 100.	Staff notes that the topic of when to allow and limit cross-system tradeoffs as a part of the performance approach adopted pursuant to PRC Section 25402(b)(1) is not directly related to the question of how to model VCHP systems or assign appropriate efficiency credit. None the less, staff will direct the request to limit enclosure / envelope tradeoffs to appropriate staff.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227221&DocumentContentId=58061
Douglas Tucker (Mitsubishi Electric)	The CVRH data shows average energy savings of 18% and 31% in cooling and heating, respectively. The 5% compliance credit proposed for cooling and 12% compliance credit proposed for heating are significantly lower than anticipated and do not reflect the actual performance of VCHP systems.	Staff finds that a higher level of credit would greatly increase the odds of a consumer not receiving the benefit modeled for the equipment, and would allow the potential deficit between projected and actual performance to be larger; staff notes that because this credit would be used to forego efficiency features elsewhere in the building, this creates an avoidable risk of significantly increasing the total cost of ownership or tenancy. For this reason, staff does not find that a larger credit value would be appropriate.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227221&DocumentContentId=58061

Commenter	Summary of the comment	Response to the comment	Link to docket item
Douglas Tucker (Mitsubishi Electric)	AHRI certified efficiency ratings should form the basis of equipment ratings in the State of California, and if they are to be de-rated based on CVRH data, then transparency, a comprehensive discussion of the underlying science, and compromise are warranted. We look forward to collaborating with CEC on an interim compliance credit agreement that is fair to all concerned stakeholders.	Staff's findings are that AHRI ratings for variable capacity heat pumps are not a reliable predictor of VCHP system performance. CVRH research determined that VCHPs of any SEER rating have a 90% probability of providing cooling performance that is 5% better than the minimum federal efficiency of SEER 14, and that VCHPs of any HSPF rating have a 90% probability of providing heating performance that is 12% better than the minimum federal efficiency of HSPF 8.2. Staff finds that 5% credit for cooling and 12% credit for heating as compared to federal minimum efficiency is an appropriate compliance credit for VCHPs.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227221&DocumentContentId=58061
George Nesbitt	The issue of continuous fan, my understanding in the past has always been that the fan ran continuously because that's where the thermostat was. Although you can buy wall mount remote thermostats, they seem to be fairly expensive. So I think that's one reason that's generally set up that way. (page 61)	MR. CONANT: I wanted to clarify on the continuous fan assumptions, we're only talking about ducted systems. And it is true that ductless mini-splits run the fan in between compressor cycles to sample the air temperature. But what we found is that the watt draw is very low on the ductless heads, and so it's not as much of a concern as the ducted systems. So the 50 watts per ton that we're talking about only applies to ducted system.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
George Nesbitt	I think you said that a ducted mini-split would have to have 35- CFM per ton. But my understanding is those systems all have traditionally operated at a much lower CFM. (page 61)	MR. CONANT: The 350 CFM per ton only applies to ducted systems. We're proposing to essentially assume that the ductless systems have correct airflow.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
George Nesbitt	Your defining everything as low static for ducted systems but there are commercial ducted mini-splits that have higher static pressures, as well as there are now some residential, including one that looks like, rather than the flat ceiling material, there is now what looks more like a traditional furnace air handling unit with higher static pressures. And I think we also know that if you run a fan at a higher static or higher than designed, you get higher fan energy use. (page 61)	MR. CONANT: There was a question or comment about the types of ducted systems that we're talking about. I just wanted to reiterate that we are talking about the short duct type systems, the low static systems. We're aware that there are other types but in this project the short duct systems are what we studied and what we set out to create a model for. So that's what this credit is for, it's specific to ductless and short duct. (page 66)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
George Nesbitt	You only show results for SEER. You're not showing results for EER. And you know, my impression is on average they are showing better performance. And I think we know from all the studies in the past that, you know, rated performance versus in-the-world performance varies and it varies for a lot of reason. So I'm not surprised that there is some variation in the results but the results do seem positive. And I do think that we have been penalizing mini-splits unreasonably by mandating a minimum -- or a maximum efficiency rating. (page 62)	MR. WILCOX: We all know that conventional systems don't perform to their ratings either. And whether or not that's true, the experimental design here doesn't depend on the ratings. We compared a single-speed conventional minimum heat pump and compared energy use between that system and the mini-splits, simply because that eliminates the problem of whether the conventional system energy performance is related to its rating or not. We know that that is the standard design. That's the DOE minimum product and that's what the Energy Commission is obligated to base standards on. And so we simply compared equipment to equipment. (page 65-66)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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George Nesbitt	In the real world, nobody undersizes equipment. Everybody -- even if they did a heat load calculator or heat -- you know, a load calc, they're going to oversize. They're not going to believe it. They're going to put in bigger. While I do think for a research sampling, it's interesting to put in undersized equipment and see how it performed, I don't know if that necessarily compares. (page 63)	Staff notes that Mr. Conant has responded to other comments in the record to say that sizing of the system in question was subsequently studied, and results found that there was virtually no difference in cooling energy use between the two systems. There was some benefit to peak demand on really hot afternoons from the larger size but overall cooling energy use was not different, so found no evidence that installing a larger size system during the year that was just being discussed would have improved energy use. To the contrary, it would have resulted in increased heating energy use.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
George Nesbitt	Ductless with -- well, it's no surprise, ductless without distribution would have wider comfort variations. Ductless with discharge has less. It certainly has been used successfully. Bruce Manclark in the northwest, passive house projects, have certainly done it successfully. (page 63)	Staff appreciates the comment of support for the use of ductless systems.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
George Nesbitt	The last issue I want to raise is ducts in conditioned space. Here is another issue where we have treated ductless mini-splits completely unfairly and it's partly my fault. I forget exactly how we were doing it in 2008. It wasn't right. And I think with CBECC-Res there was an arbitrary decision made that ductless systems would be modeled with ducts in the attic for cooling, which is completely wrong. (page 63-64)	Staff notes that this VCHP compliance option provides ductless mini-splitsystems with credit for ducts in conditioned space.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
George Nesbitt	Right now you're proposing to require all ductless -- of course, ductless systems are in conditioned space. But to require ducted systems to be in conditioned space, I think, is also treating a ducted mini-split unfairly. And as Bruce from Mitsubishi said yesterday, buried ducts in the attic can perform quite well. (page 64)	Staff considered and determined that air leakage from indoor air-handling units and ducts located in attic spaces would likely be too great of an impact to the delivered efficiency of ducted VCHP systems, so partial credit for ducts in the attic have not been proposed. However VCHP system components are proposed to be allowed to be located in indirectly conditioned space when it can be verified that the system is located inside the air barrier, and inside the thermal boundary of the dwelling unit.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
George Nesbitt	I think we're undervaluing mini-splits. And I think it's unfair if we don't have an absolute reason, proof, research to show that we should unfairly treat. Because we know all other heating and cooling systems, heat pumps, gas furnaces, air conditioners don't always perform according to their ratings. (page 64)	MR. SHIRAKH: And I disagree with George when he says that we have to have absolute proof to deny a big credit. I think it's the other way around. Because, you know, if you grant the credit for ducts in conditioned space, I mean, you can strip the house down to, you know, bare minimum on building envelop features. So I think that the proof is actually on the other side. (page 69) MR WILCOX: I think that it's clear, based on this research, that there's -- mini-splits have a big future in California. And I think we want to make sure that they're available as a measure to help meet our goals. And so I think that's why we're moving forward with this kind of simplistic (indiscernible) in trying to do something that's conservative. And you know, we're 90 percent sure that it's going to deliver the results, and that's the basis of what we're doing here. And there's been a tradition of doing that over the years. When we start out with new technologies, we give them a place in the standards and treat them conservatively. And then as we get more experience and so forth, things evolve. And that's what we intend to start the process here. That's the whole point. (page 70)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
George Nesbitt	(heat recovery ventilators story) I think we have to remember that the code is often manipulatable. And there are a lot of people out there who deliberately and wrongly manipulate the code for their purposes. And as a HERS Rater energy consultant, I've seen lots of it. I am concerned about manufacturers making claims that are not true. And I do think we have to view things with some level of skepticism. (page 82-83)	Staff finds that the proposed flat credit for these systems is likely to be less manipulatable than other modeling or credit options, consistent with the commenter's request.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
George Nesbitt	I think we have to be really careful when we create, and I'm going to say in the case of mini-split heat pumps, a very arbitrary bias against a specific technology that we are going to create two problems. One is energy consultants who are going to manipulate the code to do what the hell they want anyway. And the other problem is we may slow the adoption of the technology, as well as we may get people installing less efficient equipment because they don't get any credit, so why bother? (page 84)	Staff does not find that the current proposal creates a bias against a specific technology. Although the credit does not scale with SEER ratings, it still represents an increase in the credit obtained by installing the equipment relative to the current software. To the extent that future data or metrics can be used to create a more robust modeling of VCHP systems, staff is committed to iteratively improving the modeling software based on future advancements and findings.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
George Nesbitt	I think that if we want a highly efficient building enclosure, we have to eliminate the ability to trade off non-enclosure measures, HVAC, ventilation, and water heating for enclosure measures. The way to do it is not to derate a whole technology so that they don't trade it off for the enclosure because we let split systems and other systems tradeoff for less efficient enclosures. (page 84)	Staff notes that the topic of when to allow and limit cross-system tradeoffs as a part of the performance approach adopted pursuant to PRC Section 25402(b)(1) is not directly related to the question of how to model VCHP systems and assign appropriate efficiency credit. None the less, staff will direct the request to limit enclosure / envelope tradeoffs to appropriate staff.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
George Nesbitt	Every input in the software that makes a difference in the calculation has to be reflected and reflected properly on the compliance forms. Because otherwise, there's no way it will ever be enforced. My experience is pretty much no one ever revises the compliance forms to reflect as built in the field. Utility programs do, but I doubt they ever get submitted back to building departments. So it's extremely important. (page 162)	Staff appreciates the comment of support for the importance of accurate data inputs and of revising modeling assumptions when as-built conditions change.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
George Nesbitt	So ideally, you would input all the rated efficiencies for given pieces of equipment, even though in the calculation you are not using those rated efficiencies, just as we are with regular split-systems and whatnot. You know, yeah, we do rate them behind the back based on refrigerant charge, airflow assumptions, whether you're HERS verified or not. And those rated numbers should come out on the forms, even though they weren't used in the calculation, because otherwise it will create greater confusion. Now one of the ways energy consultants can manipulate the code is by inputting whatever numbers they want for equipment, and anything else for that matter, into the software. And you know, most of the time they're going to get away with it. If they have a good HERS Rater and a utility program, they might not get away with it. So what I proposed and actually what you mentioned was for water heaters, I guess it's maybe – it's just heat pump water heaters -- having the database where all that information is put in and it should not be editable. And in that sense the model number, the make and the model number should show up on the compliance form and all those rated efficiencies and it should not be editable, and it's then verifiable. And really, in theory, since all the equipment is supposed to be certified for use in California, we should really only be using, quote unquote, certified databases and information and certified ratings, and that would eliminate a lot of cheating. (page 163-164)	MR. WILCOX: George, I believe that's the case with the heat pump water heaters right now. So you could look at the CBECC-Res interface and let us know if you see any problems with that, but that's exactly what that system is set up to do. (page 164)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
George Nesbitt	So I mean, it should be true of gas furnaces, split ACs, PTACs, you name it, whatever, any piece of equipment, harder to do with insulation and whatnot.	Staff notes that the topic of automatically pulling data from remote databases into the software is unrelated to the question of modeling VCHP systems; staff none the less will direct this feedback/request to appropriate internal staff.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
George Nesbitt	The 350 CFM per ton airflow. So I looked up a piece of Mitsubishi equipment, the I would find, for the ducted low static pressure units. And for a one-ton cooling the airflows are 247, 317 and 388. Yes, 388 makes the 350 CFM per ton, but that is not, I think, how the manufacturer assumes and sets up that equipment. And the reps will tell you that if you're cranking things on higher speed with the fan unit you could burn the -- you know, so if you force it to high speed all the time on a low static pressure duct -- on what should be a low static pressure duct system, you're going to burn out the fan. So I just don't think that most of these ducted mini-splits are truly designed. There are higher static units out there and those -- but there again, I'm not sure if they actually assume 350 CFM per ton. And as the new rules on the small duct high velocity allow a lower CFM per ton because those units are not designed to the standard 400 CFM per ton plus or minus 50 that a traditional system is. (page 165)	Staff finds that systems need to be designed to deliver 350 cfm/ton and operate within the manufacturer specifications. If the fans burn out while operating within the manufacturer specifications, then it's a design flaw on the part of the manufacturer. System design requirements should not be based on speculation about manufacturer design flaws. Staff is not recommending that people install VCHPs into undersized and overly restrictive duct systems and then try to compensate by pushing the air handler beyond its capabilities. Staff is recommending to design the system, including ductwork, properly so the system can function properly.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
John J. Gibbons (Carrier)	Carrier appreciates the CEC's field study efforts regarding the performance of variable capacity heat pump (VCHP) systems. We have reviewed the staff report on the Variable Capacity Heat Pump Performance Compliance Option and respectfully submit the following comments. Carrier supports the credit approach for cooling at 5%, as well as the heating approach at 12%. In addition, we agree that the additional energy use for ducted systems due to continuous fan operation should be included in the software calculation.	Staff appreciates the comment of support.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230486&DocumentContentId=62055

Commenter	Summary of the comment	Response to the comment	Link to docket item
John J. Gibbons (Carrier)	We are concerned that the availability of the VSHP Performance Compliance Option is limited to “low-static” classifications of ducted indoor mini- and multi-split units. As written, the VSHP Performance Credit scope only extends to systems with a maximum design static of 035” w.c. This limitation, when combined with the requirement to use MERV 13 filters which add 0.12” w.c. of external static pressure, will result in very few systems qualifying for the proposed credit. Therefore, we propose that the scope of the VSHP Performance Credit be expanded to include mid-static systems which, under the 2017 DOE definition, extend up to .65” w.c. external static pressure. These units are able to accommodate the required MERV 13 filter static pressure and serve multiple rooms.	Staff finds that the compliance option is necessarily limited by its underlying research; staff notes that the research conducted was aligned to the equipment that was most common or popular at the time the study was drafted, with input from stakeholders. Staff does not find that establishing additional provisions in the absence of research data would be appropriate, though staff is also open to working with stakeholders to develop additional provisions as additional data becomes available.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230486&DocumentContentId=62056
John J. Gibbons (Carrier)	Carrier does not agree that this requirement [for a wall-mounted thermostat] will contribute to energy efficiency. Most VCHP systems, by default, use the return air sensor to control room temperature. As such, permanently mounting a thermostat is not likely to result in improved efficiency.	Staff finds that wall-mounted thermostat costs are ordinary for other types of zonal HVAC equipment and systems; the requirement is a baseline requirement for all HVAC equipment and not a measure specific to VCHP systems or intended to elevate efficiency above the baseline performance level of the associated equipment. Staff additionally finds that having the wall-mounted thermostat placed correctly in the zone is the most consistent and reliable control source for optimized system performance, and meets the expectations of homeowners. Staff acknowledges that allowing VCHP systems to avoid thermostat requirements would allow them to avoid associated costs; as the purpose of this proceeding is not to create exceptions for VCHP systems that allow for avoided monetary costs at the potential expense of the homeowner's experience, staff does not find that creating an exception to thermostat requirements for VCHP systems would be appropriate.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230486&DocumentContentId=62057
Khaled Saleh (Goodman Manufacturing)	I agree with the last points mentioned here, that 29 SEER is not consuming 50 percent more energy compared to 14 SEER. That’s really true. However, I believe for sure the higher SEER consumes less energy, given that the control is very -- a problem. And I will refer to two studies, one conducted by Avery (phonetic). And in this study (indiscernible) like -- and co-funded by CEC, as well. Tthe final conclusion from these well-established studies mentioned that variable speed systems can save between 22 percent to 32 percent, based on their locations and other factors. (page 85-86)	Staff's findings show that while high-SEER variable speed systems are capable of efficient performance, the correlation between specific performance and SEER rating is too weak to use as a basis for building energy modeling.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
Khaled Saleh (Goodman Manufacturing)	For the Oakridge, they conducted a similar study and that conclusion was exactly the same. Variable speed systems saving approximately 25 to 35 percent with converting that versus 14 SEER systems. We selected the same tonnage. And for me, that was already with controlled research (indiscernible) that were funded by you, another one by Oakridge National Lab. And they (indiscernible). So this is my (indiscernible) the importance of selecting the same because you will see the advantage of (indiscernible) run the system (indiscernible). With (indiscernible) you're going to have the compressor, more consumption. You're going to have (indiscernible) indoor and outdoor fan (indiscernible) consumptions which will show the benefits of using converter systems. So using the same (indiscernible) will be really important. Otherwise, if you're going to select lower (indiscernible) a variable speed system will run for (indiscernible) most of the time (indiscernible) out of that. This is an inappropriate test point of view, how the (indiscernible) should be run. And again Avery and Oakridge National Lab, they have very good published studies (indiscernible). So hopefully that will be considered before taking any final decision. (page 86-87)	Staff's findings show that while some systems are able to achieve significant savings (consistent with the Oakridge results), the amount of savings cannot be reliably predicted by the unit's SEER rating. Because this correlation is absent, staff does not feel confident in providing increased credit based on higher SEER ratings as this makes it likely that anticipated energy bill savings will not be realized by consumers.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Khaled Saleh (Goodman Manufacturing)	I don't know if you are preparing (indiscernible) which is not quite aligned just yet. So how are you going to (indiscernible) on evaluating the system performance on assumptions that was not really finalized and published? And maybe the manufacturers might have their own concerns, and other folks, as well. So this is something that should be considered and for consideration. In my opinion, (indiscernible) the testing. I might share some of the concerns with, you know, other representatives of manufacturing companies regarding, you know, the variation in the testing wattages (phonetic). We (indiscernible). And if you have ten systems, you are trying to come up with a conclusion with all of these variations and (indiscernible), I think it would be extremely difficult. And I hope that other studies conducted by Avery and Oakridge National Lab would be considered before making the final decision. (page 87-88)	MR. CONANT: So I just wanted to clarify one thing. As you mentioned, ASHRAE 205, I realized that I neglected to explain what that is. It's a standardized method for representing performance information. So it's not a test procedure or anything like that. It's just a standard that says when you specify what your performance is, you do it in this format so that everybody's using the same format and it becomes usable in, for example, modeling programs, like we're talking about here. So if ASHRAE 205 is not available, then we can specify our own form. It would be better if ASHRAE 205 was available in time to use, so that we don't need to consider changing the format later to match ASHRAE. So it's not crucial, it just would be a convenience. (page 88-89)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
Laura Petrillo-Groh (AHRI)	We support the proposal to implement an ACM option for ductless heat pumps and the provision of cooling, heating and no-duct loss credits for such systems.	Staff appreciates the comment of support.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227220&DocumentContentId=58063
Laura Petrillo-Groh (AHRI)	We believe that that suggested credit approach for cooling (5%) and heating (12%) is much lower than expected. We would appreciate the opportunity to continue working with CEC and its consultants prior to the next public workshop to implement a credit approach that is more representative of performance of these ductless systems. In the meantime, we are willing to support the credits proposed by CEC during the public workshop held on February 15, 2019.	Staff appreciates the comment of support, and is willing to continue working with stakeholders on this topic as a part of its triennial updates to the Energy Code.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227220&DocumentContentId=58063
Laura Petrillo-Groh (AHRI)	Earlier letter is included in the comments as Exhibit 1; The exhibit is provided as background information, and includes sugestions for implementation of a compliance option.	Staff acknowledges that AHRI requested a compliance option in 2014. Staff is proposing this VCHP compliance option to provide for practical measures that will allow for verification of proper installation, and provides efficiency credits that reflect actual performance compared to conventional split system heat pumps monitored at the Central Valley Research Homes over the course of 4 years.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227220&DocumentContentId=58063
Lucas Morton	The presentation includes a specific requirement that I will argue is redundant with current code requirements. On slide 27 (referencing slide 14) "Each habitable room must be directly served by ducted air handler or ductless head. “Transfer fans do not meet this requirement" The installed conditions referenced in slide 14 clearly do not meet current code requirements in CRC 303.9 (and CBC 1204.1), and therefore are not a reasonable basis for additional policy for the purposes of this credit.	Staff notes 2016 R303.9 requires every dwelling unit to be provided with heating facilities capable of maintaining a room temperature of not less than 68°F (20°C) at a point 3 feet (914 mm) above the floor and 2 feet (610 mm) from exterior walls in habitable rooms at the outdoor heating design temperature. Staff finds that R303.9 does not require conditioned air to be directly supplied to each room in order to comply. Staff notes that the CVRH research found that VCHP systems that do not provide conditioned air directly to each room failed to provide the necessary comfort in rooms that did not directly receive conditioned air, thus require that each habitable room be directly served by a ducted air handler of ductless indoor unit.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227287&DocumentContentId=58139
Marshall Hunt (PG&E Consultant)	The way that Canadian Standards Association works is the EXP is an express standard, so they can get it out there, get people to use it. And right now it’s my understanding that the holdup is they have editors making sure that the way it reads matches the template, matches the requirements of a standard from CSA. The bottom line, it’s not here, it may not be here for a year. (page 158-159)	Staff appreciates the timing question raised by the CSA code adoption process, and is committed to following up on this topic when that standard is finalized.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Marshall Hunt (PG&E)	Is it clear that we’re really talking about just one year of data? (page 56)	MR. CONANT: Much of the discussion has been about one particular year, 2015. But our analysis is four years of data.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Marshall Hunt (PG&E)	But if we just took out the 15, would it impact your conclusions? (page 56)	MR. MILLER: So the (indiscernible) experiment is not included in this analysis; right? MR. CONANT: Correct.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Marshall Hunt (PG&E)	MR. HUNT: So it seems to me that we could, at least during the swamp, if you will, and take that out and we'd still be in the same place. (page 56-57)	Staff notes that Mr.Wilcox and Mr. Conant have responded to other comments in the record to say that sizing of the system in question was subsequently studied, and it was determined that sizing was not a significant factor for the subject concern about system performance. Therefore staff finds that it is not necessary to revise the data analysis for this proposed VCHP credit.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Matt Christie (TRC)	I think one piece of agreement we have across the Board is that the AHRI tests for VCHP systems are not properly indicative of performance and we need a better testing regiment. So I'm encouraged to see on the final slides the explicit sort of check on the CSA test and all the conversations that have happened about that CSA test that Bruce has mentioned, both Bruce's have mentioned. And just from my part, we've been, TRC has, through work with NEEA and SMUD and others, been exploring that test and think, though it is not final and not fully vetted and needs to be verified and there's a lot of things that have to get crossed off, it's promising and in the right direction. And I would -- I'd love to see that continue to fall out as, at least, a particularly voluntary option coming in the future. (page 89-90)	Staff appreciates the comment of support. To the extent that ongoing efforts provide data that could be used for future compliance options and credits, staff remain committed to enhancing the modeling software's accuracy and versatility.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Matt Christie (TRC)	Regards the fan testing and the fan -- the watt draw and the cool-and-cool (phonetic) airflow, one thing I've -- in talking with HERS Raters and manufacturers, because VCHP systems have variable operating fans that will change their own operating principles based on ambient conditions and load, they can ramp up very high for certain conditions, then ramp down very low. Testing those and getting the appropriate fan speed for a testing protocol can be difficult. And so I wanted to see if there -- if there is work to help clarify the HERS verification protocol for how to lock in the specific fan speed or test at multiple fan conditions in order to confirm the airflow test and the fan watt draw test. (page 90-91)	MR. MILLER: -- we haven't clarified those points yet. We've just discussed them at a very high level. And my understanding is that we believe that it is going to be possible for the systems to have some type of test assumption available so that the indoor unit would be operated at full speed. And, Abram or Bruce, would you tell me if you have a different understanding of that? MR. CONANT: Only a slightly different understanding. There could be a test mode provided by the manufacturer. Or if the system can be forced to full speed by lowering the cooling set point, that might another possibility. (page 93-94)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Matt Christie (TRC)	I think my follow-up may be that (indiscernible) may not be the appropriate testing condition, as that condition is rarely actually used and may not be used in operation with high frequency. And so it may be that a test condition that is sort of a typical speed that's not sort of taking advantage of the higher speed potential of that fan might be a more valuable piece of information to test against. And it may mean different criteria and different expectations. But in terms of doing something to verify performance, it might be a more appropriate way of designing that test. And I just encourage at least exploration of that potential as you work towards a final HERS protocol. (page 94)	MR. WILCOX: I mean, we haven't focused on how to do this verification because we already do the same verification for split-system variable speed machines. And so this isn't like -- it's not like this is different. In a ducted mini-split and a split-system variable speed machine, I think, are similar situations, so we haven't focused on this. But if there are issues with how these things should be tested, then that's something that certainly could be worked out as we go forward. MR. MILLER: I'd just add that our premise is that 350 CFM per ton is desirable for full efficiency and that's really just -- that's all there is to it. (page 95)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Matt Christie (TRC)	We've kind of already talked about it, though, but I want to make sure that I'm understanding this right. It seems that you are only proposing to give credit to these systems if they are installed in conditioned space. And then in that case the conditioned space credit will be part of the, you know, of the system, of the credits being given. I guess my question is: Is that understanding correct? (page 91-92)	MR. MILLER: The leakage ducts in conditioned space verification protocol requires that you do two things. One is that you can visually look to see that the ducts are inside conditioned space. And the other is that you'll do a leakage-to-outside protocol and determine that there's less than 25 CFM leaking to outside. This is specifically what's been proposed as the criteria for qualification for the credit. Could you further elaborate on what you would prefer to do, other than that? (page 96)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Matt Christie (TRC)	I'm thinking that bar is too common and nearly equivalently high efficient, not quite as good as fully conditioned space. But the sealed attic concept, that -- a lot of residential new construction builders are using actively in the field right now. And then deeply buried ducts, which isn't used quite as frequently, but lots of building science can point to it being similarly valuable, once again, not quite as high. But it might be valuable to not disallow those two duct conditions as a prerequisite to get credit for this particular credit for variable capacity pumps. (page 96)	MR. MILLER: Okay. I understand. And we can consider that. MR. WILCOX: Well, the question really is whether there should be a criteria that says you have to have ducts in conditioned space or not? And the Commission decided they wanted to make that a criteria and that, you know, is obviously open to comment. The Commission is also looking into how to treat sealed attics in a clearer and cleaner way than what we do now, and that's something that's going to be worked on in the coming months. So I think we can consider those comments and thank you. (page 97)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Matt Christie (TRC)	What about some secondary conditions, like ducts in a sealed attic, which is not technically conditioned but sometimes as such, or ducts that are deeply buried ducts, as George brought up, or even possibly in a high-performance attic environment? And could those be possible or will there be any carveouts for some partial credit or some varied credit for systems that have those duct locations for duct and VCHPs? (page 92)	Staff considered and determined that air leakage from indoor air-handling units and ducts located in attic spaces would likely be too great of an impact to the delivered efficiency of ducted VCHP systems, so partial credit for ducts in the attic have not been proposed. However VCHP system components are proposed to be allowed to be located in indirectly conditioned space when it can be verified that the system is located inside the air barrier, and inside the thermal boundary of the dwelling unit.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

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Matt Christie (TRC)	With that auto fan and the continuous operating fan ban, as it were, I have heard that ducted system also will intermittently turn on to sample the room air, as ductless systems do, and will that be permitted, and how will that be tested for? (page 92)	UNDENTIFIED MALE 2: You had a question about the auto fan issue; is that true? MR. CHRISTIE: Correct, just clarifying questions again. And most likely the answer will be these are the details to be worked out over the coming months, and that's a totally appropriate answer. UNDENTIFIED MALE 2: Yeah. The idea there is just that the manufacturer would -- what would be required is that the -- when the system was shipped and turned on without making any changes to the setup, that it would come on in an auto fan mode where -- the fan cycle with a compressor. And would it be required from the manufacturer just to certify that that was the case for this particular model? MR. CHRISTIE: Okay. So similar to like the EER test, where you're just checking the spec from the manufacturer, is what is expected? MR. WILCOX: I think that's right. MR. CHRISTIE: Okay. MR. MILLER: Well, this is -- I think this is a little different in that -- so my understanding of this is that it's common for systems of this type, when they are reset they operate in a default configuration that will cause the fans to operate continuously in between calls for conditioning. And what we're trying to accomplish here is that that would not happen in order to receive the credit for fan energy that's -- MR. CHRISTIE: Yeah. MR.MILLER: -- one aspect of this credit. And so it would be something that the manufacturers could be very specific about in the way they configure their controls and they could -- what we are	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Matt Christie (TRC)	As kind of a follow-up is could you clarify how the HERS verification protocol will actually confirm that the systems that are being installed have in-continuous operation, that they only operate to -- in response to a compressor call with maybe, you know, a ten-minute overflow after it to clear the ducts, or possible the intermittent sampling procedures that just mentioned? (page 92-93)	SC3.4.6 Verification of Non-Continuous Indoor Unit Fan Operation is the proposed protocol. See Staff Report - Variable Capacity Heat Pump Performance Compliance Option	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
Mazi Shirakh (California Energy Commission)	On the question of sizing, I just wanted clarification. We heard manufacturers say the system that you tested was undersized, it was 12,000 BTUs. But I also heard you guys saying that you did actually test an 1,800 [sic] BTU. So the two claims, there's a little contradiction in there. Can somebody claim whether it was just 12,000 or 18,000 or both? (page 66)	MR. WILCOX: Well, I mean, part of the context here is that this is a project that's gone on for four years. We've tested four different distinct system setups. And without sitting down and looking at the details of what system, what year, what size and really getting into the details, I think it's impossible to understand the -- whether there's an issue or not. And you know, the sizing is potentially an issue. We -- you know, it could affect things but it doesn't -- I don't think you can make a case that the sizing that was used in the systems that we installed here affects the answer for the treatment of the credit.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Mazi Shirakh (California Energy Commission)	But that's what they're claiming (that sizing of the systems affects the answer for the treatment of the credit).	MR. WILCOX: Well, they didn't actually say that. What they said is they didn't like the way we sized the systems. And my main response is, well, so do you think it affected the answer? And I don't think it actually did. And so as Marshall said, if we pull that system out or take that whole years' worth of experiments out, I don't think it will change the analysis that we presented. And so I understand that Mitsubishi doesn't like that particular system, that we could argue the history of that up one side and down the other. I don't think that actually is relevant to whether the Energy Commission should adopt a credit for VCHP systems that can be used in the standards. And I guess to summarize the Mitsubishi position, I would say that they're -- my understanding of what they're saying is that they don't like that credit, they want a bigger credit, and so -- or maybe, I guess, or maybe they want no credit. It wasn't clear. (page 67)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
Mazi Shirakh (California Energy Commission)	You're arguing credit for a ducted conditioned space, which is a big credit. But I think their objection is to the five percent credit on the cooling side and -- (page 68)	MR. WILCOX: Yeah. Well, I'm going to show some results in a while here that show that, in terms of comparison to where we are now to where this credit would be, that the ducts in conditioned space is a major credit. And the efficiency is a smaller credit for these systems. And you know, there's no -- and George has said that we were going to require all these systems to have ducts in conditioned space and we're not requiring them to do that. We're giving them a credit when they do it and that's a different thing in the building standards. Right now there's no limitation on installing VCHP systems in new houses, you just don't get a credit for that SEER 33, that's all. You can put in any DOE-minimum system you want and that's fine. And so it's kind of a -- anyway, so the issue really here, it seems to me, is negotiating how big the credit is. (page 68-69)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Michael Adams (GLUMAC)	Baseline HVAC System Map: The baseline heating energy source is not typical of actual designs in the state. This unfairly penalizes electric heating sources due to the differences in time-dependent value (TDV) factors for electricity and natural gas. This does not align with the electrification goals of the state of California.	Staff notes that this comment was submitted to this docket in error, and is not relevant to the VCHP compliance option. Staff has directed the comment to appropriate internal staff.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227184&DocumentContentId=58022
Michael Adams (GLUMAC)	Baseline Domestic Hot Water (DHW) System: The baseline DHW heating energy source prevents the usage of projects to utilize electricity as their proposed DHW heating energy source. The TDV factors associated with electricity and natural gas penalizes electric heating sources. This is exaggerated for residential, hotel and dormitory style projects. This does not align with the electrification goals of the state of California.	Staff notes that this comment was submitted to this docket in error, and is not relevant to the VCHP compliance option. Staff has directed the comment to appropriate internal staff.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227184&DocumentContentId=58022
Michael Adams (GLUMAC)	VRF Modeling - Pipe Length Impacts to Simulation Results: How is efficiency degraded in relationship to vertical and total pipe length?	Staff notes that this comment was submitted to this docket in error, and is not relevant to the VCHP compliance option. Staff has directed the comment to appropriate internal staff.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227184&DocumentContentId=58022
Michael Adams (GLUMAC)	VRF Modeling - Pipe Length Impacts to Simulation Results: How were these efficiency calculations/curves determined?	Staff notes that this comment was submitted to this docket in error, and is not relevant to the VCHP compliance option. Staff has directed the comment to appropriate internal staff.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227184&DocumentContentId=58022
Michael Adams (GLUMAC)	VRF Modeling - Pipe Length Impacts to Simulation Results: Were FSEC piping correction factors utilized in relationship to total pipe length?	Staff notes that this comment was submitted to this docket in error, and is not relevant to the VCHP compliance option. Staff has directed the comment to appropriate internal staff.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227184&DocumentContentId=58022

Commenter	Summary of the comment	Response to the comment	Link to docket item
Michael Adams (GLUMAC)	VRF Modeling - Pipe Length Impacts to Simulation Results: How is capacity degraded in relationship to vertical pipe length?	Staff notes that this comment was submitted to this docket in error, and is not relevant to the VCHP compliance option. Staff has directed the comment to appropriate internal staff.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227184&DocumentContentId=58022
Michael Adams (GLUMAC)	VRF Modeling - Indoor Fan Power Inputs: Glumac agrees that indoor fan power will vary upon fan coil selection, duct layout (if applicable), and fan motor type, we also note that certain manufacturer-provided indoor fan coil powers are unrealistically low in provided modeling guidance documentation when compared to actual installations. Indoor fan coil powers are determined using ASHRAE 1230 test procedures, which allows the associated external static pressure (ESP) of the system to be considerably lower than expected in actual building designs.	Staff notes that this comment was submitted to this docket in error, and is not relevant to the VCHP compliance option. Staff has directed the comment to appropriate internal staff.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227184&DocumentContentId=58022
Michael Adams (GLUMAC)	Zone System Modeling: With the update to the EnergyPlus 9.0.1 engine, Glumac requests capability to be updated to allow zone systems to operate with different fan speed options. With this capability, the ability to model a zone system to stay at minimum speed constantly to provide ventilation air to the space (given ventilation air is provided by this conditioning system) and allowed to ramp up to higher fan speeds dependent on space load.	Staff notes that this comment was submitted to this docket in error, and is not relevant to the VCHP compliance option. Staff has directed the comment to appropriate internal staff.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227184&DocumentContentId=58022
Michael Adams (GLUMAC)	Noncompliance Simulation Modeling: Whether the CEC has intended or not, the CBECC-Com compliance software is used by various entities throughout the state to demonstrate project energy goals beyond solely meeting Title 24 Compliance (performance approach). Allowing building operating schedule can significantly impact the results of these various required thresholds.	Staff notes that this comment was submitted to this docket in error, and is not relevant to the VCHP compliance option. Staff has directed the comment to appropriate internal staff.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227184&DocumentContentId=58022
Mik Skuarla (United Technologies Carrier Corporation)	Today was kind of the first opportunity we've had to see some of this data. We're kind of hoping, moving forward, this can be a iterative process where we can provide input and feedback. But for that to happen, we're going to need kind of the full set of results. (page 118)	Staff notes the research papers for all four research years used to develop the proposed VCHP performance compliance credit are available for public viewing. See the references section of the docketed Staff Report for the Variable Capacity Heat Pump Performance Compliance Option for URL references to the reports.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
Mik Skuarla (United Technologies Carrier Corporation)	Do you guys have kind of a timeline on when we're going to be able to see the reports and the studies, the kind of decisions made, or at least the testing processes and, you know, the data from those testing processes from whatever the time window is, I think ou guys mentioned 2014 to whatever the four years was, so that we can kind of look at that and we can be on equal footing with the folks in this room from the CEC and from your contractors in order to provide the feedback in where we think, you know, perhaps if you had looked at this or if you looked at that? Do you guys kind of have that window of time when we're going to be able to do that? Is it going to be in the next two weeks so that we can include that, you know response in the data? (page 119)	MR. WILCOX: I'd say that -- so these projects have been recently largely funded by the California Investor-Owned Utilities. And they have a program, Emerging Technology Assessment Program that is a joint project of all the utilities. And we have a couple experts in the room back -- Bach Tsan from Edison is sitting back there. I think that -- so we do the work for that group. We write a report. It goes to all the utility guys. They all get to review it. And then we go back, we revise it, and then it goes back to them again. And there's an iterative process for publication. I think there's probably no chance the 2018 stuff will be done in two weeks, unless we do something to an ordinary schedule. I mean, I guess the other chance -- the other thing would be whether or now we could -- you could get the data outside of the publication you know, the standard publication stuff. And we'd have to talk to the utilities about that, I guess. (page 120-121). Staff notes that the report for the 2014-2015 reseach year has been published. https://ww2.energy.ca.gov/2018publications/CEC-500-2018-033/CEC-500-2018-033-AP-B.pdf Staff notes the report for 2017-2018 research year has been published. https://www.etcc-ca.com/reports/central-valley-research-homes-evaluation-sizing-and-controls-settings-2017-2018	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Mik Skuarla (United Technologies Carrier Corporation)	I just feel at this point and to date, we've been at least a half step if not several steps behind because we don't have the whole picture. We're being asked to respond but we don't have, you know, the same science that you guys have. (page 119)	Staff notes the research papers for all four researh years used to develop the proposed VCHP performance compliance credit are available for public viewing. See the references section of the docketed Staff Report for the Variable Capacity Heat Pump Performance Compliance Option for URL refrences to the reports.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Mik Skuarla (United Technologies Carrier Corporation)	I understand that there's probably an issue around some of that data. But you know, for Carrier to be a partner in this process moving forward we, obvious, we need to have the whole picture. And you guys having an iterative process between, you know, the CEC and the IOUs and keeping us out isn't going to allow us to be a full participant. And to that end, to the extent that we can -- you know, you guys can allow that and we can be a part of this process, I think we share a similar goal in terms of making sure you guys get this stuff right, making sure that the ratings are appropriate (page 121)	Staff notes that two additional CVRH research reports have been published and are available for public viewing - see the VCHP compliance option staff report for references and URL links to all four CVRH research reports. The CVRH research logged the operational characteristics of VCHPs and provide analysis of the logged performance.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
Mik Skuarla (United Technologies Carrier Corporation)	I think we all have the same, you know, goals, right, is to provide very efficient products to the marketplace and things along those lines. (page 119)	Staff appreciates the comment of support for a collaborative, public process.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Mik Skuarla (United Technologies Carrier Corporation)	I think, you know, there's kind of three things that need to happen going forward. We need a short-term, kind of pretty immediate solution to allowing these ductless units to be modeled and put in, you know, installed at something above 14. Which is once we have access to the data, going back and forth on that and improving whatever, you know, test methodology you guys are going to require as an alternative, you know, entrance so that we can get modeled above that SEER 14. (page 121-122)	MR. WILCOX: The first two reports are already published and available. And so you can jump into those. And beyond that, as I said, we'll -- we can negotiate with the utility guys about what the schedule is and let -- maybe let you know, if you're interested. (page 122-123) MR. FROESS: And I can also add a quick comment is we're just asking for public comments, asking for stuff in a two-week period. It doesn't mean you have to review everything and have responses. So that starts the ball rolling. (page 123)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Mik Skuarla (United Technologies Carrier Corporation)	Then we need the long-term. You know, somewhere between now and 2022 and the adoption of those codes, we need to find out a more, you know, solid methodology that's going to allow us to move forward with these technologies in a way that we can get full deployment into the marketplace and not be disadvantaged. (page 122)	Staff finds that the regular triennial rulemaking proceedings to update Title 24 Part 6 provide an opportunity to examine future information and consider future changes, consistent with the commenter's request.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Mik Skuarla (United Technologies Carrier Corporation)	In terms of we'd rather have this be something where, like it said, it's an iterative process not, like not an announce and defend once you guys come to your conclusions. Like we'd like to help formulate those conclusions and formulate the answers and solutions in code. (page 123)	Staff is committed to iterative improvements to building energy efficiency standards and requirements, as shown in the triennial update cycle for Title 24, Part 6.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Nathan Walker (Daiken North America)	DNA is supportive of the VCHP proposed rating method, including the 5% for cooling and 7% for heating energy credits as well as the no-duct-loss credit to be provided to ductless and short-duct products, to be incorporated into CBECC-Res.	Staff appreciates the comment of support.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227322&DocumentContentId=58418
Nathan Walker (Daiken North America)	DNA intends to continue working with CEC to further refine the rating and credit structure for CBECC-Res to incorporate in the future. This will include a preference to use an 80 percentile rather than a 90-percentile value for determining the credits.	Staff appreciates the comment of support for continued work and iterative refinement of VCHP modeling. Staff notes that moving to a lower percentile means both that more people are likely to experience a cost, and also that the size of the potential cost is greater. Staff finds that a 90% threshold is appropriate in the absence of the ability to accurately rate and predict system performance as it ensures that negative impacts are both rare and small.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227322&DocumentContentId=58418

Commenter	Summary of the comment	Response to the comment	Link to docket item
Nathan Walker (Daiken North America)	DNA recognizes that manufacturers were sufficiently involved in conducting the Central Valley Research Homes (CVRH) field tests except for the first year, which led VCHP to be evaluated as minimum efficiency.	Staff appreciates the comment of support for the level of manufacturer involvement.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227322&DocumentContentId=58418
Nathan Walker (Daiken North America)	DNA also recognizes that our inputs to the CVRH team were incorporated into the tests.	Staff appreciates the comment of support for the level of manufacturer involvement.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227322&DocumentContentId=58418
Nathan Walker (Daiken North America)	DNA sees a correlation between the VCHP's AHRI rated SEER values and measured energy performance, especially if the measured energy performance values of 14.6 and 19.0 SEER units are excluded. We hope to continue discussion on this matter with the CEC team to reflect the AHRI rating values in the CBECC-Res compliance calculation in the future.	Staff's findings indicate that the correlation between SEER and in-situ performance is too weak to base modeling predictions on; to the extent that test alternatives currently under development seem likely to result in efficiency ratings that are better indicators of in-situ performance, staff looks forward to working with DNA and other stakeholders on examining whether and how revised ratings may be utilized by the software in the future.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227322&DocumentContentId=58418
Nathan Walker (Daiken North America)	DNA believes that the above stated flat cooling and heating energy credit approach is acceptable for this first round of the VCHP rating method in CBECC-Res.	Staff appreciates the comment of support for the current "first step" credit for VCHP systems.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227322&DocumentContentId=58418
Nathan Walker (Daiken North America)	DNA believes that the wall-mount thermostat requirement for spaces over 150 sq. ft. will not improve VCHP's energy performance or end user comfort. However, it will negatively impact the VCHP business by increasing the installation costs. We believe so because if end users feel hot or cold, they will adjust a set point regardless of what the measured room temperature is.	Staff finds that wall-mounted thermostat costs are ordinary for other types of zonal HVAC equipment and systems; there is no relative cost burden in expecting that VCHP systems meet identical requirements. Staff additionally finds that having the wall-mounted thermostat placed correctly in the zone is the most consistent and reliable control source for optimized system performance, and meets the expectations of homeowners. Staff acknowledges that allowing VCHP systems to avoid thermostat requirements would allow them to avoid associated costs; as the purpose of this proceeding is not to create exceptions for VCHP systems that allow for avoided monetary costs at the potential expense of the homeowner's experience, staff does not find that creating an exception to thermostat requirements for VCHP systems would be appropriate.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227322&DocumentContentId=58418

Commenter	Summary of the comment	Response to the comment	Link to docket item
Nathan Walker (Daiken North America)	DNA believes that the wall-mount thermostat requirement for spaces over 150 sq. ft. will not improve VCHP's energy performance or end user comfort. However, it will negatively impact the VCHP business by increasing the installation costs. We believe so because even if remote control's temperature measurement is less accurate than wallmount thermostat's measurement that should not make end users adjust a set point more frequently.	Staff's concern lies with preventing cases where the location of the thermostat impedes performance of its function - although occupants are free to adjust a thermostat when they would like a hotter or colder temperature, occupants should not be expected to set a thermostat to an inaccurate value in order to obtain desired results (e.g., setting a thermostat to 68 degrees to achieved a desired temperature of 76 degress). Staff also has a concern that locating thermostats at or within casettes / heads can lead to short cycling as the air nearest the unit will be the air most swiftly heated or cooled. Similarly, locating thermostats in remote controls creates a risk of remotes becoming lost or misplaced in ways that cause their sensed temperature to be unrepresentative of room air temperature and lead to undesired unit behavior. Staff therefore does not find that creating an exception to thermostat requirements for VCHP systems would be appropriate.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227322&DocumentContentId=58418
Nathan Walker (Daiken North America)	During the public meeting, a small number of stakeholders raised several concerns about the CVRH field tests as well as the proposed energy credits and compliance requirements for VCHP in CBECC-Res. These comments were presented in a way that implied industry wide support. DNA wishes to state for the record that these comments are not reflective of our company's position with regard to the CVRH field tests as well as the proposed energy credits and compliance requirements for VCHP in CBECC-Res.	Staff acknowledges that the noted prior stakeholder comments do not reflect the position of Daikin North America.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227322&DocumentContentId=58418
Richie Mohan (Goodman Manufacturing)	We also, if I recall correctly, never had data that was shared from the consultants itself to HRI and that was, you know, just disseminated to the respective manufacturers. I think it was uploaded on some sort of a third-party software or file upload system and stuff. So there was, of course, some communication that was happening and some involvement. And I think that was a step in the right direction, even though some might believe that wasn't entirely in the right direction, so appreciate that. (page 160)	Staff appreciates the comment of support.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
Richie Mohan (Goodman Manufacturing)	The other thing I also want to just clarify is that there has been some comments about controlled space test procedures and stuff. And I believe that, you know, not all the manufacturers at this point in time may be onboard with a controls, you know, based test procedure at this point. I think we are several milestones away from having an implementable test procedure which is repeatable, as well as, you know, perhaps implementable on a practical basis. (page 160)	Staff appreciates this feedback regarding the practicality of a controls-based test procedure.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Ryohei Hinokuma (Daikin)	Between Daikin and you guys, we perceive that the communication has been fairly open. (page 57)	Staff appreciates the comment of support.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Ryohei Hinokuma (Daikin)	In slide 17, you guys point out about poor installation likely, that many field installations will be conducted more poorly. I'd like to point out that Daikin let only certified installers. We call them Dakin Comfort Processor Dealers. So again, I can't speak for the whole industry, but we make sure that very limited and skilled installers install our VCHP systems so the quality and the level of installation is basically guaranteed to be pretty well, pretty high. (page 57)	Staff needs to consider the full breadth of potential installers across all potential product brands, and therefore finds it appropriate to make conservative assumptions about skill level of professionals performing VCHP installations.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Ryohei Hinokuma (Daikin)	And slide 18, the slide -- well, I guess slide 13, sorry, the SEER, you know, and energy performance correlation slides, I would like to also point out that Daikin also sees some correlation between the SEER rating and the performance conducted at those tests. (pagge 58)	Staff's findings indicate that the correlation between SEER and in-situ performance is too weak to base modeling predictions on; staff respects the desire for equipment whose performance is accurately represented by its SEER rating to have that value considered, however staff sees a significant risk of harm to consumers under this approach given the observed lack of correlation.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Ryohei Hinokuma (Daikin)	So we would greatly appreciate it if we could continue the conversation, just like, you know, the folks from Carrier pointed out, if we could come up with some alternative middle ground solution to deviate from that, considering the HRI rated value at all, we would greatly appreciate it. (page 58)	Given the observed lack of correlation, staff does not find that use of SEER or HSPF values as modeling assumptions is appropriate at this time. To the extent that test alternatives currently under development seem likely to result in performance ratings that are better indicators of in-situ performance, staff looks forward to working with DNA and other stakeholders on examining whether and how revised ratings may be utilized by the software in the future.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
Ryohei Hinokuma (Daikin)	About slide 23, about wall mount thermostat requirement in any zones above 150 square feet. We believe is that even if on average let's say a wall mount thermostat more accurately measures the indoor temperature of where occupants hang out, what end users care in the real life is if it's hot or cold. You know, they're -- not ours, but their VCHP controls coming up that just says, you know, are you hot or are you cold? That doesn't even show, you know, the actual, you know, temperature set point. So when -- you know, even if a wall mount -- no remote controls somehow happen to inaccurate, if it's cold, end users will adjust the set point. And if it's hot, they'll do the same. So we don't think that remote controls will make end users adjust the set point more frequently either. (page 58-59)	Staff's concern lies with preventing cases where the location of the thermostat impedes performance of its function - although occupants are free to adjust a thermostat when they would like a hotter or colder temperature, occupants should not be expected to set a thermostat to an inaccurate value in order to obtain desired results (e.g., setting a thermostat to 68 degrees to achieved a desired temperature of 76 degress). Staff also has a concern that locating thermostats at or within casettes / heads can lead to short cycling as the air nearest the unit will be the air most swiftly heated or cooled. Similarly, locating thermostats in remote controls creates a risk of remotes becoming lost or misplaced in ways that cause their sensed temperature to be unrepresentative of room air temperature and lead to undesired unit behavior. Staff therefore does not find that creating an exception to thermostat requirements for VCHP systems would be appropriate.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Ryohei Hinokuma (Daikin)	If wall mount thermostats are required in any zone above 150 square feet, that will significantly add the financial burden of end users. So basically, that will significantly impact the business expansion of VCHPs in general. (page 59)	Staff finds that wall-mounted thermostat costs are ordinary for other types of zonal HVAC equipment and systems; there is no relative cost burden in expecting that VCHP systems meet identical requirements. Staff additionally finds that having the wall-mounted thermostat placed correctly in the zone is the most consistent and reliable control source for optimized system performance, and meets the expectations of homeowners. Staff acknowledges that allowing VCHP systems to avoid thermostat requirements would allow them to avoid associated costs; as the purpose of this proceeding is not to create exceptions for VCHP systems that allow for avoided monetary costs at the potential expense of the homeowner's experience, staff does not find that creating an exception to thermostat requirements for VCHP systems would be appropriate.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
Ryohei Hinokuma (Daikin)	There should be some potential that we can land somewhere in the middle, you know, like an alternative approach that wall mount thermostat is not required in any room above 150 square feet, basically, any room is bigger than that. So we appreciate it if we could, you know, continue discussing on this, as well. (page 59-60)	CVRH research found that VCHP systems - especially ductless VCHP systems - did not keep all rooms in the homes within ACCA Manual RS guidelines for maintaining setpoint temporature when thermostatically controlled conditioned air was not provided to each habitable room. Staff finds that failure to maintain comfort in all rooms is not aceptable performance. Staff staff finds that each indoor unit that serves a zone greater than 150 square feet should be controlled by a permanently mounted wall thermostat located at an apropriate location within the zone served by the indoor unit.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Ryohei Hinokuma (Daikin)	In slide 28, you guys mentioned about extra credit to be provided if we provided it from CSA Exp-07 test or ASHRAE 205 performance map. And, Abram, you said the model is to be developed. If we can get any ballpark information of when you guys think the model can be developed, you know, not exact date or year but more or less around when, that would be greatly helpful on our end. (page 60)	The CSA EXP07:19 method of test is available from the Canadian Standards Association at the following URL: https://store.csagroup.org/ccrz__ProductDetails?viewState=DetailView&cartID=&portalUser=&store=&cclcl=en_US&sku=CSA%20EXP07%3A19 This method of test is applicable to systems that have a single indoor unit connected to a single outdoor unit. Voluntary tests of systems has begun, however the infrastructure for making a directory of rated products available for use for code enforcement has not been implemented. Although development of a method of test for systems that have multiple indoor units is in process, it is unclear how many years it will take to complete development of the multi-split test. ASHRAE Standard 205 - Standard Representation of Performance Simulation Data for HVAC&R and Other Facility Equipment is still under development.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Sreenidhi Krishnamoorthy	What was the basis of choosing these systems? Are they most sold systems as of today? (page 99-100)	MR. CONANT: So there are a variety of reasons for choosing the systems. In some cases the manufacturer told us which system they wanted to install. In one year the systems were selected because the identical units were being tested as part of the CSA development process and they wanted field results for those same system. And in other cases we didn't have a driving reason to use a specific model and so we went to the local distributors and asked what was available. (page 100)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153

Commenter	Summary of the comment	Response to the comment	Link to docket item
Sreenidhi Krishnamoorthy	So on slide 13, do the fans mentioned refer to the transfer fans? (page 100)	MR. CONANT: Yes, but not only the transfer fans. So any fans that were running when the compressor was off, that energy use is -- well, actually, let me back up. None of this data includes transfer fans, all of that. The systems that use transfer fans are excluded from this analysis. So it's not transfer fans that we're talking about, it's the indoor fan and the air handler running in between compressor cycles that was excluded from this data set. (page 100-101)	https://efiling.energy.ca.gov/GetDocument.aspx?tn=227301&DocumentContentId=58153
Steve Uhler	CVRH Project is perfectly designed to get the results in the reports. Of course that can be said of anything humans design and build. If CVRH Project were run for all possible combinations, I believe it would soon be identified that there is process variability that would show the method does not have value in accurately predicting energy efficiency of buildings and their HVAC systems.	Staff presumes the commenter is referring to the test methods for HVAC equipment; the scope of the CVRH project is necessarily limited, and staff finds that speculating on the overall veracity of HVAC appliance testing in general would be outside of the scope of the compliance option being considered. None the less, staff will direct the comment to appropriate internal staff. Alternatively, if by "method" the commenter is referring to the observational in-situ testing comprising the CVRH project, the comment seems to be stating that "upstream" variation will have as a consequence observations of inconsistency much like what the CVRH project observed (per the "inspector" role in the YouTube video referenced later in the comment letter). This would not be inconsistent with the findings and recommendations made by staff in relation to VCHP equipment.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230372&DocumentContentId=61926
Steve Uhler	CVRH Project shows control system bias in not reporting real-time humidity with temperature even though there is a attempt to simulate humidity and temperature of a occupied building. Is there a test setup procedure for the simulated humidity and temperature method? Perhaps the simulation did not perform as required?	Staff notes that the CVRH project monitored real-time humidity and temperature.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230372&DocumentContentId=61926
Steve Uhler	CVRH Project methods have not been tested and reviewed enough to provide a results beyond speculation. Speculation has no place in regulations.	Staff notes that the CVRH project measured what happened with real VCHP systems running in real houses; staff does not find anything speculative within the project design, or within the proposed credit based on its observations.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230372&DocumentContentId=61926
Steve Uhler	Perhaps SEER, EER, HSPF and COP should be compared with coil sizes and air flow for each HVAC system?	Staff understands the commenter to be making a suggestion for updates to HVAC test procedures that is outside of the current proceeding to determine appropriate modeling credit for VCHP equipment based on currently specified tests. Staff has nonetheless forwarded this comment to appropriate internal staff.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230372&DocumentContentId=61926

Commenter	Summary of the comment	Response to the comment	Link to docket item
Steve Uhler	Motor rpm and run capacitor value tolerances and power requirements should be compared to published motor specifications to ensure that worst case is taken into account.	Staff understands the commenter to be making a suggestion for updates to HVAC test procedures that is outside of the current proceeding to determine appropriate modeling credit for VCHP equipment based on currently specified tests. Staff has nonetheless forwarded this comment to appropriate internal staff.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230372&DocumentContentId=61926
Steve Uhler	Motor inrush current duration should be given values to encourage reduction of the effect of synchronous events caused by time of day electricity pricing.	Staff understands the commenter to be making a suggestion for updates to HVAC test procedures that is outside of the current proceeding to determine appropriate modeling credit for VCHP equipment based on currently specified tests. Staff has nonetheless forwarded this comment to appropriate internal staff.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230372&DocumentContentId=61926
Steve Uhler	Perhaps in changing metrics for HVAC systems, improving energy efficiency as spoke of in CEC-500-2019-038 can be realized with less variation, thus providing high quality of service?	Staff notes that the test procedures for the majority of HVAC equipment are established at the federal level; changes in metrics are outside of the scope of this compliance option and, where federally prescribed, not able to be changed at the state level. Staff has nonetheless forwarded the comment to appropriate internal staff.	https://efiling.energy.ca.gov/GetDocument.aspx?tn=230372&DocumentContentId=61926