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CALIFORNIA ENERGY COMMISSION

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PUBLIC WORKSHOP

WARREN-ALQUIST STATE ENERGY BUILDING

FIRST FLOOR – ROSENFELD HEARING ROOM

1516 9TH STREET

SACRAMENTO, CALIFORNIA

FRIDAY, FEBRUARY 15, 2019

9:00 A.M.

Reported by:

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PUBLIC COMMENT

Bruce Severance, Mitsubishi Electric

David Paschall, Mitsubishi Electric

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Marshall Hunt, Consultant to PG&E

Ryohei Hinokuma, Daikin U.S. Corporation

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AGENDA

P R O C E E D I N G S

9:07 A.M.

SACRMENTO, CALIFORNIA, FRIDAY, FEBRUARY 15, 2019

MR. FROESS: I'd like to welcome everybody to the Public Workshop of the Residential Alternative Calculations Methods Variable Capacity Heat Pump Modeling Approach.

I want to get some housekeeping out of the way first.

In case of an emergency, please follow the employees out of the building to the park across the street, Roosevelt Park. Proceed calmly and quickly, following the employees with whom you are meeting.

There are restrooms outside of the -- of our hearing room, just across the way there. And there's a snack area located up the stairs on the second floor, just underneath the white awning.

I'd also like to announce that this broadcast is using WebEx. This meeting is being recorded. In-person participants are encouraged to please sign in. Online participants are going to remain muted until they request to make a comment by raising their hand. The online

commenters will be taken after the in-person participants in an alphabetical order. We ask that commenters in person provide a business card to the recorder and provide your name and affiliation before speaking. And for the online, please provide your name and affiliation before speaking. This presentation and the transcripts will be posted on our website in a few days.

I am the Moderator, Larry Froess, the Senior Mechanical Engineer at the Energy Commission. And we have two presenters today. The first one is Abram Conant with Proctor Engineering Group. And the second is Bruce Wilcox. And then after the presentations, we'll have a questions and answers period at the end.

So with that, Abram? The clicker or mouse, if you need them.

MR. CONANT: Okay. Thanks. Okay, so I'm going to talk about the research that fed into our decision-making process.

(Off mike colloquy.)

MR. CONANT: Okay, so I'm going to talk about the research that fed into our decision-making process, talk about what led us to make some of the decisions that we made and the

analysis behind our assumptions for credit. I'm not going to get into any specific credit amounts because Bruce is going to cover that in the next presentation.

MR. FROESS: Speak up for people, so they hear you.

MR. CONANT: Okay. Okay, so as a background, currently there's no credit given for many multi-split system. They're treated like a minimum efficiency system with ducts in the attic. The purpose of our research was to try to understand what credit they should be given. There are a lot of issues to study with these systems. They're complicated in various ways relative to single-speed systems, and so we set out to understand how they actually work in the field so that we could determine an appropriate amount of credit.

So our resource plan was field based. We studied variable speed, I'm going to refer them to as VCHP, variable capacity heat pump, system in three houses in Stockton, California. We've been running this study since 2014, so we've got four years of results represented in what I'm going to show today.

There are two reports out, publicly available on the Emerging Technologies' website right now. There a third report expected out later this year.

These are the three houses. They cover a range of vintages from 1940s era to near-modern construction. But they're all better than the typical house for the year of construction because in 2013, they all received energy retrofits. Currently, they're more similar to a house built to modern efficiency standards.

The houses are all fully instrumented. We've got temperature and humidity sensors in each room. We've got the air conditioning systems monitored. We've got lots of instrumentation throughout the house. And we're also, because these are unoccupied houses, we're simulating occupancy. So on the left, that's a humidify simulating latent gains from people in the house. And on the right, that's an electric resistance heater simulating sensible gains. Those are controlled to equal the eternal gains assumptions in Title 24.

The basic experiment that we're running is a direct comparison of the VCHP system to a

minimum efficiency single-speed heat pump, so a SEER 14 HSPF 8.2 single-speed, basically bottom of the line, no bells and whistles, split-system heat pump. The internal -- the indoor unit is entirely internal to the conditioned space, so you can see all the duct works are running inside the house. The air handler is located inside the house, fully in the conditioned space. VCHP systems were also fully in the conditioned space, with the exception of one unit in 2014 that was ducted in a crawl space. Every other unit was fully inside the conditioned space.

And what we do is every two or three days, we flipflop between the two systems. So we run the single-speed, what we call the reference heat pump system, for two or three days and then we switch to the VCHP system and we run that for two or three days. And we just, all summer long and all winter long, we switch back and forth between the two heat pump systems, so that we can compare how much energy they're using and really direct head-to-head comparison.

And going into this experiment the expectation was that the energy savings would be predicted by the efficiency ratings for the

machines. So the relative SEER rating should predict the cooling energy savings that we would see and the relative HSPF rating should predict the heating energy savings that we would see.

These are all the different systems that we've tested over the years. I apologize that it may be a little bit difficult to read. There's more detail provided in the reports. What I'll point out here is that the majority of the systems that we tested were ducted mini-splits, and I'll get a little bit more into the reason for that later on. There were some ductless mini-splits.

The majority of those, you'll see a notation that they were tested with transfer fans, that's referring to a fan that's installed and runs continuously and it moves air from a conditioned space to a space that's not directly conditioned. So the way those systems were installed was they didn't directly condition the whole house, they conditioned central areas in the house and then transfer fans were used to move air around the house.

I'll also note that there's only one multi-split system showing up there. And we're

still in the process of evaluating multi-split systems. But what we're going to talk about today is mainly ducted mini-splits.

So our basic comparison is annual, normalized annual energy use. And the way we did that is just a simple linear regression of the energy use that we monitored for the two systems.

So what we're looking at here is daily energy use by the heat pump system on the Y axis against daily average outdoor temperature on the X axis. We do a linear regression of that and then project that regression to the Title 24 weather file for Stockton to predict normalized annual energy use for the two systems. And again, the amount of energy savings that we expect to see from the VCHP is relative to the SEER rating compared to the single-speed SEER 14 or the HSPF rating compared to the single-speed HSPF 8.2 machine.

So the reason I called out how we installed the ductless systems is that one thing that we discovered is that when you don't fully condition the whole house, there's a real comfort problem that can occur.

So what we're looking at here is

temperatures in the various rooms in the house. This is a ductless system that served part of the house. This is when the system ran with no transfer fans, so the bedrooms were not conditioned at all. There was no air movement, forced air movement to the bedrooms, and you can see that it didn't work very well. On hot days the bedrooms were 15 degrees above the thermostat set point.

When the transfer fans were used, things got a little bit better but not that much. So this is the same system, the same situation, except now we have constantly running transfer fans moving air into those bedrooms and we still see on hot days the bedrooms getting up to ten degrees above the thermostat set point.

So that causes a couple of problems. One, we can't really say that the VCHP system is providing comfort when it can't keep temperatures within ten degrees of set point. And it also means that we really can't compare the energy use of this system to our single-speed ducted system that didn't control the house to set point. We know that not fully cooling the house will use less energy than fully cooling the house but

that's not the comparison we're trying to make here. So for that purpose these types of systems are not included in the analysis that I'm going to talk about later on.

And just by way of comparison, this is a ducted VCHP system in the same house, ran the same year. And you can see, there's a really big difference in the comfort provided. It was able to maintain temperatures in the house near set point. This is good comfort and it gives us a good energy use comparison.

So based on these results, one of the decisions we made early on was that a requirement to receive the credit that we're working on would be that all of the rooms in the house need to be directly served. Air transfer fans are not a reliable way of providing comfort.

Okay, here's the list of all the VCHP systems that we tested. Again, the ones that are grayed out are ones that are excluded from the analysis that I'm about to go through, in most cases because they were ductless systems that didn't serve the whole house, in one case the top line because that system was undercharged. And that experiment was useful to highlight that low

refrigerant charge is a problem that we need to worry about with these machines. The performance of that system isn't something that we want to factor into the credit granted to VCHP systems, so we excluded that from our analysis.

Okay, so what did our results show? The expectation going in was that the SEER ratings would predict cooling energy use and that turned out to really not be true at all. This is a plot of the reduction in annual cooling energy use for the VCHP systems relative to the single-speed SEER 14 system. You can see that the lowest SEER rated VCHP system actually had the highest cooling energy savings. And then the rest of the results are sort of a scatter that don't track very closely with the SEER ratings.

One thing to point out here is that these results exclude energy use from indoor fans in the VCHP system that are sometimes set up by the manufacturers to run constantly by default. And when that happens it dramatically increases the energy use. We're excluding those fans from this analysis. If we included those fans, then the results would show that a number of these VCHP systems with higher SEER ratings actually used

more cooling energy than the SEER 14 minimum efficiency unit. But we're going to handle the fan energy separately in our modeling approach for credit, so we're not showing that here.

One other thing to point out, in addition to the results not really tracking well with the SEER ratings, is that -- so if you look on the -- toward the right side of this chart there's some SEER 29 systems that, based on the SEER rating, you would expect they would use less than half as much energy than a SEER 14, and that's clearly not true. They did use less energy than a SEER 14 but not half as much.

On heating, basically the same thing. There's no clear correlation between the HSPF and the heating performance that we monitored with these systems. In general, the heating energy savings were larger than in cooling but we didn't see a better correlation to the HSPF rating.

So there's several areas of uncertainty in our analysis and our experimental design and our results. One is that there's -- there are fundamental differences in how variable-speed machines control indoor temperature compared to single-speed machines. So what we're looking at

here is, if you look at the blue dots, each one of those dots represents one hour.

Is there a pointer on this? Yeah. Okay. Is everyone --

(Off mike colloquy.)

MR. CONANT: I just wasn't sure if anyone could see it up there because I can't see it from where I'm standing. Okay.

So each one of these blue dots represents one hour. This red line up on the top is the outdoor temperature, so each one of these peaks is an afternoon, so we're looking at three days here. This is three days when the single-speed heat pump was running. And you can see that it keeps temperatures -- the blue dots are the temperature at the thermostat location. It keeps that temperature very close to the thermostat set point all the time, within half a degree or so.

And that's different from what happens when the VCHP machine is running where we see it controlling the temperature at the thermostat location to a degree or so below set point when it's cool outside, and then letting the temperature rise up to one or two degrees above set point on hot afternoons.

So that's just a fundamental difference in the way these machines control temperature. It raised some questions about what might happen on these hot afternoons if an occupant in the house -- for example, on this day an occupant might notice the indoor temperature increasing by three degrees on this hot afternoon. They might take action to lower the thermostat setting and stay comfortable and that would increase energy use over what we monitored. So that's one area of uncertainty.

Another is that these are unoccupied houses. We ran a constant thermostat set point all the time. And we acknowledge that that might not be what happens in a house that people are living in. This graph here is not from our project. It was provided by another researcher who was studying a mini-split in an occupied house. And what we're looking at is heating energy use. The purple-ish line is outdoor temperature, so this was a day where it got down to 35 degrees overnight. And the green area is energy use by the heat pump. This is a small one ton mini-split heat pump.

And what happens is the occupant in this

house gets up in the morning and turns up the heat and forces this mini-split heat pump to run at a very high watt draw, actually higher than the watt draw listed in the manufacturers literature as the maximum that this machine should draw. And this repeats every day and over the course of a winter, adds up to about a third of the energy use by this system.

So we're aware that occupant interactions with variable-speed machines might cause them to run at higher and less efficient speeds than we monitored in our project, that real-world energy use might be a little bit higher than what we're representing, so that's another source of uncertainty.

Other sources, the systems that we studied in almost all cases, all except for two, the systems were specified, installed, configured and commissioned either by our research team or by the manufacturer of the VCHP system. So that's kind of an optimistic scenario. We didn't go out of our way to find inefficient systems. In fact, we mainly studied machines that members of our research team believed were particularly good machines. And our expectation is that the

manufacturers would also provide their better systems for this study. So there may be some positive bias in our results because of that.

The two VCHP systems that were installed by local HVAC contractors, and these weren't just any contractors, they were actually authorized dealers of the brand of mini-split that they installed, these systems didn't perform very well at all.

In the case of the Grange system, which is on the left in this plot, there was -- the installer didn't do a good job on the flare connections. There was a refrigerant leak, and this is the one that at the end of the project was found 29 percent undercharged, so that's a major contributor to its poor performance.

Both of these, but especially the Mayfair system which is the one on the right, the indoor fan operated constantly when the compressor was off and that contributed a large amount of energy use.

So that's another factor and one of the reasons why we're considering the fan energy use separate from the outdoor unit energy use. This system, if we exclude the fan energy use,

actually performed relatively well, but the fan energy use really hurt it.

Okay, so our modeling approach, based on these results, is to represent the VCHP system in a single default model. We didn't find good evidence that we can base energy use assumptions to the SEER or HSPF ratings, so we're proposing to use a single model that will be adopted for all VCHP systems and that model is not a function of the ratings of the VCHP unit that's being installed. We do envision a more specific model. I'm not going to talk about that right now. But when I get to the last slide, I'll go into a little more detail about what we're talking about there. But we would like to provide a pathway for machines that are demonstrated to perform better to receive appropriate credit.

So our analysis of what the cooling energy credit should be was done -- well, both the cooling and heating energy credit analysis is just a basic comparison of the VCHP systems to the single-speed SEER 14 HSPF systems that we compared them to in our study.

So were looking at the energy savings here. This is a distribution based on our

monitored cooling energy savings for the VCHP system over the SEER 14. So based on our sample and standard distribution of the results in that sample, we propose setting the energy use or the energy credit for VCHP systems at five percent better than the SEER 14. And our analysis indicates that we can be 90 percent sure that that level of savings will occur based on our results.

The heating analysis is done the same way. In this case the savings are a little bit higher, 12 percent.

And there's a few other factors that are very significant in the total energy credit. So five percent cooling energy savings over the minimum efficiency single-speed unit and 12 percent heating energy savings. There's also an additional credit given on fan efficacy because the reference systems that we used in our project had an average fan efficacy of 0.35 watts per CFM which is better than the standard assumption, so we give the VCHP system that credit as well.

And here's the big one, ducts in conditioned space. Currently the VCHP systems get no credit for ducts in conditioned space.

We're proposing to give that credit and that's a really big deal for energy savings.

And lastly, the continuous fan issue that we discovered in our experiment, we propose to deal with that by assigning 50 watts per ton of continuous fan energy. That's the average continuous fan energy that we monitored in our project for ducted VCHP systems. So we'll assume that that occurs, unless the manufacturer certifies that the default control settings for that machine do not operate the fan continuously, that it's auto fan, meaning that the fan cycles on and off with the compressor.

The system types that this credit will apply to are mini- and multi-split variable capacity heat pump systems, both with ductless indoor units and ducted indoor units. And the type of ducted indoor unit that this is specific to is low static, sometimes kind short duct indoor units. And our definition that we adopted is the same definition used by DOE in this proceeding referenced here. It's the next round of efficiency standards. They break down different types of HVAC systems by the amount of static pressure provided by the indoor unit. so

we're adopting the low static definition.

Other requirements, as I mentioned before, we found that it is necessary to serve each indoor room directly. Transfer fans aren't a reliable say to provide comfort, so we require each indoor room to be directly conditioned. All ducts and all indoor units for both ducted and ductless VCHP systems need to be located entirely in the conditioned space.

For zones larger than 150 square feet, a wall-mount thermostat located in the zone is required.

The indoor and outdoor unit make, model and serial numbers need to be visible for field verification. And field verification will be performed on the installed system. A little bit later, we'll talk about what that involves.

Ducted systems have some additional requirements, some that are very much in line with the existing requirements for ducted HVAC systems and some that are new. So one is that the manufacturer needs to certify that the VCHP system meets the DOE definition of a low static system, so it actually is the type of equipment that we're talking about. They also -- if auto

fan credit is claimed, so if you want to avoid the 50-watt-per-ton assumption for continuously operating fans, the manufacturer needs to certify that they don't operate the fan continuously be default, meaning that when the compressor is off the fan does not run, except for a fan overrun of less than ten minutes at the end of each compressor cycle.

The VCHP system model numbers need to be listed on the CEC website as a low static system. And it needs to indicate whether or not it's eligible for the auto fan credit.

Low leakage ducts in conditioned space, the requirements are the same as what is currently in the standards. Airflow greater than 350 CFM per ton is required and that's for each ducted indoor unit, so that's a difference from the current requirements. We're not talking about the nominal tonnage of the outdoor unit because you can have multi-split systems with multiple indoor units, so we're talking here about the nominal tonnage of the indoor unit.

Air filters need to be sized according to the current requirements with one additional requirement, that the clean filter pressure drop

can be no more than a tenth-of-an-inch water column at the filters designed airflow rate. And the reason for that requirement is that we're talking about low static systems here, so they need to have a less restrictive filter.

Field verification, for all system the model number, nominal cooling capacity and location of the indoor unit, that that all matches what was reported. That will be verified for both ducted. And ductless systems and refrigerant charge verification is still required.

Additional requirements for the ducted systems, verified low leakage ducts in conditioned space, airflow greater than or equal to 350 CFM per ton, that the air filters are sized according to requirements, that the model numbers are actually listed on the Energy Commission website, and that if the auto fan credit was claimed, that the model number is listed as eligible to claim that, and that the installed system actually does not operate the indoor fan continuously.

In addition to new construction, the HERS protocols for multi-split systems are also being

extended to any type of multi-split ducted installation, so verified airflow for ducted indoor unites. And again, the main difference here from the current procedure is that it will be referenced to the nominal capacity of the indoor unit, not the outdoor unit. And each ducted indoor unit is required to comply, so it will be verified for each ducted indoor head.

Duct leakage measurements, basically the same as the current requirements, except that, again, we're referencing the nominal tonnage of the indoor unit, not the outdoor unit. And verified low leakage ducts in conditioned space, those verification protocols are the same as what is currently in the standards. Each indoor unit is required to comply individually.

Okay, so the future modeling approach that I referenced earlier, we want to provide a pathway for specific machines that are reliably demonstrated to have better performance to get appropriate credit for that performance. And the way that we envision that working is that the manufacturer provides test data from the CSA Exp-07 test. What that is, is a test method that CSA has been developing over the last couple of years

that is an unlocked test procedure, essentially a load-based test. So it allows VCHP systems to perform as they would perform in a house, as opposed to the ASHRAE test procedure which locks them at certain speeds and causes them to perform in ways that they may never actually operate in the field.

So the CSA test procedure, we believe, is more representative of actual field performance of these types of systems. And we envision using the results of that test to provide credit for specific machines. This would be a voluntary reporting requirement. Manufacturers could voluntarily provide CSA test data to receive additional credit for their systems.

We also envision that the information would be reported in the format of ASHRAE 205, which is another, still-in-development standard, but a public review draft is due out soon. So these are both approaching public availability and usability. We haven't worked on developing this model yet but we envision it to become available in the future.

And that's all.

MR. FROESS: Thank you, Abram.

Our next --

MR. SEVERANCE: I have a question.

MR. FROESS: Oh, is it appropriate for questions? Okay. Okay, we're going to take questions now for Abram's slides.

So state your name and affiliation first.

MR. SEVERANCE: Bruce Severance, Mitsubishi Electric.

On the ten case studies that you're including in the charts and graphs as the basis for the change in the 14 SEER cap, did -- 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?

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.

MR. SEVERANCE: And so the Mayfair house

which, you know, I know you're not disclosing manufacturers, you know, we had some intimate involvement with. And my understanding was that you had at some point included transfer fan watt draw in the total fan power on some of these cases. And is -- 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?

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.

MR. SEVERANCE: Okay. 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.

MR. CONANT: So to clarify, sizing in the experiment that you were talking about was determined entirely by the manufacturer. We did not --

(Indiscernible off mike audience member.)

MR. FROESS: Hold it. Who said it? You said it? Okay. Just, you know, everybody stay calm.

Go ahead.

MR. CONANT: 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.

MR. SEVERANCE: What if I were to say that we have email strings that contradict that directly? And you know, I tend to believe the staff that I've talked to about this. And 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.

Variable capacity wants to be sized properly so that you've got some margin for the system to modulate. And of course, the control algorithms are going to behave differently with some makes and models compared to others. And I think that's one really valuable thing that we've learned from the research that you've done is that, you know, the controls are really the key thing. And I think all the manufacturers are aware of that now.

But 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.

Now what I'm going to say is that what I really believe here is that there is no dishonesty on the part of your team. I know a lot of the members of your team personally and I have a great deal of respect for everybody that has worked on your team. I think there's been nothing but good intention.

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. And what I'm going to say is the State of California spent a whole lot of money doing research in these homes and there has been just invaluable information that we've gained from it.

I think pointing to the CSA test protocol that you're discussing, it's very clear to me and you've won me over that the only for us to see the light of day and really be transparent is to have 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. It's very clear to me. I've spent many, many hours talking to Charlie Stevens about this and I'm won over.

So it's not that you didn't win many victories with what you did, but 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.

And then to have 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.

And then 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? It's --

MR. CONANT: It's a credit.

MR. SEVERANCE: -- it's not a level --

MR. CONANT: Are you saying you don't want --

MR. SEVERANCE: -- playing field.

MR. CONANT: -- the credit?

MR. SEVERANCE: It's not a level playing field.

I think a year ago I had conversations with folks at CEC. I had folks -- conversations with folks on your staff. And what we asked for, and a number of my counterparts in industry were asking for the same thing, we wanted transparency. 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.

You know, what you're doing is very difficult. 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. All of that's very interesting.

But normally, 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. We weren't given a seat at the table, and those are the exact words that I've been using for a year is a seat at the table.

So what 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.

And to give the entire industry a black eye for a period of six or seven years and minimally rate equipment?

You know, go back to the slide with the cooling load equipment, and if you -- if we could just make some generalizations here, there's clearly cause for concern about what may have caused the 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.

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, and 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, okay?

I've heard story after story after story of 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.

And I've sat in on numerous Title 24

workshops on the phone, and webinars, where the talk energy experts that are teaching Title 24 are telling you that, yeah, the way to go in that condition is to just put in a radiant floor, that's the better thing.

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.

So what I would like to say that is if we're going to -- can you go back to the chart with the green bars on it, on the cooling loads, on cooling? There's clear correlations here if you take out the outliers. I mean, you're complaining that there's one 14.6 SEER system that seems to be giving 30 percent energy savings and it's better than the 33 SEER. Well, I'd like to know what their secrets are on controls because I know that's what the issue is here, you know? So to me, it's like, okay, that's an outlier.

And if we look at the 19 SEER unit,

that's another outlier. Everything else there generally is improving in energy savings. And 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.

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.

So all I'm asking here is for a fair hearing and a seat at the table. And I think, you know, the State of California has serious objectives. The manufacturers that I have contact with, we want to collaborate. I've spoken to any of them that have said, yeah, if the state's going to electrify and that's inevitable, you know, we're going to work to improve our heat pump systems and try to work with them, but you're really refusing to work

with us.

You know, we need open dialogue about these things, about how the systems were tested. And I'm very anxious to see the CSA test protocol take effect. I've, you know, literally called Charlie Stevens every month. Last time I talked to him, he was riding a horse through the mountains in Montana or something along those lines. He was way out in the sticks. And you know, I know he's about a retire, which I think is a tragic loss. His work has been something that I think is really going to help the state of California and really help the country turn the lights on and fix the problems with controls.

And I'm sure there's those manufacturers that would argue with me and say, oh, my god, this is going to give one system or another a black eye. My attitude is let's turn the lights on and kill the cockroaches and fix the systems. Let's make these systems better, okay? So to me, it's about transparency.

And for the record, I've got to say, and forgive me for taking more than my five minutes, I've got to say that, you know, I've heard some people on the research side say, well, HRI is

dishonest. AHRI is not dishonest. It's, you know, it's not accurate, I'm going to say that. It was the best they could do at the time to try to understand what these variable capacity systems were doing. It needs to be replaced. And really, the greatest benefit of your research is to show that AHRI really needs to move in the direction of a more transparent system.

But I don't think that it was intentionally dishonest at any point. And you know, I knew some of the people that worked on that, developing that standard in the first place, and I think they're extremely credible and they were trying to do the right thing.

So the bottom line is that, you know, let's work together to solve the problems, do it quickly, get CSA implemented quickly, but don't kill us in the meantime. Don't shut the door on our face. 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.

And the one thing I do have to say for this is the reason that I question this science

so much is because 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.

And you know, the beauty of what he's doing is it's going to show us the problem areas where we have problems with controls on defrost, for example, or what have you. There's going to be tweaks to the controls that are going to benefit the entire industry as a result of that. But the basic data of what he showed us was very close alignment with what we were publicly documenting.

So I don't believe this, okay? I don't believe this. I don't believe it because the controls were not -- the variables were not controlled. And there's -- you know, this last year, 2018, you know, you were kind enough to have us come down and take a look. You know, some of the researchers say, yeah, you know, we know what the load calcs in this house but we intentionally oversized all the systems in order

to just see what happens. Well, here we go again.

It's -- 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, okay?

I think I speak for all the manufacturers that are here in the room. And they're going to come up and give you their peace, as well. But let's change the rules to the game and let's work together to create what those rules are so there's consensus. And don't, you know, look at it as you're compromising the integrity of your study if you even pick up the phone and talk to us. That's not fair, you know? We want to be participants with you.

When we're putting stuff through test labs elsewhere, our staff has some kind of say.

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."

Well, really?

Is -- we're not going to optimize how the system is installed and intentionally -- you know, 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." At one point, because the system was undersized --

(Indiscernible off mike audience comment.)

COURT REPORTER: I need you on the microphone.

MR. SEVERANCE: I'm being interrupted, for the record. And I had -- I deserved a hearing here today. The industry deserves a hearing.

MR. WILCOX: Well, you've had a half-an-hour. How much do you need?

MR. FROESS: I'm not (indiscernible).

MR. WILCOX: Okay. I'm sorry.

MR. FROESS: Steve?

MR. CONANT: Bruce, did you have a response?

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 this is -- 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 see that we didn't -- 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.

So you know, it's -- I don't want to -- as I say, 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.

But I think there's -- we've been, 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 people -- 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.

MR. PASCHALL: All right. Thank you for your time, guys. Good morning everybody. My name is David Paschall, Area Sales Manager for Mitsubishi. I'll keep it brief. I just want to go on record with a few things.

I was only involved in Phase 2 of the CVRH Program. When I came in I actually -- 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.

I then asked about the difference in sizing of the reference system and was personally

told they were not being compared against that.

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.

So as Bruce had mentioned, 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 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.

Now again, I'm not here to question anybody's integrity. I'm not here to say what

the intentions were. I'm just saying, there was a breakdown, there was a miscommunication. 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.

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.

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.

I'd like to go on record and say that 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.

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. 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.

Thank you for your time, guys.

MR. CONANT: Can I respond?

MR. FROESS: Yeah. Yeah.

MR. CONANT: Okay. So I wanted to respond to a couple of points.

First, what we just heard, 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.

The second point that I wanted to make is that when I -- 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.

MR. SEVERANCE: I just have to. 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. It was Paul Doppel, who has a seat on a number of committees or did have a seat on a number of committees at AHRI and ASHRAE at the time, who is a director at Mitsubishi, he's since retried, I've had many long conversations with him and taken assiduous notes about the history of how this went down.

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.

And David Paschall was directly involved, if you want him to get back up on, you know, the mike and talk about this. 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, okay? Let's get the history straight here.

And you know, I'm sure you guys are working from your recollections as best you can. I'm not here to, you know, name call. We just want a level playing field. We want to be able -- if you're going to test performance of equipment, let's follow specific protocols that manufacturers can agree to and that you can agree to and the State of California can agree to. You know, thank god, Charlie Stevens has been working on that. That's all I can say.

But 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.

So 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, it's just -- you know, it's hard to sit in the audience and not feel sick to your stomach. I'm just telling you, it's not fair. This is not fair.

We're asking for fairness. We're asking for transparency. We want a working relationship where we can get to the facts, that's all we're asking for. We're asking for a fair shake and a seat at the table. That's not unreasonable. And I'm sorry I've upset people here.

Honestly, I really respect you, Bruce. I really respect you. I know you have a tough job. 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. And you know, I have to say that I have nothing but respect for your good intentions, okay? I have to say that. I've spoken to you personally.

I know you, Abram Conant. You really believe in the technology. That's why it's hard for me to understand why we haven't been able to have a better dialogue as things were happening.

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. 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. And you know, it's very interesting to see what happens when you undersize and oversize systems.

I tout Rick Chitwood's work at many venues. I really think his research is just cutting edge. I'm trying to get him talking with ACCA to bring ACCA up to speed with all of his system optimization methodologies. 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?

But that's the level of dialogue that, you know, I want. 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.

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.

And second 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.

MR. PASCHALL: David Paschall, Mitsubishi again.

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. Are we clear here?

Because Mitsubishi, again, 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.

But our system, again, 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.

MR. HAHN: Hell. My name is Bobby Hahn with Carrier. I'll be quick, Mr. Wilcox.

I just want to say that, you know, looking at these numbers here, you know, 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. We do have some equipment that's rated at 42 SEER. To say it's 14, it's just not fair.

So I just want to say maybe we can meet somewhere towards your side and just get rid of

anything that's sold under 16 SEER, not allowed. That's all.

MR. HUNT: Hi. Marshall Hunt, PG&E consultant.

So am I -- is it clear that we're really talking about just one year of data? Okay. So that's what I've heard, one year.

MR. MILLER: (Off mike.) No. No.

MR. CONANT: Much of the discussion has been about one particular year, 2015. But our analysis is four years of data.

MR. HUNT: But if we just took out the 15, would it impact your conclusions?

MR. MILLER: (Off mike.) We oversized in 2018 (indiscernible).

COURT REPORTER: That's making it on the transcript.

MR. MILLER: (Indiscernible.)

MR. CONANT: Here. Bruce Wilcox.

MR. MILLER: So the (indiscernible) experiment is not included in this analysis; right?

MR. CONANT: Correct.

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.

Thank you.

MR. HINOKUMA: Hi. I'm Ryohei Hinokuma with Daikin.

And first of all, we would like to sincerely appreciate all of your collaboration for many years. I can't speak for, you know, all of industry, but between Daikin and you guys, we perceive that the communication has been fairly open.

And there are a few things I'd like to make comments about the slides you guys presented today and one quick question.

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.

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.

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.

And the third of my three comments is about slide 23, about wall mount thermostat requirement in any zones above 150 square feet. We believe that was -- that came up because of the potential risk that -- or potential that a wall mount thermostat will more accurately measure the actual indoor temperature than these remote controls that are commonly used for VCHPs.

But what 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.

And also, 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.

So we believe that there's -- 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.

And the last one is just a simple question. 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.

So again, thank you very much.

MR. FROESS: So if there's no more in-person speakers, we can go online.

MR. WICHERT: Okay. First up, online, George, I'm going to un-mute you now. Go ahead.

MR. NESBITT: Can you hear me?

MR. WICHERT: Yes, we can hear you. Go ahead.

MR. NESBITT: Yeah. Give me a second to adjust my phone to -- and also you need to mute the mikes in the room. One second. Okay. Sorry. George Nesbitt, HERS Rater. Can you hear me?

MR. WICHERT: Yes, we can.

MR. NESBITT: So first, 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.

Two, my understanding, 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.

And then on -- 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.

For SEER versus EER, I think a long time

ago we used SEER and then we changed to EER only because it, quote unquote, reflected our dry-hot climate better than SEER, although I think in recent versions of the code we've put SEER back in. But I suspect the EER is the dominant metric we use for energy use, rather than SEER. But I think SEER might actually play in now.

So a question or -- honestly, the data does show -- well, okay.

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 reasons, you know, design, sizing, ducting, duct location, duct losses, airflow problems, so on and so forth. And we do know that variable speed or two-speed variable speed equipment tends to have even better EERs running on lower -- at lower capacity. 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.

System sizing; 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.

The next is 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.

And then sort of 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.

And then 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.

So those are sort of my basic things. 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.

So you know, if you want me to respond, I'd be happy to respond. Thanks.

MR. CONANT: So I'm not sure if I can remember all of the issues that were raised, but I'll respond to the ones that I do remember.

So first of all 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.

Also, the 350 CFM per ton only applies to ducted systems. We're proposing to essentially assume that the ductless systems have correct airflow.

Let's see, what else was there?

MR. WILCOX: So one of the points that George brought up -- this is Bruce Wilcox -- is that 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.

Anyway, that's -- I think that --

MR. CONANT: Yeah. Just one more thing that I remembered. 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.

MR. SHIRAKH: So this is Mazi Shirakh, CEC Staff.

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?

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.

MR. SHIRAKH: But that's what they're claiming.

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, actually, I decided it wasn't worth arguing this, but 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.

MR. SHIRAKH: (Indiscernible.) 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 --

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.

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.

Thank you.

MR. WILCOX: Well, I mean the other way

to look at this and what I like -- the way I like to look at it, sorry to take your time, Bruce --

MR. SEVERANCE: No. Go right ahead.

MR. WILCOX: -- is that I think the -- 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. And so --

MR. SHIRAKH: Yeah. That's the way the standards work. Thank you.

MR. SEVERANCE: Bruce Severance,

Mitsubishi Electric.

I really want to be brief but I think, first of all, I think it's clear from my half-hour comment earlier that a theme that we're asking for here is transparency and a level playing field. So to me it's not just, oh, Mitsubishi wants a better rating, we're not happy with that one, we're asking for me, I want a fair rating. I want the lights to go on so we can see what these systems are actually doing.

And I have cause to question the validity of some of the science that was conducted in this research. I'm sure there were certain cases where sizing was correct and you got good data and all the variables were controlled. There were others that were highly questionable from things you've heard.

David Paschall was at the site. This is not somebody who was on the phone talking to you cone and a while. He was there, he saw was happening. He was there arguing with your staff. These are firsthand accounts of what happened in some of these test cycles. So we have reason to question. And I think that it's only fair to give us some kind of hearing at this point in

time.

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. 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 --

MR. WILCOX: Let me stop you.

MR. SEVERANCE: -- in the performance or the equipment.

MR. WILCOX: Stop for a minute. You've raised this five times at least.

MR. SEVERANCE: Well --

MR. WILCOX: No. Let me just get clarification.

MR. SEVERANCE: -- we're asking for transparency. That's what we're asking for. 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. WILCOX: (Off mike.)

(Indiscernible.)

COURT REPORTER: This is all off mike. I need to get this on micro. It's not on the transcript.

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.

MR. SEVERANCE: All right. So just for clarity's sake, I think it's important to understand that a person in my position would have cause to be nervous about what controls you guys had. And so when we ask for transparency, if you were providing that, it would certainly help settle our misgivings about how you're deciding to rate the equipment, rate the entire industry based on, you know, averaging and projecting probabilities.

And you know, 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.

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.

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?

So give us fair hearing, that's what I'm asking for. I'm not asking for anything that we don't deserve, okay? I'm not, you know?

MR. CONANT: So I just want to point out that I started my presentation --

MR. SEVERANCE: Like I'm getting some disbelief here.

MR. CONANT: -- 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.

MR. SEVERANCE: Well, I've read those.

I've read those 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.

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?

And ducts in conditioned space credit, we've deserved that all along.

To me, it's like it -- and, you know, Mazi, all due respect, I disagree, you know, that 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.

So in my mind, 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.

So 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. You know, we've learned a lot from this.

But give us fair hearing. And 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.

And bring us a CSA test standard immediately. Let us have that so that we can kick the tires. For the last six months, I've been telling our test facility, yeah, we'll have the CSA any day now, according to Charlie, put something in your calendar for next month. That's been a conversation I've had with the director in charge of the test lab for the last six months, you know? And I understand they're working the bugs out, but we're anxious for that. We want to be able to prove what our equipment can do for you. And we want to be able to make it better.

We're not asking for anything but a fair shake. That's all I got to say.

MR. FROESS: Hang on, Bruce. I just want to make a quick comment.

I know we were hearing a lot of the same back and forth arguments, and I don't want to diminish anything that's been said by the commenters. But just for the sake of the workshop, feel free to document everything on the

docket and we will respond to it and evaluate it on the Energy Commission basis.

So just to keep the workshop moving, are there new comments or questions from anybody?

But, yeah, go ahead and finish your response.

MR. WILCOX: One very quick response here which is way back in history, this project got started because the DOE minimum single-speed heat pump is a SEER, what, 14. And we were going to -- we wanted to include -- in the performance standard, we wanted to include mini-splits. And so you've got mini-splits that are SEER 33. And so just the very simplistic model says, okay, those machines are going to use half as much energy and they could take a tradeoff based on that.

And so the original idea was, well, let's test these things in a simple way and figure out if that's true. Because if they can do -- 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 so you do this very simple test; right? 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.

MR. SEVERANCE: I'm sorry. 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. But if CSA is -- you know, if we got that test protocol today, it would take us six months to a year to kick the tires and verify that the protocol is repeatable and workable. And it would take your labs the same amount of time.

We have a year in the meantime. 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.

I do have other comments that just have to do with the filtration and CFM requirements. I'm going to save those for later to just take a break from the tit for tat. I don't mean this to be an argument. I really mean this just to like give us a voice and give us a seat at the table, that's all. You know, I keep saying that. And I think, you know, everybody else that I've talked to in industry, that's what they're looking for, as well, You know, let's develop a test standard

that we can agree to.

MR. CONANT: Thank you, Bruce.

Do we have --

MR. WICHERT: Yeah. We have a few online comments.

George, I'll come back to you. I know you had another question. Go ahead. George, are you there?

MR. NESBITT: Yes, I'm here.

MR. WICHERT: Yeah. Go ahead and give your follow-up.

MR. NESBITT: Yeah. George Nesbitt. Yeah. So I'm actually going to make a comment that was relevant to yesterday's workshop, as well as to today's a

So Pat Splitt brought up an issue of heat recovery ventilators. And if you oversize the ventilator you apparently got, you know, somehow, a much better credit. And then one of the Energy Commission staff, it might have been Todd Ferris, I think mentioned that if in a heat pump, you oversize the heating capacity, you put in a higher capacity than it actually has, it helps you improve -- your compliance improvement.

So 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.

And so I think what we have to be -- well, 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, but I don't think we derate a gas furnace, not on its efficiency for sure. We derate air -- a normal split air conditioners based on the fact that we know, well, they're often not charged right, their airflows are low, duct leakage. There's a lot of ways we derate the equipment, as well as we derate the system. And then we give you credit for doing it right and proving you do it right.

So 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?

So -- and I don't want to get into the tit for tat. I spent $5,000 last week to fight my brother and a trustee. Okay. I don't want to get into it. But 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.

And that's all I want to say, you know? That's all I want to say. Thanks.

MR. WICHERT: Thank you, George. We'll go on to the next online question.

Khaled, I'm going to un-mute you now. Go ahead and state your name and affiliation.

MR. SALEH: Okay. This is Khaled Saleh from Goodman Manufacturing. So I have a few comments regarding the presentation, especially the performance.

So if you go to slide number 13, I really agree with the --

MR. CONANT: I sorry. Which slide number?

MR. SALEH: 13, 1-3. So 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.

So looking at these studies, we go (indiscernible). We installed (indiscernible) for (indiscernible) and we installed variable speed, set them on the other identical (indiscernible). They were on it for a year. And collected the actually, you know, (indiscernible) consumption data. And the final -- actually, they did that in four different locations in California. And the 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.

But in these four different locations, they selected two identical rooms. They put in one 14 SEER, in the other one I think it was (indiscernible). And hopefully this study will be considered, you know, before coming up with any conclusion here because it's, again, with controlled study from a research point of view.

Oakridge, not in a lab, they conducted similar (audio cut out) save something between 25 percent to 35 percent with converting that versus 14 SEER (indiscernible) systems.

So this is pretty much --

MR. CONANT: Khaled, can I interrupt you for a second? I mean, you cut out for about five seconds there, maybe about ten seconds back. I don't know if you could repeat that last 30 seconds of so?

MR. SALEH: Okay. So --

MR. CONANT: Starting with Oakridge.

MR. SALEH: Yeah. 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.

This is very much my recommend. 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.

Thank you.

MR. WICHERT: Thank you.

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.

MR. SALEH: Okay.

MR. WICHERT: Our next commenter, Matthew, I'm going to un-mute you now. Go ahead and state your name and affiliation.

MR. CHRISTIE: Thank you. Yes. This is Matt Christie with TRC. Thanks. Yes, I have one comment and three questions. I'll go with the comment first so it's easier to keep the questions in mind for those that will be

answering.

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.

And then my three questions are kind of more operational and logistical about the credit that is being proposed, the 5 slash 12 percent credit that's being proposed and some aspects of it.

So first, 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. That's question number one.

Question number two is just a clarification. 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?

And then in either case, 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?

And then thirdly is, 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?

And then 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?

And that's it. Thank you very much. I look forward to the answers.

MR. MILLER: This is Jeff Miller. Can you hear me? Jeff Miller, Energy Commission Staff.

I couldn't write fast enough to keep up with all those questions, so I'll --

MR. CHRISTIE: I'm happy to clarify them as we go, if you want to take them one at a time, Jeff? Thanks.

MR. MILLER: All right. So the first one that I've made note of is how will the maximum airflow be determined for the HERS verification; is that correct?

MR. CHRISTIE: Correct.

MR. MILLER: So --

MR. CHRISTIE: Yes.

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.

MR. CHRISTIE: 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.

MR. MILLER: Bruce, do you have a comment?

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: Yeah.

MR. CHRISTIE: Thanks.

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.

MR. CHRISTIE: Great. So my second question, Jeff, to remind you and put us back on case, is it says the (indiscernible) ducts and sealed attics of deeply buried, and would that be possibility a permissive path to get some partial

credit or a portion of the 5-12 percent VCHP upgrade?

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?

MR. CHRISTIE: 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.

MR. MILLER: Okay. I understand. And we can consider that.

Mazi?

MR. CHRISTIE: Thanks. And then -- oh, unless there's another comment here --

MR. MILLER: We have some discussion happening. We just want to make sure we're finished.

MR. CHRISTIE: Of course.

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.

MR. CHRISTIE: Thank you.

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.

UNDENTIFIED MALE 2: 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.

UNDENTIFIED MALE 2: -- 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 asking them is if they -- if the systems are to receive that credit, the manufacturer would declare when they certify their equipment to the Commission, that the systems will operate in that manner. And then the follow-up verification by a HERS Rater would first look to see whether the manufacturer had made that certification to the Commission. And then also in the field, to operate that system to see whether the fan continues to run in between calls for conditioning.

MR. CHRISTIE: Perfect. Thank you. I appreciate all the responses. That's it for me.

MR. WICHERT: We have a few questions about the presentation from online. I'll go through them pretty quickly.

From Sreenidhi Krishnamoorthy, "What was

the basis of choosing these systems? Are they most sold systems as of today?"

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.

MR. WICHERT: Okay. Next question. "So on slide 13, do the fans mentioned refer to the transfer fans?"

MR. CONANT: Can you clarify which fan mention you're referring to?

MR. WICHERT: Oh, on slide 13.

MR. CONANT: Oh, slide 13. Yeah. Okay. So, 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.

MR. WICHERT: Okay. Our next question from Doug Maddox, "What was the range of indoor fan power and watts per CFM for the VCHP systems?"

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.

MR. WICHERT: And then our next question is from Brian Bogdan, "For the baseline ducted unit, was the duct work in the conditioned space? I believe it was."

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.

MR. WICHERT: And then the next question, "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?"

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.

MR. WICHERT: And that's it for online.

MR. FROESS: So I just wanted to thank everybody for the comments on this session.

We just want to take a quick break here, maybe a 15-minute break, come back at 11:45, and we can start with Bruce's next session. And at the very end, we'll also have a question and comment period to go over anything presented here, as well.

(Off the record at 11:26 p.m.)

(On the record at 12:36 p.m.)

MR. FROESS: Welcome back. We're going to start the second session of the VCHP workshop presentation.

I just want to remind everybody, for comments spoken, try not to reargue the same

point that was brought up already. Just try to keep it with new facts. And definitely submit written comments, which I'll present at the end of this presentation with the websites and addresses of everybody who needs it, so just to keep it moving forward.

So our next presenter is going to be Bruce Wilcox. There it is. And that's the clicker.

(Colloquy)

MR. WILCOX: Thank you, Larry.

So I'm going to move on to a new topic here which is to explain the implementation of this draft VCHP compliance option in a special version of CBECC-Res 2019 that is now publicly available. The purpose of this is that it can be -- you can exercise the credit and try it out and see how it works and test everything and give us comments on anything that you don't think is right, and so forth.

So I'm going to spend a little time and go through the inputs and how they work and what they are and try and connect that up with what we mean about ducted and unducted VCHP systems that are eligible for this credit. And then I'm going

to show you some results for our prototype building and all the climate zones and how much savings there is and sort forth.

So this is this kind of -- let's see, I can use this. What's on the screen here is a screenshot of the CBECC-Res software. CBECC-Res is the Energy Commission's free public software for use in complying with the building standards. And CBECC-Res is for the low-rise residential standards. There's a comparable CBECC-Com for commercial and high-rise buildings. And a large fraction of the building permits in residential are actually submitted using the performance approach and CBECC-Res either as the software. There are also a couple of private software vendors who are third-party providers of this same calculation engine through their own interfaces. So this is a widely used calculation method and important in California compliance.

So my agenda here is I'm going to talk about the software, I've just already done that to some extent. And then I'm going to talk about the special new VCHP model inputs, and this won't take very long. You've already heard from Abram about most of what that is. And then I'm going

to show an example compliance comparison with a standard design split heat pump and two cases, one where the split heat pump has ducts in a prescriptive attic and one where they're -- the split heat pump has verified ducts in conditioned space and show how the VCHPs compare to that.

So the CBECC-Res compliance software, as I said earlier, provides performance compliance for low-res residential building permits. IF -- many of you who attended the workshop yesterday already heard about the new features of CBECC-Res, so I'm not going to spend much time on this. Compliance is based on comparing energy design ratings, EDR, we call them, a prescriptive standard design with the builders proposed design. And if your energy design rating is less than the standard design, then your design complies.

There are two separate criteria in the 2019 software, one is called efficiency and the other is called total. And efficiency is the traditional components, the envelope of the building, the mechanical systems, the water heating systems and so forth are all part of the efficiency EDR. And then the total includes new

things that we sometimes call flexibility, but the new PV requirement is mostly not in efficiency, it's mostly in the total, and along with other credits for things like batteries and precooling and so forth.

The CBECC-Res software is based on detailed hourly simulations. It uses time-dependent valuation, which is a time varying value for energy, in doing all its calculations. And there's a draft 2019 standards version of that out for public review right now. And there was a public workshop on that yesterday.

So the draft VCHP version is also out and it's, basically, it's exactly the same as the regular CBECC-Res 2019 alpha version, except we've added this option to get a compliance credit for VCHP so people could look at that and see how it fits into the system.

You can download this from the project website. You can get that link and it's the Alpha-VCHP version is the one you want to get if you're going to look at the VCHP stuff.

I wanted to point out that the regular 2019.0.11 Alpha was posted on January 28th but the -- and then shortly thereafter, we posted a

VCHP version. But we found a couple of bugs in that VCHP version and posted a new one on Wednesday this week. So if you're going to do the review, if you've already downloaded the software earlier, please download it again and use the version that we posted on February 13th.

So there's a new input in this version of the software. When you're doing performance compliance and you have -- you don't have a heat pump system in your proposed design, then there are -- there's this big list of different types of heat pumps and they're treated differently in the standards. And you can see what the list is here. The new one at the bottom here is simply, "VCHP - meets requirements of the VCHP compliance option." So the idea is if you meet all the requirements of the compliance option that Abram summarized earlier, then you can select this HVAC system for your proposed design.

And then once you've done that you have an input screen that's tailored to the VCHP system. And you know, it echoes the type and the -- and it tells you what the requirements are. And then the inputs here are -- actually, there's this note in the middle of the page here

which is because of the way this thing is specified -- and for some reason I cannot find the cursor here anymore, there were. I think we need to get out of there. Oh, there it is, hiding under that piece of paper. I don't know need the paper. Okay.

So there's this note here that says that most of these requirements are here for reporting only, don't have any impact on the analysis. And this is basically the algorithm that Abram specified. So the only thing that really matters here, well, there are two things -- three things, the capacity at 47 degrees F for the heat pump because that's actually used in the calculations and that's the rated capacity of the VCHP that you're proposing, and then an AC charge in an input, and whether it's ducted or unducted and the fan certified or not.

So at this point, we're proposing that you'd input this, all this other stuff, that we require for normal heat pumps. But I'm not sure whether we're going to end up doing that or not because if they don't matter, it's not clear that we need to verify them or report them.

So in terms of the individual inputs, the

unducted VCHP input, if you select unducted, the choices are ducted, unducted or partly ducted, and if you choose unducted, then you're done in terms of the duct and fan stuff because that's the one where fans aren't an issue and so forth.

And so what does one of these machines look like? Just here's a picture of an unducted VCHP that was installed at the CVRH houses a while back. And the part that you normally see in a normal house is this air handler that hangs on the wall, or sometimes on the ceiling, and that doesn't have any ducts. What it's got is refrigerant lines and those connect to the outdoor unit. And there's some electrical connections. And then there's a condensate drain. And so this is, you know, in a big way one of the big advantages of the system is that there's no ducting, there's nothing. You know, it's all being handled right there in the room.

So then if you're proposing a ducted or partly ducted system, then you selected either ducted or partly ducted. And then you have the choice of whether it's certified auto fan or not. So if you're -- if the manufacturer that you're going to install have certified that the fan

behaves nicely and only runs when the compressor runs and it's been certified to the Commission, then you check the checkbox for certified auto fan and you're done.

If you can't check that certified auto fan, then you, if you've selected ducted, then you're done and you get 50 watts per ton of continuous fan energy whenever the system is not running in heating or cooling. And if it's partly ducted, you end up with 25 watts per ton of continuous fan energy when the system is not running. So a very simple set of choices here to get this to go.

So what is a ducted VCHP in conditioned space? What are we talking about? I've got some pictures here of an installation that (indiscernible) did to just kind of illustrate what we're thinking about.

So here's a house under construction and there's a ceiling, and here's the interior walls and doors and so forth. And so the idea is one of the ways to do the simple installation that we think works pretty good is that you fur down in a hallway and put a lowered ceiling in and you put the ducted VCHP air handler up in that ceiling

cavity. So here's that. It takes about a 12-inch space to do that, at least for certain systems. A lot of California houses these days have nine-foot ceilings, so it's pretty to fur down hallways and utility areas and so forth.

And then you feed the ducts sort of right out of that. Here's the ceiling (indiscernible) here at the bottom and feed the ducts right out of that into the adjacent room. So there really is short duct runs, very low static, and no reason to get outside the conditioned space with the ducts.

And then air handler fits up into that ceiling cavity and you end up in this case with a return grill and access hatch that's at the bottom, so you can get access to that machine. And it's got the large-sized return filters and so forth.

So this is a ducted VCHP. And we think this is a good solution for maybe a lot of new construction, residential.

All right, so now I've got these tables full of numbers here. I don't expect that anybody's going to right these down or anything. This presentation will be available on the

Commission website by Monday, I think.

But what I'm trying to do here is give you a kind of picture of how things will turn out if you -- with this new version of the software with the VCHP option. And this is for a specific house. And what I've used here is what we call the 2,700 square foot prototype. It's one we use in standards development all the time. It's a four-bedroom, two-story house. It's actually quite similar to the Caleb House at CVRH. And, you know, it's all set up here in these runs with the standard design photovoltaic system.

And in this particular case here with the standard design split heat pump, it's got -- the ducts for that standard design split heat pump are in the prescriptive attic, which means it's a high performance attic with insulation at the roof deck and so forth. And it's meeting the maximum fan watts per CFM and it's -- and so forth. The standard design is sized according to rules at 75 percent of the heating load, so it's not -- it's intended to be a traditional heat pump that's got backup resistance, which is one, you know, one thing that affects its efficiency for the split system. But the VCHP system is

sized at full load. Just being upfront about sizing here.

All right, so what we're showing here is the compliance values. This is the EDR number. And there's one for efficiency, which is in the green here. These columns are the EDR efficiency for the standard design heat pump and for the VCHP. And then we've calculated a difference and a percentage difference in EDR. And then there's the second criteria which is EDR flexibility. And there's the standard in the VCHP and the difference and the percent difference, and then the EDR total.

So if you're going to comply you have to meet the proposed houses, in this case the VCHP case has to have an EDR less than the standard for both efficiency and total. And all of these cases, I believe, comply. And here's the percent differences that you end up with for all 16 climate zones, Climate Zone 1 through 16, and the average is 15 percent compliance margin.

So that's -- this is the new 2019 metric of EDR. And the fact -- and then the new flexibility and efficiency criteria separately. You'll notice that the VCHP has no impact on the

flexibility. It's the same as the standard heat pump because the EDR -- sorry, the VCHP goes into the efficiency side of the equation, along with all the other envelope and water heating and so forth.

So then let's look at, in a more traditional view here, if you're used to the 2016 standards where compliance was based on a comparison of the TDV energy use, this is the same set of values, except it's in TDV per square foot, which is the traditional current 2016 standards metric. And it's, you know, it's basically the same. The percentage differences are slightly different because it's -- the magnitudes of the numbers are different. But it's basically exactly the same picture.

And then for those who are into real energy, here's the kilowatt hours. And so it's got the -- I'm reporting that the standard design heating kilowatt hours, the VCHP heating kilowatt hours, the difference and the percent difference, and then cooling, the same thing, and percent difference. This is just so you can understand maybe how TDV is different than kilowatt hours. And if you want to get your feet on the ground

about kilowatt hours and things that are reported in other studies and so forth, you could do that.

So part of the comparison here is the efficiency credit for the VCHP compressor and operation. And part of it is because the ducts are in the attic for the standard design and not for the VCHP system. So this is giving the total comparison picture and, you know, it's pretty advantageous for VCHPs.

So here's, in order to try and separate out how much of that is due to ducts in conditioned space and how much is due to the efficiency of the machine, I've got a second set of -- a pair of metrics here, a second comparison in which the -- instead of the standard design with the ducts in the attic, it's got standard design with the ducts in the conditioned space. And so this one is -- the difference is strictly due to the efficiency difference -- the efficiency credit for the VCHP machine.

And here we are in EDR terms again. And we end up with an average of five percent credit for efficiency. And again, it doesn't do anything to flexibility. And we get an overall nine percent average. The numbers are bigger in

the more extreme climate zones, the more extreme heat -- cooling climate zones, 17 percent in Climate Zone 15 which is Palm Springs, and not very much in Climate Zone 7 where there's almost no heating and cooling.

I also have the same tables here for the TDV version of that comparison, and the kilowatt hours version of that comparison.

So I encourage you guys to take a look at this and give you an idea about the magnitude of what we're talking about here and also, you know, run the cases that are of interest to you in the software if you're into the details of this thing and see how it works out for yourself.

So the other thing that's not in my tables here is if you said you had a ducted system and you didn't have the continuous fan certification, I calculated an example of what -- how the impact of that would be, just to make sure you guys understand that it's serious. So we got a fully ducted example in Climate Zone 1. In that case, if you have -- if you say you have 50 watts per ton running every hour of the year when the compressor is not running, then you end up using 686 kilowatt hours of fan energy that

are running only in that standby mode.

The total kilowatt hours for the annual VCHP machine are 2550. So that continuous fan operation adds 27 percent to the energy consumption, so these are -- that's a big number. That can wipe out, more than wipe out the savings that I was just showing for the increased efficiency of the VCHP machine DNA the ducts in the attic credit for many of the climate zones. So this is why we're trying to make sure that we keep track of this and get the manufacturers to change their practice to make the default not be continuous in operation and get that certified so it can get to be part of the calculations.

So that's my introduction to the software. And I'll be happy to answer questions or whatever.

MR. FROESS: Yeah. Before we get to the questions, I wanted to put up our final slides here, just to indicate this is our contact information for Jeff Miller for any specific comments that would come in. This is how to submit written comments, which we really are encouraging. The deadline is two weeks from today, March 1st, for prioritization of the

comments. And there's a web link information and address to provide them. So I just wanted to get that out of the way first, Bruce.

And then so now we can take some questions about Bruce's comments -- presentation, or Abrams, but let's try to keep the comments succinct and let's not repeat statements that have already been made.

If there's anybody in person?

MR. SKUARLA: Hi. Mik Skuarla here on behalf of United Technologies Carrier Corporation.

First, we appreciate that we're having a public workshop today. But today, I think we started to have concerns about kind of the ductless variable speed issue in early -- you know, late 2017. And we've talked to Staff a number of times about it and today was kind of the first opportunity we've had to see some of this data.

To that end, 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. And to that end, 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 you 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?

You know, 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, obviously. And for this to be a scientific discussion with -- 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.

So 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 --

MR. WILCOX: Well --

MR. SKUARLA: -- response in the data?

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.

MR. SKUARLA: With you guys but --

MR. WILCOX: I think there's probably no chance the 2018 stuff will be done in two weeks, unless we do something to an ordinary schedule.

MR. SKUARLA: Okay.

MR. WILCOX: 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 --

MR. SKUARLA: Right.

MR. WILCOX: -- you know, the standard publication stuff. And we'd have to talk to the utilities about that, I guess.

MR. SKUARLA: Right. And you know, to that end, if they're able to respond, 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, that whatever the methods are -- you know?

And to that end, 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.

And then there needs to be the near-term, 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.

And 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.

So I appreciate that.

MR. WILCOX: So -- but you -- the first two reports are already published and available.

MR. SKUARLA: Right.

MR. WILCOX: And so you can jump into those, you know, on the plane going home and --

MR. SKUARLA: Well, I'm here in Sacramento, so --

MR. WILCOX: Okay. Well, so, then you've got even more time.

And then 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.

MR. SKUARLA: Yeah. Just, you know, 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.

So thank you.

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.

MR. HAHN: Hello. Bobby Hahn from Carrier.

First, 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 well, so --

MR. WILCOX: You mean as part of a mini-

split system?

MR. HAHN: As part of a VRF system, a mini-VRF system.

MR. WILCOX: This is not a VRF system. This is -- these are VCHP systems.

MR. HAHN: Okay. There are -- pretty much all the manufacturers make a single-phase VRF 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.

MR. WILCOX: Well, are you talking about a ventilation system?

MR. HAHN: No, heat recovery, VRF heat recovery. I don't --

MR. WILCOX: It's not part of an IAQ ventilation system.

MR. MILLER: (Off mike.) (Indiscernible.)

MR. WILCOX: Oh, okay. You're transferring heat from one zone to another?

MR. SKUARLA: Correct. Yeah. And it's very efficient but I didn't see it on the dropdown boxes.

MR. WILCOX: Yeah. Well, first I've ever

heard anyone was marketing those for residential but --

MR. SKUARLA: Okay.

MR. WILCOX: -- we haven't tested them and there's nothing in the standards at this point.

MR. SKUARLA: Okay.

MR. WILCOX: So --

MR. SKUARLA: Okay. They're fairly new, so --

MR. WILCOX: Yeah. I think so.

MR. SKUARLA: Okay. 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.

And earlier 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 but --

(Off mike colloquy.)

MR. WILCOX: Well, so, actually, in 2015, was it, in 2015 we reached out to the AHRI Mini-Split Committee.

MR. SKUARLA: Okay. That would be Paul at that time.

MR. WILCOX: And Paul Doppel --

MR. SKUARLA: Yeah.

MR. WILCOX: -- was there and 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 -- I can't come up with the guy's name. There was a Carrier guy on the committee?

MR. SKUARLA: Rubin Willmarth? Okay.

MR. WILCOX: And so, you know, and they weren't involved in, as we said earlier, I don't want to argue this again, but they were involved in --

MR. SKUARLA: No, no, we don't want that

either.

MR. WILCOX: -- 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. But that's -- so that's the connection.

MR. SKUARLA: Okay. Okay. And I believe that's it for me.

MR. WILCOX: Okay. Thank you.

MR. SEVERANCE: Bruce Severance, Mitsubishi Electric. I guess I really have more questions than anything. I'm trying to understand what you're proposing.

And is there -- first of all, is there a timeline on how soon the residential VCHP modified CSA test procedure is going to be available? Has anybody at CEC or any associated consulting groups that are working on this, have any of you been given a promise of when that's going to be delivered?

And so, you know, 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? And do you have a plan or

a program to reach out to manufacturers to get manufacturers to --

MR. WILCOX: Yeah. Well,

MR. SEVERANCE: -- participate in that kind of beta test of the procedure?

MR. MILLER: Staff have talked about timelines and determined that since we have documentation to present that gives more detail on HERS verifications and certification procedures, we'd have one more workshop and make those materials available for public review. And we'd have a subsequent version of the software to present at that workshop also. And a timeline for that workshop would likely be a couple of months from now. And the horizon for approval of the comp op, we're thinking approximately August business meeting.

MR. SEVERANCE: So we're --

MR. MILLER: Excuse me. So I don't think you answered his question, Jeff.

MR. WILCOX: Yeah. I think you were asking about the CSA procedure that we talked about as a --

MR. SEVERANCE: Yeah. I'm taking about the --

MR. WILCOX: -- future (indiscernible); right?

MR. SEVERANCE: -- modified CSA that NEEA has been working on for ten years.

MR. MILLER: Oh, I totally misunderstood your question.

MR. SEVERANCE: Yeah. So it's a test procedure that's 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.

So you know, I keep going back to that because I think that's going to be the way that we kind of resolve all arguments here, right, is if we can turn the lights on in the room and see what's happening, and manufacturers have an opportunity to go back and rewrite control code and resolve whatever issues under whatever test conditions you're encountering those, that new

CSA test procedure is really going to take a look at -- well, there's two regiments, you know, that Charlie Stevens has developed. There's a marine climate regiment and a dry climate regiment, which I think is really warranted. So it's looking at a whole, much larger range of data points relative to performance and a much more accurate mapping of a performance curve.

You know, so the key question is that that's, A, repeatable, the test procedure is repeatable, that it's accurate and, B, that it's not something that's going to quadruple the time in a test lab trying to execute the test so that we can actually schedule and appropriately test a sufficient body of equipment for the California market without completely impacting our test schedules on other equipment for other markets.

So there's some wild cards in there and that's why we're anxious to, you know, see how -- you know, Mitsubishi is anxious to see that come to fruition so we can test it. And 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 lap 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.

MR. WILCOX: Well, there's --

MR. SEVERANCE: And my guess is that's going to take a year.

MR. WILCOX: Well, it's going to --

MR. SEVERANCE: You know, so we're really talking about --

MR. WILCOX: -- a year or more. You know, that's -- 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.

MR. SEVERANCE: Yeah. I think the main testing is being done at Purdue. And the only thing that remains, according to Charlie, and the

last time I talked to him was a couple of weeks ago, is there's some sheet metal device that helps them verify the correct amount of airflow relative to possible static pressure changes. You know, so there's some very detailed work that he says is just kind of like the finishing touches. So they're putting -- you know, the icing is almost on the cake.

MR. WILCOX: But it's -- that's a standard that's not for public review.

MR. SEVERANCE: Okay. So --

MR. WILCOX: It's not published; right? So there's kind of --

MR. SEVERANCE: That's my --

MR. WILCOX: -- indeterminate --

MR. SEVERANCE: -- that's my point.

MR. WILCOX: -- how long it's going to take.

MR. SEVERANCE: So here's where we are is we're a year to a year-and-a-half away from having a test procedure that's been verified that everybody kind of likes, that the California Energy Commission has embraced, that, you know, a handful of manufacturers have embraced at that point. And we have an interim year-and-a-half.

And 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 --

MR. WILCOX: Oh, yeah.

MR. SEVERANCE: -- continuously, is that part of the CSA --

MR. WILCOX: No, that has nothing --

MR. SEVERANCE: -- added on to the CSA test --

MR. WILCOX: No.

MR. SEVERANCE: -- 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?

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. You know, Payam is the guy in charge here.

What do you say, Payam?

MR. BOZORGCHAMI: So this is a compliance option. A compliance option really doesn't have

a timeline per se, this is an alternative. So what's going to happen is this is going to have to go through some sort of business meeting. And the timeline that we were kicking around here at the office was trying to get into the August business meeting, August of 2019 business meeting (indiscernible) for now.

Now that doesn't mean that in a year, a year-and-a-half from now if CSA or URL or whoever comes up -- or Purdue, excuse me, in that matter, comes up with a valid testing procedure, i.e. CSA, that we cannot make those modifications at a later time.

For now, we need to get some sort of a credit into CBECC-Res so you guys can do some business out here.

MR. SEVERANCE: Okay. So we have to be able to certify --

MR. WILCOX: Just to --

MR. SEVERANCE: Yeah. Go ahead.

MR. WILCOX: -- just to be clear here, 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.

MR. SEVERANCE: Yeah.

MR. WILCOX: We have -- 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.

MR. SEVERANCE: Okay.

MR. WILCOX: So --

MR. SEVERANCE: 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?

MR. WILCOX: No, no. We got those.

MR. SEVERANCE: Is there --

MR. WILCOX: We got a list of all the NEEA certified heat pump water heaters in CBECC-Res right now.

MR. SEVERANCE: So you just pull down, select the model that you're using --

MR. WILCOX: That's right.

MR. SEVERANCE: -- and all the data drops in?

MR. WILCOX: That's right.

MR. SEVERANCE: Okay. So you would do --

MR. WILCOX: And so --

MR. SEVERANCE: -- you would do something similar if we --

MR. WILCOX: Well, let's --

MR. SEVERANCE: -- if we had --

MR. WILCOX: Yeah.

MR. SEVERANCE: -- a similar test from NEEA --

MR. WILCOX: Yeah.

MR. SEVERANCE: -- 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 --

MR. WILCOX: Yeah.

MR. SEVERANCE: -- test protocol?

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.

(Colloquy)

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. Sorry. I apologize.

MR. SEVERANCE: Okay. 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?

MR. WILCOX: Go ahead, Jeff.

MR. MILLER: Yeah, essentially. Staff will create a document that you would certify those, that your equipment conforms to this.

MR. SEVERANCE: 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 --

MR. WILCOX: No, no, they just -- they

look it up on the list and if that model number is listed, then you're in.

MR. SEVERANCE: Okay. So that's all that he HERS Rater --

MR. WILCOX: And this is --

MR. SEVERANCE: -- needs to verify?

MR. WILCOX: -- this is done for lots of different equipment actually.

MR. SEVERANCE: Yeah. Well, I just wanted clarity on how --

MR. WILCOX: Yeah.

MR. SEVERANCE: -- that is confirmed in the field, that's all.

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.

MR. SEVERANCE: So they would have to be at the house for --

MR. WILCOX: This is beside me.

MR. SEVERANCE: -- a period of time to watch it --

MR. WILCOX: I've never heard --

MR. SEVERANCE: -- cycle.

MR. WILCOX: -- this before.

MR. SEVERANCE: Yeah. Okay. Right.

MR. WILCOX: I think you made that up.

MR. SEVERANCE: Yeah. Okay. 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.

So the other --

MR. WILCOX: So, Bruce --

MR. SEVERANCE: -- specification that I had --

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? You might --

MR. SEVERANCE: Well, it would be --

MR. WILCOX: -- you could --

MR. SEVERANCE: -- either or; right?

MR. WILCOX: No. They could coexist

easily.

MR. SEVERANCE: So you would still need a letter certifying --

MR. WILCOX: No. We --

MR. SEVERANCE: -- that the algorithms --

MR. WILCOX: Well, I mean --

MR. SEVERANCE: -- aren't running continually, the fan isn't running continuously?

MR. WILCOX: If you're going to submit your CSA test results, you're going to need more than a letter. I mean --

MR. SEVERANCE: Well, no, no. 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 --

MR. WILCOX: Well, I think --

MR. SEVERANCE: -- the equipment rated.

MR. WILCOX: -- you know, it's -- at this point the CSA option is kind of a concept because it's at the stage --

MR. SEVERANCE: Really?

MR. WILCOX: Well, because the standard is not approved yet. And in fact --

MR. SEVERANCE: Well, it's --

MR. WILCOX: -- you're the first manufacturer I've ever heard say --

MR. SEVERANCE: -- if you build it, they will come.

MR. WILCOX: -- anything positive about

it, so --

MR. SEVERANCE: You know, it's, you know, to me, I think this is more than theoretical. I mean, Charlie has been working on this for ten years.

I understood the State of California was like the BPA states who are interested in it. New York is interested in this. This is -- you know, there's probably a population of 100,000 in the United States that's interested in possibility implementing this new test procedure. So of course, manufacturers are taking that seriously. And we understand that it might be too expensive to test a wide range of equipment, so it may only be a few selected models or lines that we end up hand picking for the California market. And you know, everybody has their opinions about what that should be.

So -- but the point is that that's a very rigorous test standard. 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. What it gets -- how it gets tested is how --

MR. WILCOX: I've been being nice all day. I didn't mention Volkswagen even once. You brought it up.

MR. SEVERANCE: Well, you know, the reason I feel defensive about that is clear, that 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.

So 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 --

MR. WILCOX: Well, I mean --

MR. SEVERANCE: -- models or --

MR. WILCOX: -- I did not conduct a survey. And -- but I'm -- the assumption we're operating under is that installed correctly, those systems will deliver airflow, just like any other system, and that's --

MR. SEVERANCE: Well, you know, low ESP systems are running at 0.1 to 0.2 inches of water column.

MR. WILCOX: Right.

MR. SEVERANCE: Their, 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?

MR. WILCOX: No. That's --

MR. SEVERANCE: 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.

MR. WILCOX: Well, I'm -- that's not -- I don't think that's true. So that number comes from --

MR. SEVERANCE: Can we be sure? Can we be sure? Can somebody conduct a survey of that please?

MR. WILCOX: So a survey? We know --

MR. SEVERANCE: Well, I mean, if you're --

MR. WILCOX: -- we know that there are systems out there that will meet this requirement because I showed you pictures of them. I mean --

MR. SEVERANCE: Well, is that an outlier or is that the mean of --

MR. WILCOX: No, I don't think so.

MR. SEVERANCE: -- you know, is that -- 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.

MR. WILCOX: And that's absolutely true.

MR. SEVERANCE: Okay. So --

MR. WILCOX: But they —

MR. SEVERANCE: -- 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.

MR. WILCOX: I mean, we could certainly do that.

MR. SEVERANCE: Yeah.

MR. WILCOX: Personally, I have not done that survey. I didn't --

MR. SEVERANCE: Okay. So --

MR. WILCOX: -- think it was an issue.

MR. SEVERANCE: -- 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 --

MR. WILCOX: (Indiscernible.)

MR. SEVERANCE: -- a sealed ducted mini-split compartment in a hallway. Is that what we're looking at?

MR. WILCOX: Yeah, that's right.

MR. SEVERANCE: Okay. 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?

MR. WILCOX: No. I believe it's a standard piece of equipment but I'll --

MR. SEVERANCE: Okay. So the question I have is: Is there ducting between that filter grill and the return side of the ducted mini-

split --

MR. WILCOX: My understanding is not.

MR. SEVERANCE: -- behind it? Okay. So 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?

MR. WILCOX: Yes.

MR. SEVERANCE: So how -- what's the test procedure for doing that?

And then 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?

MR. WILCOX: No, there's no duct leakage requirement.

MR. SEVERANCE: There's no duct leakage requirement in --

MR. WILCOX: There's a requirement to have no duct leakage outdoors but there's no overall duct leakage.

MR. SEVERANCE: Okay. So as long as

there were ducts in this conditioned space, there's not duct leakage requirement; is that what you're saying?

MR. WILCOX: I believe that's the case.

MR. SEVERANCE: Okay. So I think that should be in writing somewhere. And if --

MR. WILCOX: You can try reading the (indiscernible) but --

MR. SEVERANCE: 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 --

MR. WILCOX: Well --

MR. SEVERANCE: -- a standard applications manual that the CEC, you know, comes out with.

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.

MR. SEVERANCE: Well, 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?

MR. MILLER: The standards don't allow that.

MR. SEVERANCE: Okay. 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 --

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.

MR. SEVERANCE: Okay. I understand that. 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.

MR. WILCOX: Okay.

MR. SEVERANCE: 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?

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.

MR. SEVERANCE: Right. That's why I'm asking this.

MR. WILCOX: 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.

MR. SEVERANCE: Okay. So you're giving us a credit to account for that? That's --

MR. WILCOX: That's right.

MR. SEVERANCE: I hadn't understood that.

MR. WILCOX: Yeah. No, I mean --

MR. SEVERANCE: And I do appreciate that clarification.

MR. WILCOX: Yeah.

MR. SEVERANCE: 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.

And in the interim, this is a problem that I think came up in 2011 and hasn't been fixed yet, and it has been something that has inhibited sales for manufacturers in California. I could get into anecdotal stuff but we've literally gotten phone calls from architects in Bakersfield that were trying to get stuff through plan check and the planner said, oh, it's not on the listing. You can't use Mitsubishi. You're locked out. And we got back to them and say, no, here's a letter dated 2011 from somebody at the CEC that says the AHRI listing is sufficient until they fix their website. And the guy says, that's too old. We're not going to honor that.

And you know, we have numerous cases of this happening. It started lighting fires in the department I report to. We would just love to see some serious cooperation between your staff and AHRI to resolve this problem.

There's a letter still on the website, I

found it last night. It's under bulletins. It's not even under where the listing itself is. There's no notices on any of the listing pages. There's over 65,000 units listed on the CEC website and it's to the exclusion of many, many models that are actually approved by the CEC. And there's nothing on any of the pages, there's probably 1,400 pages of listing.

And what 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.

Because we've tried to explain this to clients in the field, to our dealers, and everybody's scratching their heads, saying how could this possibly be the case? So --

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. How's that?

MR. SEVERANCE: I'd really, really appreciate that.

And 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.

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. NRDC, I know, feels very strongly about this. And 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.

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.

So 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.

Thank you very much.

MR. HUNT: Hi. This is Marshall Hunt with PG&E consulting, or I consult for PG&E. I

was an employee of PG&E to do the SCA EXP-07. And I can shed some light on the standard.

Yes, Charlie Stevens has been a great mover and shaker in this, but we also have Purdue involved. And at this moment, we're having a goal of testing 30 systems in commercial labs, starting with UL, who was the first lab to set up, to step up and do the testing. 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.

So I, too, wish it would come out any moment. I hope it's soon. And after it comes out we'll run a lot more testing. And we're getting various energy efficiency groups to support more and more testing at commercial labs, because we've done our research lab work but now it's time to get Intertek and UL and others to test it.

I might mention that Natural Resources Canada got UL to test the very, very cold

conditions, which our lab can't even test, down to minus 15 Fahrenheit or something.

So it's under process, it's in the works, and I appreciate your support of it. And I'd be happy to keep in touch with you. I hope that helps you all understand.

But the bottom line, it's not here, it may not be here for a year, but we hope that the 30 tested units will begin to populate the database.

MR. MOHAN: Hi. Richie Mohan from Goodman Manufacturing. I just want to clarify a couple of things, the first thing being that, yes, you know, we had a working group.

And first of all, unfortunately, AHRI could not really make it over here in person but I believe somebody's there on the phone right now.

You know, we did have a working group for this particular project, the VCRH project, you know, set up a couple of years ago, well, I would say three or four years ago. And this was under the purview of the HRI ductless equipment section. So you know, at that point in time, we did make some selection criteria that was, you

know, shared by the manufacturers to perhaps, you know, Bruce and your team.

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.

You know, 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.

So just, that's all, so thank you.

MR. FROESS: So if there's nobody else in

the room, we'll go take some online.

MR. WICHERT: George, if you're ready, I will un-mute you now. Go ahead with your -- it looks like you might have lost audio, George.

(Pause)

MR. FROESS: We're searching to see if there's any more online comments.

MR. WICHERT: Yeah, George, please submit your -- oh, it looks like you're back online. I'll go ahead and un-mute you now.

MR. NESBITT: First, can you --

MR. WICHERT: Oh, you're --

MR. NESBITT: -- can you hear me?

MR. WICHERT: Yeah, we can hear you, just right now. Yeah.

MR. NESBITT: Yeah. (Indiscernible) called back in after lunch but it didn't work right. George Nesbitt, HERS Rater.

Gosh, let me go back to 1994. Radiant heated slab, code required slab edge insulation. The compliance forms showed R-0. They showed R-0. They showed R-0 because it was required by code, therefore, the building didn't enforce it. The energy consultant admitted, yeah, it's required but, you know, nobody puts it in.

So this comment is very related to yesterday. You missed the offline -- the online people yesterday at the end of the day.

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.

And actually, if, Bruce, if you could put up your slide on the detailed heat pump input, I'd appreciate that.

So you've made a comment. So because you are -- because we're not allowing the full rated efficiency to have credit, I believe you have, for one, the little note. So you have the SEER and EER for reported only, no analysis impact. And I think that's fine. And I think -- so you were -- yeah, right there. That slide.

MR. WILCOX: We tried to click on it.

MR. 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.

That's my real main comment.

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.

MR. NESBITT: Right. 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.

Then the other thing I want to hit back on because the Mitsubishi Bruce brought up again, 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.

MR. FROESS: Okay. Thank you, George.

Is there anybody else? Okay.

Well, I want to thank everybody for attending the workshop today. A lot of good comments. And again, we really encourage the written comments to be submitted for everyone to review. And we will -- we'll begin our review

process for all the comments that come in.

Yeah, and then so Monday is a holiday, we'll probably post all these workshop presentations on Tuesday. And then when the transcripts come in, we will post them as well.

So thank you very much.

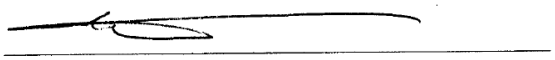
(The workshop adjourned at 1:54 p.m.)

REPORTER'S CERTIFICATE

I do hereby certify that the testimony in the foregoing hearing was taken at the time and place therein stated; that the testimony of said witnesses were reported by me, a certified electronic court reporter and a disinterested person, and was under my supervision thereafter transcribed into typewriting.

And I further certify that I am not of counsel or attorney for either or any of the parties to said hearing nor in any way interested in the outcome of the cause named in said caption.

IN WITNESS WHEREOF, I have hereunto set my hand this 7th day of March, 2019.



PETER PETTY
CER**D-493
Notary Public

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I do hereby certify that the testimony in the foregoing hearing was taken at the time and place therein stated; that the testimony of said witnesses were transcribed by me, a certified transcriber and a disinterested person, and was under my supervision thereafter transcribed into typewriting.

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I certify that the foregoing is a correct transcript, to the best of my ability, from the electronic sound recording of the proceedings in the above-entitled matter.

March 7, 2019

MARTHA L. NELSON, CERT**367