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CALIFORNIA ENERGY COMMISSION

In the Matter of:

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Calculation Method Variable)
Capacity Heat Pump Modeling)
Approach)
_____

PUBLIC WORKSHOP

WARREN-ALQUIST STATE ENERGY BUILDING

FIRST FLOOR – ROSENFELD HEARING ROOM

1516 9TH STREET

SACRAMENTO, CALIFORNIA

THURSDAY, FEBRUARY 14, 2019

9:00 A.M.

Reported by:

Susan Palmer

APPEARANCES

STAFF

Larry Froess, Moderator, Senior Mechanical Engineer

Christopher Meyer, Manager, Building Standards Office

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PRESENTERS

Mazi Shirakh, Project Manager, California Energy Commission

Dee Anne Ross

Todd Ferris, Supervisor, Software Tools Unit

PUBLIC COMMENT

Patrick Splitt, App-Tech, Inc.

Megan Cordes, ConSol

Pierre DelForge, NRDC

Joe Cain, Solar Energy Industries Associations

Bruce Severance, Mitsubishi Electric

George Nesbitt (via WebEx), Independent HERS Rater

Jeremiah Ellis, Duct Testers

Mike Hodgson (via WebEx), ConSol

Meghna Chowdary, SolarEdge

Mr. Yamasaki (via WebEx)

APPEARANCES

PUBLIC COMMENT

Cathy Chappell (via WebEx)

Eric Adair (via WebEx) Hearths, Patios and Barbecue Association

AGENDA

P R O C E E D I N G S

9:07 A.M.

SACRMENTO, CALIFORNIA, THURDAY, FEBRUARY 5, 2019

MR. FROESS: Good morning everyone. Welcome to the 2019 Alternative Calculation Methods Reference Manual and Software Update Workshop for Residential. My name is Larry Froess. I'm the Senior Mechanical Engineer with the Energy Commission, and also the Project Manager for the ACM and the software. Along with me is Mazi Shirakh, and we have Dee Anne Ross and Bruce Wilcox to help with the presentations.

First, let me do a welcome introduction, which I just did, and some housekeeping items here.

First, in case of an emergency and we need to evacuate, please follow the staff to the Roosevelt Park, which is across the street. There are restrooms in the atrium just outside the door to your left. And there's a snack room up the stairs to the right up on the second floor.

We are broadcasting today with WebEx. All parties should be aware that the entire

workshop is being recorded.

For in-person participants, please sign in or staple your business cards to the sign-in sheet available at the table in the lobby.

We will post electronic copies of this presentation on the CEC website in a few days.

For WebEx participants, you will remain muted until you make a comment. Please use your hand-raise function during the public comment period to notify our WebEx coordinator that you want to make a statement. Online remarks will be taken after in-person comments in alphabetical order.

And for those in person making comments, please bring a business card to our court recorder or -- and state your name and affiliation before you begin speaking.

This is our general agenda for the day. We'll have a quick overview of the ACM manual and software. Then we'll get into the energy design rating, or EDR, discussion, photovoltaics and demand response. And then after that, we'll have a public comment period. Then we'll jump into envelope HVAC and water heating topics. And then we'll have a public comment period at that point.

It depends on how this presentation unfolds. If it's -- if we're ahead of time, we may not break for lunch since that last, Field Verify, HERS provider file upload and miscellaneous, probably those are going to take 15 minutes to 20 minutes to a half-hour. So if we're at 11:30 and we're done with water heating, maybe we can just push through and not take a lunch, so we'll just have to see how that goes.

And I think our Office Manager, Christopher Meyer, wanted to make a few opening comments before we begin.

MR. MEYER: Hello everyone. Thanks for joining me. I'm Christopher Meyer. I'm the Manager of the Buildings Standards Office. And I just wanted to say a quick thank you to everyone who's, you know, made the journey out here to help us, you know, have a better process. And thank you everyone for all your help over the code development cycle for all the comments made in our rulemaking process and the communications you've had with our staff to make sure that the end product has been as good as possible.

And just to give you sort of a message from Commissioner McAllister, who's our Lead

Commissioner and who's been guiding and supporting us throughout this process, that, you know, he's been very supportive and very direct with Staff of how important is it for us to have standards that are enforceable, that are achievable in the field, and how important for us to have the ability for people to go out and build the projects and understand how they comply and how to make them comply with the standards.

So this workshop is very important, just to make sure everyone understands, you know, what the rules are and how to comply with them and how to, you know, model the buildings that are coming out. So thank you for your participation and thank you for helping us out today.

MR. FROESS: Thank you, Christopher.

So we'll start with a quick overview of the ACM. What it is, the residential ACM is a reference manual, is what describes the rules that are generated based on the proposed inputs. So it will create a standard design model based on prescriptive requirements. There's also a reference design model that Mazi will get into in his presentation that establishes a secondary baseline for the proposed model. And everything

will then get reported on the proposed design on their certificate of compliance.

The software that does it all is the California Building Energy Code Compliance, or CBECC, CBECC-Res. And today's version that we have releases is an alpha version for public review. And then we will have a prior version available before the business meeting where then it gets presented to be approved. And once approved, it will be allowed to be used to show compliance for buildings.

With that, here's Mazi Shirakh.

MR. SHIRAKH: So good morning. I'm Mazi Shirakh. I'm the Project Manager for zero-net energy, decarbonization, and anything that has to do with the PVs and battery storage.

The CBECC software underwent a major upgrade for the 2019 standards. We added a bunch of cool stuff, like PVs and battery storage and grid harmonization strategies. And we've also switched to an EDR, or an energy design rating, metric to demonstrate compliance, which is different than the past, so I'll be talking about this topic this morning.

I'm going to go through both my

presentations, EDR and the PDM battery storage first, and then we'll take questions. If you have a specific question on a topic that's on the slide, I'll be happy to take that. Otherwise, for general discussion, please wait until the public comment.

So we switched our energy design rating metric. And to do that, we aligned with RESNET. We use a 2006 IECC compliance building as the reference building and we compare our proposed building to that. The scores range from zero to 100; 100 is a building that is good -- as bad as 2006 IECC. And zero means full ZNE. We use TDV as the metric for this determination. For 2019 standards the EDR score for buildings that include the PV system range from 15 to 27, to give you an idea.

And one of the advantages of EDR is that we worked with builders and other stakeholders and we came up EDR performance targets. And then the builders are free to basically get to that EDR target anyway they want. So this was an attractive feature for many of the stakeholders.

EDR has three components, an energy efficiency EDR, there is an EDR for PV and demand

flexibility, and a total EDR. For a building to comply the EDR score of the proposed efficiency must be equal to zero or less, that's the proposed EDR should be equal or less than the standard EDR for efficiency. And similarly, for a total EDR the proposed EDR must be equal or less than the standard.

I've included some screen shots here to illustrate that, first of all, on the right is a graphic depiction of how the EDR scale works. Up here is a square of 100, that's the 2006 IECC compliant, and down here is a full ZNE. For the 2006 standards, for instance, the EDR score was about 65. For 2019, without the PV system, efficiency only, it was in the 41 to 48 range. And when we include the PV, we were in the 15 to 27 range.

And the software will report these. This the standard efficiency EDR. And down here is the proposed. And the proposed must be equal or less, which is the case here in this example I have.

For the EDR of PV plus flexibility, which includes battery storage, the proposed EDR must be equal or greater than the standard EDR. So I

modeled this building, assuming the 14 kilowatt-hour battery storage. That's why you see this number to be larger than that. And finally, the total EDR of the proposed must be equal of less.

And down here you can see, this is the reference building and this is the proposed building, you can see how these numbers are so much lower for the 2019-compliant building because it's so much more efficient. For instance, the space cooling for the reference building, the kilowatt-hour consumption is 1,769, for the proposed building it's 422. This is in Climate Zone 12, Sacramento. And that's why these EDRs are so much lower.

The photovoltaic requirements, some changes there. First off, in the 2006, the current code, we have a compliance credit which is called a PV Compliance Credit. And this was a credit that allowed tradeoffs between PV system and building envelope features, such as high-performance attics and walls. For the 2019 standards, that compliance is gone, it's been removed.

So there is, for the first time, a minimum PV requirement. And the size is

determined by the annual kilowatt-hour consumption of the house. The software will calculate the annual kilowatt-hour consumption of the house based on the efficiency features of that house, walls, doors, windows and equipment, calculates the annual kilowatt hours. And then it has the weather file, it knows, you know, how many cloudy days and all that, so it calculates based on the parameters or attributes of the PV system, what size PV you need to, basically, satisfy those annual kilowatt hours.

And by the way, that determination is set by the NEM 2 rules. Basically, the NEM 2, the Net Energy Meeting Rules, prohibit sizing the PV system that's greater than the consumption of the house. It doesn't really prohibit it, it just -- you're not going to get compensated for it, so you're donating those electrons.

And the PV is sized to displace the entire annual kilowatt consumption of the house. This includes both regulated and unregulated loads. Space heating, cooling, IAQ, water heating, battery storage -- you know, battery storage has some draw because of the roundtrip efficiencies -- interior lighting, appliances,

cooking, plug loads and exterior lights, so it's anything that's attached to a house. And for the time being, this does not include electric vehicles, so that's outside of it.

And the users may use either a simplified approach. You know, if you have a clear roof that's facing south, there's no obstruction and all that, you can use a simplified and, you know, it's easy and it has a lot of preset defaults, or you may use a detailed approach where the user can define the attributes of the PV system, including the modular efficiencies, invertors, orientation, and shade.

We instituted a number of exceptions, prescriptive exceptions into the standards. This was kind of worked between staff and the builders and architects. And we also incorporated the same exceptions into the CBECC software, and there are five of them. And -- but before we understand the exceptions, there's some definitions we need to understand.

One is annual solar access which is the -- solar access is the ratio of solar insulation, including shading over -- solar insulation without shading. So you know, if you

a PV system that's sitting on the roof and it's unshaded, so that gets the maximum solar access. But if you have some shading, then you're proposed annual solar access is going to be lower than that. So the annual solar is the ratio of those two.

Effective annual solar access shall be greater than 70 percent or greater of the output of unshaded. So basically what that means is that as long as you've got areas on the roof that have -- their solar access is greater than 70 percent of an unshaded system, then, you know, we think that's a good candidate where this -- that's a good area where you can put your PV systems on.

Sir?

MR. SPLITT: Pat Splitt from App-Tech.

Has the shading been defined? Like shadows move throughout the day and throughout the seasons. Do you have some definitions of on what shade is?

MR. SHIRAKH: Yes. And those are all described in great detail in the Residential Compliance Manual, you know, how to determine shading and all that. But you know, in general,

you have to -- you know, if you inspect a roof and, you know, it's clear, there's no shading, there's no obstructions, then you can basically assume there's no shading. But if there are adjacent buildings, if there is chimneys, vents and all that nearby, then some documentation is required.

And there are several tools that are available to determine the annual solar access. One of them is like a semi-type of a device where, you know, the installers will go on the roof and they can take a visual of the trees and of buildings and it generates an annual report, and that is acceptable. And there's also other tools. And again, as Larry suggested, you read the Residential Compliance Manual.

MR. SPLITT: I usually wait until all the dust settles before I look at that stuff with --

MR. SHIRAKH: Yeah.

MR. SPLITT: -- directions. But the question is, I'm working on designing a building there isn't a roof to get up on yet. The roof doesn't exist, so you have to make a bunch of assumptions.

MR. SHIRAKH: So, I mean, is it a new

construction of is it a --

MR. SPLITT: New construction, yeah.

MR. SHIRAKH: Is it in a development of is it in a --

MR. SPLITT: I'm from Santa Cruz. We don't have developments.

MR. SHIRAKH: Santa Cruz. So you know, you'd kind of need to look at the neighborhood. You know, I actually have a friend who's doing this. In Downtown Sacramento there's big trees, so it's very obvious that he has shade on it. So you can proceed as if there's no shade. You can always amend that. You know, once there's a roof, you can amend the CF1R, once you have the actual roof and you know the exact shading and the place where the chimneys and all that, and adjacent buildings, you can always amend the CF1R at that time.

MR. SPLITT: Thanks.

MR. SHIRAKH: So the PV, there are five exceptions. The first one is kind of like the example I was just talking to Pat. You know, it's a building. It's in a neighborhood that's existing or, actually, it could be like in the redwoods. There's no -- not enough solar access.

So in that case, if the roof is completely shaded, there is no PV requirements.

But if there is some areas of the roof that's more than 80 contiguous square feet that has, you know, decent solar access, then the rule is that then you can put in as much PV system as possible to -- within that available roof area.

Otherwise, if there is no access, then nothing is required.

The next three exceptions, two, three and four, these are exceptions that modify the PV size requirement but don't exempt it. It's a recognition of situations where there may be -- there may not be enough roof area to accommodate the prescriptive PV size. One of them is Exception Number 2 in Climate Zone 15, which is the most severe climate zone in the state. And in this climate zone, you end up with an unusually large PV system because of the heavy summer cooling requirements.

So then the requirement is that the PV system shall be the smaller size that can be accommodated by the effective annual access, what's practical is the smaller of what's practical or feasible, or the PV size required by

equation one, and equation one basically means the prescriptive requirement, but no less than one-and-a-half watt per square foot of the conditioned floor area.

And so we looked at several plans for this and, you know, we found that this one-and-a-half watt per square foot is feasible, even in Climate Zone 15. Essentially, what that does, if there is a restriction on the roof, it reduces the PV requirement in Climate Zone 15 and brings it in alignment with Climate Zone 13, which is the next most severe climate zone in the state.

Similarly, Exceptions 3 and 4 deal with the buildings that may be two or three stories high. And as you go up in the number of stories the roof area becomes smaller relative to the conditioned floor area. And you may have restrictions or limitations on how much PV you can put. And the approach is the same; you know, you either have to put the smaller of what's feasible or the prescriptive requirement but in no case, in the two habitable story case, you cannot put a PV system that's less than one watt per square foot. To give you an idea, a 2,700 square foot home in Sacramento requires about 3.2

kilowatt system. With this exception, that requirement drops to a 2.7 kilowatt system, and it's about a half-a-kilowatt drop.

Same thing for three stories, except in this case the minimum requirement drops down to 0.8 watt per square foot of conditioned floor area.

And the last one is an exception for dwelling units whose plans are approved prior to the effective date of the standards but they haven't really pulled the permit yet. And they may have pulled the permit even after the effective date. So this is like a one-time exception. And in those circumstances, what the exception is saying is that, you know, we give you a pass if, you know, you didn't think carefully enough about your roofline. And you know, you can get away by putting a much PV system as you can. And if there is -- there's no good roof area, you could be exempt. But again, this is a just a one-time pass for these buildings.

Other features of the software, one of them is an automated PV sizing for EDR targets. So this is a cool feature we added, mostly

because I was really frustrated because I was trying to find out what the PV size would be for various EDR targets for Reach Codes. And as you know, Reach Codes could specify lower EDR targets for both Tier 1 and Tier 2. And then, you know, you've got different climate zones and you've got -- you know, you keep changing this with that. And you know, without this feature, it became really frustrating, so, you know, we added this now. You can model your building with all the cool features that you want and you can specify, you know, your batteries if you have it and all of that. You put your target EDR and the software will calculate the amount of PV system that you need. It's convenient for Reach Codes when a lower EDR target is specified. And it's calculated based on the actual features of the house. And it's really good for if you're doing iteration in incremental runs.

So there's some situation when the PV size may be -- may have to be oversized. Per the -- you know, the NEM rules say, you know, this is the limit but, you know, you may want to go beyond that. There's several reason for going beyond.

One of them is that, you know, these are simulated results. These are not actual consumption of the house. I mean, the house that's occupied could behave differently, the occupants, and what we assume an average occupant is. And also, there could be additional loads in the house.

So for Title 24, Part 6, the software automatically calculates the PV size for the house that is compliance with the NEM rules. But for Reach Codes, as we mentioned, you know, you may have a jurisdiction that will go to a lower EDR, like ten, or even zero. And in those cases, to get to those scores, you may have to oversize the PV system. And the software will allow you to do that as long as you specify a battery storage system that's JA12 compliant and has a capacity, storage capacity of at least five kilowatt hours. And if you install this battery storage, five kilowatt hours, the software will allow you to oversize the PV system by a factor of 1.6.

In our simulation, we found, with the battery storage system, in most climate zones, even with an oversize factor of 1.3 or 1.4, you

can get very close to an EDR score of zero, so 1.6 is actually very generous.

But there may be other situations where you have to even exceed the 1.6. For instance, if you're expected to have -- the occupants, you know, want to have the EVs in the premise, then the software will allow you to bypass the 1.6 sizing by checking a checkbox. And at that point, you can put in any PV system. But the software will warn you that this may violate the NEM rules and you better consult with your local utility before you do that, otherwise, just because the software says you can oversize, it doesn't mean you can. You need to check with the local utility. And in most cases, you know, if you have a good justification, they'll probably let you.

So another concept that's new in 2019 standards is community solar. You know, everybody talks about the PV system as an onsite requirement on their roof but the standards do provide an alternative to the onsite PV system, which is community solar. And once and if these community solar concepts become available and approved by the Commission, it can used in lieu

of onsite PV system.

They have to have certain features. They must be dedicated to the building, just like a PV system is. They must be durable. They must provide energy savings to the house for at least 20 years. There must be an additional resource by the provider that is dedicated to the house and cannot be redirected or used for any other purpose, like RPS goals. There are accountability and recordkeeping requirements. The records must be maintained for 20 years and made available to relevant stakeholders. And finally, the Commission must approve these plans.

Currently, there are no approved community solar concepts. There's a lot of dialogue with both munis and IOUs. Time will tell. Even when these are approved, then we can approve them into the CBECC software as they become available. There's probably going to be a checkbox. You know, one strategy would be like there would be a checkbox for SMUD, one for PG&E. If there is, you know, other utilities or, you know, other entities that are providing, you know, we can incorporate all of those concepts into the CBECC. And for the eligible buildings,

they'll take that option instead of the onsite PV system.

And all the exceptions that I mentioned for the onsite PV system, by the way, also applies to community solar. For instance, if you house is a shaded pad and so you don't have to put a PV system onsite, you don't have to subscribe to community solar either. So the same exceptions apply to both concepts.

So this is the PV input screen which is this tab. Up here is where you can specify a target EDR. Let's say, you know, you want to go to a target EDR, you check this and the box pops up here and you put your target EDR, like ten, and the software will back calculate. I've got to warn you that when you did this the simulation time increases dramatically because the software has to go through a couple more iterations, so don't leave that checked all the time. You know, you'll be wasting time. Just do it only when you want it, then uncheck it. So that's that.

This is the reduced PV requirement checkbox. These are the exceptions that I just mentioned. You can check that and then you go to this drop box and you select the exception that

you think you qualify for. In this case, this is the exception for two habitable zones. And by doing that the software knows that you can change this minimum PV size requirement from 3.2, you can go maybe down to 2.7 or 2.8. If you go any lower than what this exception allows the software would not allow it. So then that's how the exceptions are handled.

Now down here is where you describe the attributes of your PV system. Under this tab, you have two choices, a simplified or detailed, so I chose the detailed for this, for demonstration. And down here you put in your PV size, which is about 3.2. Here the -- under the modules, you have several choices, standard and premium. Premium panels have more efficiency.

The CFI, this is orientation, the CFI orientation is anything between 150 to, I believe, 270 degrees from true north. So if your PV system is within that range, you can check the CFI box. If it's outside of that, then you've got to go into this tab and actually put in your actual orientation. You may actually have more than one string facing different orientation and that's what the second box is. You know, you can

model one string here, another string here. You can go down to run five strings.

And over here, that's the invertor efficiency. So if you're using a different invertor that's more efficient, or less, you can put it here.

There are several demand response measures, including battery storage and self-utilization credit. The software allows coupling Joint Appendix 12 -- or JA12 compliant battery storage system with the PV system and you'll get a credit for that.

For Part 6 compliance, coupling the battery with a PV system will allow you to downsize the PV system modestly, you know, by some amount.

But more importantly, for Part 11, the Reach Codes, coupling a battery storage system will allow you to reach the target EDR with a smaller, much smaller PV system. And we think that's desirable because when you couple a right-sized PV system with a battery storage system, then this becomes a great harmonized system that works to the benefit of the grid, the homeowner and the environment. So you know, we think this

is a good strategy to go and that's why we put it in there.

Again, the minimum battery storage capacity must be five kilowatt hours and has to be JA12 compliant. And just a note, the JA12 is a new appendix that we installed, we developed this time around. And it's a document that basically specifies how the battery must operate in a dynamic fashion to bring the maximum benefit to the homeowner and the grid. It has to have certain communication capabilities and controls strategies.

The battery credit is the result of the TDV cost differentials because, you know, when you have a battery storage, you can save the electricity in the middle of the day when the electricity is cheap and then discharge it when the electricity is much more expensive during the evening ramp. And in the TDV universe, you can translate that into a credit that can be used against other features.

We also work with the stakeholders and we allow a portion of the battery storage credit, that's coupled with the PV system, to be used against -- for tradeoffs against the energy

efficiency features of the house. It's a limited credit and it's called self-utilization credit. And these are -- this is a strategy that, you know, we're trying to promote because, both, it gives builders a little bit more flexibility on how to get to those EDR targets. It also grid harmonizes the PV system which minimizes the exports to the grid and maximizes the self-utilization of the PV array at the site.

So the magnitude of this credit is equal to 90 percent of the difference between the 2016 and 2019 standards envelope improvement, so this is key. This doesn't allow you to trade away all of high-performance attics and walls, only the difference between 2016 and 2019, and only 90 percent. So the features that are included for this calculation are below-deck batt insulation, the difference between R-19 for 2016 and R-13 for 2006. The wall U-factor, a difference between 0.048 for 2019 and 0.051 for 2016. U-factor, modest improvement of 0.30 versus 0.32. And modest improvement for SHGC, 0.23 and 0.25. Probably the biggest component is the incorporation of QII. So those -- when you add one through five and take 90 percent of it, it

determines the amount of that credit.

So this is the battery storage input screen which is this tab here. Up here you include your total rated battery capacity. You know, I used 14 kilowatt hours for this simulation. This is the checkbox for bypassing the PV size limit. And since I've checked this, there's this warning here that this PV size limit may violate the NEM rules and go talk to the utility.

Down here there's this checkbox. This is the one that allow you to take that self-utilization credit at I just mentioned which allows you to trade a portion of the battery credit against envelope efficiency features.

Down here are the control strategies for the battery. There's, I think, there of them here. There's a basic time of use, advanced DR. For this demonstration, I used time of use. And here you can specify the first hour of summer peak, which depends on what utility is serving you. And down here, you know, you put in the roundtrip efficiency of the batteries. And you know, if yours is lower or higher, then you can change it.

So there are other demand responsive measures. One is called precooling credit. This is a very modest credit. This is nowhere near battery storage. And the thinking is that, you know, with a 2019 standards, you have a really nice building shell. You have high-performance attic with R-19. You've got high-performance walls. You've got good windows, that it's tight. We're almost at passive house performance, you know, with these requirements. Not quite. I don't want to imply that this is a passive house but we're getting close to it.

So in most days, if you pre-cool this house when the electricity is cheap in the middle of the day or there's PVs generating, you can shut off that air conditioning at the onset of the highest peak and coast through those three or four hours, so that's a benefit of this credit, that it cools the house when the electricity is much cheaper.

So this credit only impacts the PV-plus-flexibility EDR. In other words, you cannot use this credit to trade away building efficiency features.

I should add that, you know, in general

the standards allow more efficiency and less PV but it doesn't allow -- they don't allow more PV and less efficiency, with -- the only exception was the self-utilization credit. So typically, tradeoffs go against the PV system for more efficiency, except for the self-utilization credit. And this credit is the same. It can only be used to lower the EDR on the PV and flexibility side. You cannot use it to trade away walls and attics. And it's not even big enough to actually allow you to do that.

A checkbox is provided under the Building Input tab to enable this option. When you select this option the software assumes the house is pre-cooled in the hours preceding the onset of the highest peak, and then the house will coast through the highest peak hours. It requires the installation of a communicating thermostat. And the homeowner will have to enroll in a program with the utility, which is one of the downfalls of this, the system, is because at the time of inspection, we don't know who's actually going to enroll into a program or not. So this is very occupant dependent.

Similar to battery storage, it takes

advantage of the TVD cross differentials. And if you are already taking credit for battery storage, this pre-cooling is not going to help you very much because battery storage will basically overrun and swamp this credit. And the credit is discounted by 70 percent, again, because it's a very occupant-dependent strategy. As I mentioned, the homeowner would actually have to enroll into a program and operate the thermostat to take advantage of this credit.

Now the setpoints are -- the pre-cooling setpoints are determined by the forecasted average outdoor temperatures. And this is a graph that Bruce Wilcox sent to me. And you know, if there's a forecast, like the next day the temperatures are going to be 101 degrees, then their setpoint is going to be about 73-and-a-half, or about 73 degrees. And if the forecast is it's going to be 91, then the setpoint will be about 75-and-a-half. So it depends. Depending on the forecast the utility will send a signal and it will set the setpoint down to make sure that the house is actually pre-cooled down to that level before the onset of the highest peak where the air conditioning will shut off.

The Pre-Cooling Credit is provided under the Building Input tab. This is the same area where you specify the air leakage of the house, 5 ACH at 50 pascals. And this is where you specify QII requirements, the orientation, single-family, number of bedrooms, and so forth. And here is the checkbox for the pre-cooling.

So getting closer to the end, there are several slides on the CBECC onscreen reports. Because we changed the requirements in the standards, the reports have also changed accordingly.

So this one is the compliance summary. In the past, we only had one criteria for pass/fail, which was basically the energy efficiency. Now, because we've added, you know, a second metric for PV, then we have a couple metric. And your proposed design must be greater than both EDR scores. Actually, sorry, for the -- the amount must be less -- the proposed design must be less or equal. And here, you see the margins, basically. And because these have positive margins here, then this building complies. So the key difference is that in the past there was only one criteria. Now we have a

two-criteria system.

We also are very interested in reducing carbon emissions from the buildings, so we've included a CO2 Emissions tab. And what this tab does, it reports the emissions, CO2 emissions of the house, in metric tons per year. And it -- basically, that calculation is done the same way as the efficiency calculation. It looks at the efficiencies of the house, envelope, the more efficient it is, you know, you use less energy and, also, you emit less CO2. So it's an hourly calculation, very similar to the energy efficiency features. But it also reports the benefits of CO2 reduction from the PV system and battery storage system.

So this 3.2 is the total potential CO2 emissions, excluding solar and demand flexibility, is about 3.2 metric tons per year. In this tab, it reports the CO2 savings for solar electricity, you know, for the amount -- the PV system that you put up there, about 3.2. For the proposed design, it says you reduce the carbon emission by 0.29 tons per year for self-utilization. It means, you know, your PV's up there; right? You know, now we're not home, so

it's sending -- most of the electrons goes to the grid. But some if it is used, you know, to run your refrigerator and all that. Then when you go home, you turn on TV. So from the self-utilization the PV reduces the carbon by about 0.29 metric tons but most of that actual goes back to the grid.

Other -- if you add battery storage, you'll see these numbers actually change quite a bit. Your CO2 savings from self-utilization shoots up to 0.83 from 0.29 and the exports that go back to the grid reduces from 0.3 to 0.14. So that's the benefit of battery storage. When you grid harmonize, you don't have to send electrons back to the grid and most of the benefit stays back in the house, including CO2 emissions. And these last two tabs, basically, it's about the same thing, it captures the impact of CO2 emissions. This includes exports to the grid -- the excludes exports to the grid. And basically, these are benefits from self-utilization only.

Energy Design Rating, this is very similar to the tab I previously showed you, so I won't go over it.

The good news is I think this is my last

slide. Yeah.

So this is the Energy Used Detail tab. This should be very familiar to you. It's very similar to the 2016 tab. You know, you've got your standard design building here and you've got your proposed design. You've got all the kilowatt hours terms, TDV metrics all align here. This shows the margins for this building. I think what I did was, for this building, I improved the window SHGC somewhat. So you know, you get some benefit in the summer but you take a small penalty in the winter for having a higher SHGC.

But the only difference between this tab and the previous tab is now we've got the photovoltaic and battery storage information included here. So in this building the PV system in Climate Zone 12 generates -- this is about, I think, a 3.2 kilowatt PV system -- generates about 5,200 kilowatt hours. So when you look at down here, on the annual basis this house gets about 150 kilowatt hours net from the grid. The rest of it is coming from the PV system. The battery storage is using about 250 kilowatt hours and that's because of the roundtrip efficiencies.

So I'd be happy to answer any questions.

MR. FROESS: Yeah. Thank you very much, Mazi. That was a great presentation.

We'll take in-person questions and comments first. And again, please present a business card or -- and state your name and affiliation.

MS. CORDES: Hi. Can you hear me? Megan Cordes with ConSol, representing CBIA. Just have a comment and one easy question.

MR. SHIRAKH: Um-hmm.

MS. CORDES: My comment is I think community solar, a viable community solar option is going to be an important aspect when we look at builders complying with the 2019 standards. And as you mentioned, there's no viable option yet, nothing is approved, so we've been working with you guys and we look forward to continuing to work with you and the CPUC, the IOUs and the munis to make sure there's something that's in place as we go into implementation, and then how that will play out in the software and how builders are going to show compliance with that.

My question is a small one. You mentioned, and I didn't know this before, that

when you're using the community solar option, you are still working with the exceptions. So I see how that works on like for the options where you just avoid solar altogether. But for the options where you're reducing the solar requirements, so say you have a three-story house and you can only put 0.8 watts per square foot on that house, you would only have to provide that much output from the community solar as a 0.8 watt per square foot --

MR. SHIRAKH: Yes.

MS. CORDES: -- you would have to do?

MR. SHIRAKH: The PV size is determined by the software. And the software include all the exceptions.

MS. CORDES: Okay.

MR. SHIRAKH: So you assume that you have an onsite PV system and you run it with all the exceptions, including for the two and three, whatever number comes out of that, that's the PV size. So when, you know, SMUD for instance, I don't want to pick on them but just as an example, if you want to enter into their Community Solar Program, they have to dedicate a portion of their resource that's equal to the

number that comes out of CBECC. There's some exceptions, even for that, because, you know, typically rooftop PV systems are on a fixed orientation, whereas a solar -- a community solar may be on tracking, so they can actually adjust for tracking. Or if they have like bifacial where you have higher efficiency, they can actually further adjust it for that.

MS. CORDES: Okay. Thank you.

MR. SHIRAKH: That was easy. Thank you.

MS. CORDES: And what's your favorite color?

MR. SHIRAKH: Blue.

MR. SEVERANCE: Bruce Severance, Mitsubishi Electric.

I had a question about the -- if you could just go over or repeat for me the tradeoffs between the Petty Officer Bowler system and the batteries and if you're allowed to reduce wall assembly efficiencies if you add batteries and more PV; is that what you were saying, that there's a list of five tradeoffs there and you're allowed to --

MR. SHIRAKH: So --

MR. SEVERANCE: -- shell efficiencies if

you add batteries?

MR. SHIRAKH: So if you add batteries to the PV system, you get a very large credit, about ten EDR points. So this credit allows a portion of that, about three EDR points, to be used against efficiencies. Let me go to this to kind of give you an idea of what the magnitude is. There. So like in this case the EDR score for energy efficiency is 44, that's EDR points. And this house, this has battery storage, so you can see the EDR score of the proposed PV is about ten EDR points higher than standard design, so that's how much credit you're getting from the battery.

MR. SEVERANCE: So you can trade that off on --

MR. SHIRAKH: Not all of it. You know, what we're saying, if you check that box, the self-utilization credit --

MR. SEVERANCE: Yeah.

MR. SHIRAKH: -- it allows you to transfer a portion of this credit from this column to this column. It's roughly about three EDR points.

MR. SEVERANCE: Okay.

MR. SHIRAKH: So it will lower this EDR

score from say 44 down to 41. And then you have that much room with three EDR points. You can use it for any feature that you want, actually. It was calculated. The calculation is based on the improvements within 2016 and 2019, but it's not restricted to those figures. That's just the magnitude of the credit. The actual credit can be used to increase more window areas.

MR. SEVERANCE: Right.

MR. SHIRAKH: It can be used --

MR. SEVERANCE: It can be traded in other --

MR. SHIRAKH: Yeah, you can.

MR. SEVERANCE: -- in other ways?

MR. SHIRAKH: You can use it for anything.

MR. SEVERANCE: Well, I guess the one question I have is that are you assuming that when these batteries, batteries always have a life, so lithium is anticipated to last, what, 10 or 15 years? Is the assumption that when the battery pack dies, that somebody's going to replace that or that the system is going to be designed so that it won't work unless somebody replaces that battery pack?

MR. SHIRAKH: Actually, that's a really good question. The batteries are not required. We're not requiring batteries, we're just providing incentives, compliance incentives, so we don't require it. So this is going to go in, if the builder decides they want to install it for some reason, you know?

MR. SEVERANCE: Right. But I guess what I'm saying is if somebody's trading off those, you know, three EDR points --

MR. SHIRAKH: Right.

MR. SEVERANCE: -- there's nothing that would prevent the homeowner from just failing to replace the battery pack.

MR. SHIRAKH: After 10 or 15 years --

MR. SEVERANCE: After 10 or 15 years.

MR. SHIRAKH: -- it's possible. But we're also hopeful that in 10 or 15 years the cost of the batteries will come down so much that it will be an easy choice for the homeowner at that time to replace that battery. And what we're hearing, the forecast from the manufacturers, that over the past five years the cost of the batteries has gone down by about 70 percent. And if that trend continues, then it

becomes an easier choice --

MR. SEVERANCE: Right.

MR. SHIRAKH: -- for the homeowners to replace.

MR. SEVERANCE: Yeah. I --

MR. SHIRAKH: But, yeah, there's no guarantee.

MR. SEVERANCE: So if I can move on to my comment is that, you know, similarly, I appreciate in the past the CEC has taken a pretty strong position on having high standards for building shells because it's considered an infrastructure issue. And you know, I'm probably, you know, one of the few people in the HVAC advocacy arena that really believes that we should be doing the most cost-effective shell improvements as a mandatory requirement. And currently, there's no standard for building leakage where it's really required. You know, we should be shooting for 3 ACH 50, you know that's easy to do, and there's no standard right now.

And very clearly from, you know, the data from Energy Upgrade California and other places, that building leakage is the biggest bang for your buck in terms of what we can do.

So just reminding us all that, you know, the Commission's, I think, mission statement is to look at cost tradeoff analysis and figure out where we're really getting the most bang for our buck for the consumer. I don't believe the consumer really benefits from having big batteries in their house. I mean, that's really something that it's serving a grid harmonization function and I do believe grid harmonization is the elephant in the room that we need to address.

But batteries as a solution is more beneficial to utility managers, grid managers, than it is to the home, except for those cases where people want to be able to island and operate when there's a blackout. But most of these systems have anti-islanding devices that don't prevent -- you know, prevent them from operating as a standalone powered house when there's a blackout.

So you know, my concern is, just in terms of value for the customer, I would encourage the CEC to really look at higher standards for building leakage and looking at cost tradeoff analysis on different type of wall assemblies, I don't believe exterior foam is the best way to do

a continuous break on the outside, really evaluating vapor drive issues, et cetera. At the same time, there's a lot of data on failure modes with buildings that don't breathe properly. I have a feeling we're painting consumers and builders into corners where there are going to be engineering failure modes down the road. And the reason that this is relevant to HVAC is, you know, generally, heating and cooling loads are probably the most difficult to manage relative to grid harmonization. That's kind of the key. You know, if we can lower the demand side of that equation, we're going to be able to harmonize more solar on the grid; right?

So to me, those are things that shouldn't be compromised. If we're going to create incentives for adding batteries, it shouldn't be to the detriment of the building shell at the same time. I think that's -- we need more long-range thinking than that.

MR. SHIRAKH: Yeah.

MR. SEVERANCE: And that's just my comment.

MR. SHIRAKH: I agree with your comments that --

MR. SEVERANCE: Yeah.

MR. SHIRAKH: -- you know, we did find the building envelope efficiencies were more cost effective than batteries. We did look at the cost effectiveness of batteries and it turned out that they're not cost effective but they're not that far off, but they're certainly not as efficient as envelope measures. And again, that's -- we do not require batteries.

MR. SEVERANCE: Yeah. And these are --

MR. SHIRAKH: It's an option.

MR. SEVERANCE: -- these are numbers I've studied, and so forgive me. I don't mean to proselytize. Forgive me --

MR. SHIRAKH: Yeah.

MR. SEVERANCE: -- for doing that. But I just, I do think that it's a function that the CEC should fulfill, is looking at the cost tradeoffs and really trying to make clear recommendations about alternatives that are going to be the most cost effective to the consumer and actually lower the cost of ZNE homes and make them more affordable for the public. So --

MR. SHIRAKH: Yeah.

MR. SEVERANCE: -- I just ask you guys to

have some checks and balances and maybe some number crunchers in the background that are --

MR. SHIRAKH: So we agree with you. That's --

MR. SEVERANCE: -- you know, tapping on your shoulder once in a while.

MR. SHIRAKH: We do that every cycle.

MR. SEVERANCE: Yeah.

MR. SHIRAKH: And so, you know, we're not done.

MR. SEVERANCE: Okay.

MR. SHIRAKH: You know, we're still --

MR. SEVERANCE: That's my comment. Thank you.

MR. SHIRAKH: Thank you so much.

MR. SEVERANCE: Yeah.

MR. SHIRAKH: Appreciate it. Any other comments in the room?

Good morning, Pierre.

MR. DELFORGE: Good morning, Mazi. Good morning everyone. Thank you for -- Pierre DelForge with NRDC. Thank you for the opportunity to comment. I want to start by saying we appreciate all the hard work that's gone into the software. We understand how much

work it is and it's really important to implement the new 2019 code on a timely -- in a timely manner.

I have three comments. The first one, just to build off Bruce's comment on the self-utilization credit, as you know, NRDC has always supported energy efficiency as the first measure, the first priority measure in terms of reducing energy and emissions, and we continue to do that. We also, however, realize that, you know, there's a need for flexibility for industry in terms of getting to, you know, high-performance envelopes. And we -- and also that batteries are an emerging energy technology that, you know, as an emerging technology, can be supported.

So, too, because of that, we support a temporary measure that, you know, (indiscernible) as a temporary measure. But we're also very concerned that this is temporary so that we don't permanently trade off energy efficiency that is cost effective and that, we believe, provides higher value to the consumer over the life of the building because it's more dependable, it's more persistent. So we support this as a temporary measure and we would encourage the Commission to

revisit that in the next code cycle.

MR. SHIRAKH: Can I respond? Yes, I mean, you know, we had the PV, tried it out for one cycle. And you know, this will probably going to be in there for this cycle. You know, we can revisit it for the next one. But again, the amount of credit that you get by installing batteries is very limited. In a sense, what you end up with us a 2016 compliant building with high-performance attics and high-performance walls, a PV system that's grid harmonized because you have a battery storage system. I mean, that's not a bad scenario, actually.

But, I mean, we always revisit this every code cycle so, you know, things change in the future.

MR. DELFORGE: Thank you. My second point is around demand management or demand response credit for electric water heating. So staff has indicated, so -- and I know we have water heating later on the agenda, so I can hold my comment until then. But I know we also covered the DR credit for battery and for pre-cooling, so is it all right to comment now?

MR. SHIRAKH: So Larry is going to talk

about that, right.

MR. DELFORGE: Okay. So I'll hold my comment until later then.

MR. SHIRAKH: I'm the PV guy, not the water heating guy.

MR. DELFORGE: Okay. That's great.

MR. SHIRAKH: I have my own bucket here.

MR. DELFORGE: All right, so I'll move to -- my last comment then is on CO2 emissions. So you know, we strongly support the inclusions of CO2 emissions. It's obviously key to support California's climate goals. So again, fully support it.

My question is around the source of data that is -- you know, what's behind that number that is calculated? I assume you have an hourly schedule. And it's, you know, determining what's the methodology for determining this hourly schedule for hourly emissions factors for emissions? Can it be shared with stakeholders? Because the devil's in the detail and we want to make sure that the methodology for determining these emission factors are -- you know, that we agree with it and that it reflects the state's energy policies and goals.

And it's important because we anticipate a lot of cities are going to, especially in terms of Reach Codes, are going to be looking at the emissions as one of the measures for how to justify Reach Codes and, you know, looking at what are the climate benefits that do that as part of climate reduction plans and that it can quantify the upper (indiscernible) benefits of the actions.

MR. SHIRAKH: So for CO2 report, this is a very complicated topic, the metrics and how they -- but for this purpose, what we're using is long-term marginal emission rates assuming, I think, a 50 or 60 percent RPS by 2030. And it's a marginal rate so it -- I mean, you've been in those discussions with E3. It's the one, the metric five, or some people call it the hour resource energy, it's that metric where, you know, it changes by the hour of the day and the year, depending on what resources are on the margin.

In my opinion, that represents the -- and it's just my opinion -- the emissions from the house today better than the other metrics. But you know, the future, as the grid becomes

greener, you know, there's that AB -- or SB 100 where, you know, we're requiring 100 percent, so these things will change in the future.

But for today's buildings and the grid, I think that's the best metric to report this year to emissions.

MR. DELFORGE: I think I agree but is it possible to -- you know, for this metric to be available so that we can --

MR. SHIRAKH: Yeah.

MR. DELFORGE: -- you know, analyze it.

MR. SHIRAKH: So you know, this metric here is not used for any kind of compliance, it's just informational so people get an idea. You know, if you're a community, you're trying to limit CO2, in addition to energy efficiency, they can use. But in the future, you know, this doesn't mean, by any means, that this is a metric we're going to use for tradeoffs in the future. That's an entirely separate topic.

MR. DELFORGE: Thank you.

MR. SHIRAKH: Sure. Any other questions in the room?

Morning, Joe.

MR. CAIN: Joe Cain with the Solar Energy

Industries Association, also called SEIA. I have some comments and I have some questions, so I think what I'll do is pause each time I get to a question.

First of all, I want to say, you know, express again, as we have in earlier parts of this process, our support for the Commission's staff and how these standards came together. I think it's been a really fruitful development cycle.

Speaking to some of the questions about PV sizing and shading, and as Pat Splitt from App-Tech asked the question, how to determine the shade, and I have a couple things about that. But one is that the, of course, the software, as mentioned, Mazi, has some particular features in it as far as how to implement these exceptions. The question came up about what do you do if there's not even a house and you cannot go on the roof to do an actual measurement of shade?

So one thing to point out is there are some commercially available software packages for PV system design. And without mentioning names, one of -- there's a demo I saw of one where you can take the actual house plans and transpose

those over an aerial image of a bare site that has trees on it, for instance, project the trees up into some idealized shapes, and then actually calculate shading and PV system size and complete design based on that.

That particular package, I communicated with the owners, and they said that they, for institutional use, they can share copies of that for a nominal fee. But anyway, it's available.

And so you can do this 3D automation, I mean, take the house plans and actually project them up in 3D and particular shading and project it up in 3D and then do an actual calculation on that.

So I think my point there is that if you are using the CBECC-Res software, I think it would behoove you to use some method of PV system design concurrent with the inputs into the software to avoid finding out that you have to do some iterations and come back and correct your compliance package.

And along with that the -- again, with the exceptions based on limited roof space, the rules for rooftop fire setbacks and access pathways, I've been involved in developing those

and improving those in the International Fire Code and the International Residential Code. And those did change in California during the intervening code cycle with a number of improvements that we've put in there that, you know, gain more flexibility and regain some roof space, to regain some real estate that.

So the question I'm going to ask is in terms of using the exception in the software, are those new setback rules and the flexibility of those incorporated into the software or how does -- how do you determine available roof space based on even some more flexibility and if-then statement-type rules? Is that built in or is it not built in?

MR. SHIRAKH: Bruce is going to explain.

MR. WILCOX: (Off mike.) This is Bruce Wilcox. It's not currently built in -- the current -- in the current software, which of course is not the final version, there are changes to be made, but currently the user determines the areas and so forth and inputs those. And this is the way of providing them the best flexibility, use any of the tools that you've mentioned or --

MR. CAIN: Okay.

MR. WILCOX: -- whatever.

MR. CAIN: Okay. Great. Thank you. Okay.

Next topic --

MR. SHIRAKH: Let me ask --

MR. CAIN: Please.

MR. SHIRAKH: -- the first topic, you know, if you don't know what your roof looks like and all that, again, it's possible to assume that the house complies with the prescriptive PV credit and proceed like that. It's not uncommon to revise CF1Rs. I mean, people do that all the time. You have more windows, you want a skylight, you know, you have to resubmit your CF1R.

So you can, you know, start your construction and compliance work and then always revise it in the future when you know the actual because there's several ways of approaching it. And what you suggested is obviously another one, using the software that's approved by the Commission. You know, that could be acceptable too.

MR. CAIN: Sure. Thank you. And I think

there's going to be some decision points, I mean, other than the ACM Reference Manual, but in practice on some decision points about whether the energy consultant that has been doing building modeling for all these years wants to also design PV systems or design layout and sizing of PV systems, or whether that is done in partnership with, you know, a solar installer that would tend to want to do their own designs. I mean, there's going to be some iterations there but, like I say, I mean to distribute -- to reduce iterations.

MR. SHIRAKH: Okay.

MR. CAIN: Next question. In the efficiency of the PV modules themselves there's three buckets, there's standard, there's premium, there's something else. And I think that the user the is forced to, you know, take whatever modules they plan to install and put them into one of three buckets.

So kind of a two-part question here is: How impactful is that in the overall energy modeling, and would it make sense to have a fourth option which is a user-defined efficiency based on an actual product?

MR. SHIRAKH: I think so. I know we're providing a user input for invertor efficiencies. I mean, I don't see any problem with that. And Bruce is saying, yeah.

MR. WILCOX: Well, the solar calculation here is an adaptation of the NREL PV Watts Program. Those categories or built into the NREL program. These could be definitely added. We recently added tracking.

MR. SHIRAKH: Well, we have a similar comment from some solar vendors, manufacturers, Sundried (phonetic), I believe. So yeah, we can have a user-defined efficiency.

MR. CAIN: A bucket for user defined?

MR. SHIRAKH: Yeah.

MR. CAIN: Yeah. It may be helpful. Thank you.

Okay, so and on pre-cooling and the next topic, pre-cooling being in the, essentially, the PV and battery efficiency score, and I -- it seems that's, to me, more of an efficient -- I know that there's a demand response aspect to it, but it also communicates with building ventilation and some other parts in the efficiency score, so I'm wondering whether pre-

cooling ought to be on the efficiency side in the efficiency EDR score rather than the self-utilization efficiency score. That's --

MR. SHIRAKH: No. We thought about that. The problem is, I mean, we just heard concerns about trading off battery storage against efficiency. And since the battery storage is going to be there, everybody knows it and it's got some automatic controls, you know, you should work with the pre-cooling credits, that's not the case.

You know, at the time of inspection, we don't even know who's going to occupy the building and if they're going to enter into an agreement with their local utility, if they're going to get the signal, so it's very occupant-dependent. So trading away efficiency features for something that's very precarious, you know, seemed questionable.

And also, the magnitude of this credit is very small. I mean, if you're worried about downsizing your PV system, we're probably talking about 100 watts or something. I mean, it's just -- it's in the noise when it comes to impacting the size of the PV system.

MR. CAIN: But you also said in your presentation, if I can clarify, it sounded as though you say if there is batteries specified and there's a compliance credit associated with the batteries and the EDR score, that that sort of switches off the --

MR. SHIRAKH: It doesn't switch off, it's just basically the battery storage --

MR. CAIN: That's --

MR. SHIRAKH: -- uses all the credits --

MR. CAIN: So --

MR. SHIRAKH: -- that the pre-cooling would have claimed.

MR. CAIN: Okay.

MR. SHIRAKH: And so if you turn on that the pre-cooling switch, you'll see no difference in the EDR score if there's already a credit --

MR. CAIN: Okay.

MR. SHIRAKH: -- or battery storage.

MR. CAIN: Okay.

MR. SHIRAKH: So you know, it's a small, very small credit.

MR. CAIN: Okay. So the 90 percent of those incremental things is not impacted by the pre-cooling; is that what you're saying?

MR. SHIRAKH: So pre-cooling takes advantage of the energy usage of the house between midday electricity which is cheap and on paid which is expensive. Battery storage does exactly the same thing except it does it on a much wider scale. Pre-cooling only impacts the air conditioning loads of the house. Battery storage swings everything. So that's why if you -- you know, when you install a large enough battery storage and enable it, then these other DR measures because rather insignificant because --

MR. CAIN: Okay.

MR. SHIRAKH: -- battery storage is the biggy, the monster.

MR. CAIN: Okay. Thank you. I am curious, though, what -- the pre-cooling, is that just only extreme days or is there --

MR. SHIRAKH: So it is, yeah. I mean, it kind of works, the benefits are TDV-driven.

MR. CAIN: Okay.

MR. SHIRAKH: So it's the same concept as battery storage. And --

MR. CAIN: Okay.

MR. SHIRAKH: -- this will work based on,

I mean, the forecasted data. You know, if there's a heat wave forecasted the next day, then presumably the utilities can send a signal --

MR. CAIN: Okay.

MR. SHIRAKH: -- an appropriate signal to set the setpoint down prior to onset of the highest peak.

MR. CAIN: Okay. Thank you. And a final couple of points here, just related to our friends at the NRDC, and I'm personally a big fan of NRDC and we agree with them on almost anything, but the temporary thing is, no. I mean, we've had a compliance credit for solar thermal for, you know, decades. PV -- a compliance credit only began in the 2013 standards in a small way in some climate zones. We got it expanded in 2016. It's now not even a compliance credit for PV, it's batteries.

We need to continue to make batteries an attractive option for builders moving forward. And you know, the cost curve will come down but it's not -- you know, it will be better in six years than three years and better in nine years than six years.

And then just final comment and just an

anecdote, on the source, the carbon, we do look forward to the Commission's development in future cycles on moving to a carbon metric. I hope that that actually happens.

And just the anecdotal part of this is that I was just in D.C. the last three days and came here from there on -- for the Consensus Committee of the National Green Building Standard. And we had the perennial battle over source versus site energy factors. And I was able to share with them that, hey, what we're -- maybe this battle we've been talking about, site versus source, for all these years, maybe we can make that go away if we do what California plans to do and try to think into the future for carbon instead of site versus source.

MR. SHIRAKH: Sure. That's a very active area of discussion.

MR. CAIN: Thank you.

MR. SHIRAKH: Thank you. Any other comments in the room?

MR. SPLITT: Hi. It's Pat Splitt from App-Tech again. Just two comments, one about the community --

MR. SHIRAKH: Can you get closer there?

I can't hear.

MR. SPLITT: Can you hear me?

MR. SHIRAKH: Yes.

MR. SPLITT: Okay. It's just that I can't read with this thing right in my face.

For the community solar, the fourth quarter of this year I'm going to be doing -- working on a lot of buildings that won't get applied for a permit until next year. Now I have many buildings that might like to take this credit. There are a lot of buildings up in the Santa Cruz Mountains that, you know, are surrounded by redwoods, but indecent conduct can't wait until January of next year for you guys to come up and to certify something because I don't know if it's really there, so I don't know whether I can take this credit or not.

So I hope somebody's trying to shake the trees to get something done maybe three months, at least three months before that so that --

MR. SHIRAKH: The builders, the Commission, the utilities, we're working on this. And I think Bill Pennington is sitting here. I mean, that's primarily what he's doing. These are very complicated issues. You know, there may

or may not be. If you are building in the, again, in the redwoods up Santa Cruz or Sequoias, if the building is shaded, you know, you're exempt from PV requirements so you don't need a community solar.

But I cannot promise that there will be anything because there is really an earnest effort. There's NEM rules. There are interconnection rules. Some of them are in NEM regulations. Some are in statutes. And there's single-family, there's multifamily. And the questions and issues are very complicated and interconnected. We're sorting through those problems. I'm usually the optimist in this office and even I am very cautious in promising that there may be a community solar concept very soon.

MR. SPLITT: Okay. So my takeaway is the optimist is pessimistic?

MR. SHIRAKH: I mean, I don't know.

Bill Pennington, you want to add something to this?

MR. PENNINGTON: Yeah. There are a lot of barriers by statute or regulatory decisions that the PUC has made for this to be possible.

IOUs have less constraints and so SMUD is very interested in having a program. We've also been contacted by Plumas-Sierra cooperative and they think they can create a program. Maybe CCAs could create programs. We haven't seen interest from CCAs on this yet.

MR. SPLITT: Um-hmm.

MR. PENNINGTON: So to correct the laws that are blocking the IOUs and then a new procurement after those laws are corrected is probably three years, something like that.

MR. SPLITT: Okay.

MR. SHIRAKH: So it's not for a lack of desire --

MR. PENNINGTON: Yeah. Exactly.

MR. SHIRAKH: -- on our part. It's just the more we looked into it the more issue we found. Again, they're not insurmountable but they're going to take a significant amount of time --

MR. PENNINGTON: Okay.

MR. SHIRAKH: -- and a lot of willpower.

MR. PENNINGTON: Okay. I won't plan on using that.

So just one other comment. It was

mentioned previously that there's software programs that you can do shading and extrude your building up to get it -- so I've been looking. You know, I haven't just been snoozing here. I've been looking at different shading programs and how they work and how much they cost. And the problem I see and I have seen is if I have a house that's in town, I have the plans for my building, proposed building, but the shading is coming from adjacent buildings that I don't have any control over and don't have access to the plans. And it might be a neighbor that really is unhappy about this person building a house that's going to shade his view or something, that he's never going to give me these.

So there are other things, other than just being to model your own home, to find out what's going to be shaded or not shaded.

MR. SHIRAKH: So that first exception that I showed specifically for that situation is the shading issues that are outside of the builders control and specifically mentions trees and existing buildings. So if you do have an existing high-rise next to your building that shades the sun during the afternoons, then it's

probably not a good candidate for a PV installation. You can probably use that exemption. You know, you have to document that.

MR. SPLITT: Yeah, but I have to document it, so I have to model that. It is a shading problem.

MR. SHIRAKH: You have to, yeah. And then you can use the device that I think Joe mentioned. And you know, we have also left the door open for other approaches because, you know, we recognize, you know, we don't -- can't foresee all the problems and all the solutions. So new devices and solutions can be approved.

Joe, you want to elaborate on that again?

MR. SPLITT: Yeah. Just one more thing is that another thing that can happen is I've had three adjacent lots and they're all sort of soon going to be building houses at the same time.

MR. SHIRAKH: Yeah.

MR. SPLITT: You have to set it up so that the first guy in doesn't grab the sun and the other guys lose.

MR. SHIRAKH: Yeah. I mean, those are interesting issues that's going to come up.

Joe, did you want to -- thank you, Pat.

MR. CAIN: Joe Can with SEIA.

Pat brings up a really interesting question because, of course, with these standards, you know, applying the new construction up to three stories, we have to be thinking, concurrently thinking of the new residential development or multifamily or whatever it may be that's in kind of new open space, and plus we also have to think of the new construction within existing built-out neighborhoods. And so I think it's a really excellent question.

And so what I would say to that is that the -- and I'm going to keep an eye on some of my other solar folks to see if they shake their head in an up-and-down fashion to give me a queue, but in the PV on existing building space, solar resources have -- our question, I mean, design resources have improved over time to where, again, there are particular proprietary packages that can interpret satellite images and convert those into 3D models of existing homes, including roof pitch and roof dimension, and they get pretty darn close.

So I guess what I'm thinking, and this --

and in response to Pat's question, is there may be a mesh of looking at some of those resources that can take a 3D, you know, satellite images and convert them into 3D space to represent the existing buildings and topography and then mesh that with some of the other new software packages that were maybe same that can project drawings, you know, of new buildings into a 3D space. So it may be a mesh of things that we have been doing for existing buildings and things that we would do for new buildings.

MR. SHIRAKH: Thank you, Joe.

MR. CAIN: I think it's time for me to re-up my membership in CBECC.

MR. SEVERANCE: Bruce Severance, Mitsubishi Electric. I'll try to be extremely brief.

Just hearing the other comments made me feel like there was a few things that probably should be added to what I was saying earlier. And the concern about solar access in new communities, I mean, that shouldn't even be a problem. Because in a new community, you're allowed to orient the streets and the lots in any way you want. And there really should be

something, I was talking to Martha Brook about this, this last week, encouraging builders to look at passive solar features.

CBECC currently does not model full slab insulation and all of the radiant gains on interior surfaces, like passive house software does. It would be marvelous is, you know, it has like four of the six features that would allow us to model passive houses but it doesn't have all of them. And I've seen passive house designs in custom home building that, for the $3.00 a square foot of additional cost in the under slab insulation, 50 percent of the heating and cooling loads are shaved. And from a grid harmonization standpoint, this is something that, you know, we really should be thinking about in the next code cycle.

And if we're designing passive communities and we're orienting streets east and west and the lots are east and west, then we're not -- and we're planting shade trees, you know, thoughtfully we're not going to be having small setbacks where we don't want them and shading where we don't want it from adjacent structures.

So that's really part of the community

planning piece of that in my mind. And in new community developments, it's certainly something that can be avoided. Obviously, when we're filling in around existing structures, that's a different thing.

Just touching on leakage again, I just had to tell an anecdote about this, and that is that having seen a lot of energy upgrades being performed the usual scenario is you take the insulation out, you take the R-38 insulation out and you send a crew in to vacuum, clean, air seal the heck out of the attic, and the client comes home and says, wow, did you already insulate, because the effect of reducing air leakage on the attic plain is so significant.

So the point that I make here is that to give up -- to not have a standard for air leakage is just crazy because that's such a significant issue. And if we're really talking about load shifting and the ability to pre-cool and preheat a home, I have a bias towards air source heat pumps independent of working for Mitsubishi because radiant really doesn't offer the same opportunities for dehumidification and cooling,

you know, in the same way that an air source heat pump can do that. And I just think that the opportunity to create a home that has much lower leakage that we can preheat and pre-cool and ride through the peak in the evening is significant.

At the CVRH homes, they've just tested a PCM phase change drywall material that is increasing the ability of a 1953 home to preheat and pre-cool. And the preheating condition is showing better results. You know, the data hasn't really been released from that but Rick Chitwood is pretty excited about it. Bruce is a bit more skeptical.

But nevertheless, the point being that on new construction, we shouldn't be missing that opportunity. We should really be looking at designing the shells to allow that preheating and pre-cooling. And that completely eliminates most of the need for a battery if that kind of thinking is built into it.

And I understand your concern about somebody having to sign up for a program and really, you know, programming their equipment to do that. I think that's where time-of-use metering, you know, should be something that

really incentivizes that for the homeowner.

You know, in the big picture thinking, everything that we're doing, focusing on the buildings, TDV and all the problems we have managing the grid, would be radically shifted if the CEC is also really talking with higher-ups in the government about offshore wind and really changing the grid mix so that we don't have this high emissions deviation over time, both over the period of a year and on a daily basis. So taking that grid emissions charts and making the whole thing green would certainly help the condition and really help lower emissions on the HVAC side on an all-electric HVAC install in existing structures that maybe are not built to the same standard of what we're talking about today.

So all that being said, big picture, we've got SB 100 to think about and that really, we need to align what the CEC is doing with SB 100 goals. So thank you very much.

MR. SHIRAKH: All right. I don't know if I can remember all the points you made but I'm going to respond to a couple of them.

On the exceptions, you know, when we were designing these exceptions, we assumed what you

were just saying, that the builders, production builders should and must be thinking about proper roof design and roof lines. So there's nothing in these exceptions that allows them to get out of this PV requirement because they have a bad roof design.

For instance, this exception one, it says, "shading from existing permanent, natural or manmade barriers external to the dwelling, including but not limited to trees, hills, and adjacent structures." There's nothing here about, oh, I have a poor roof line.

And the other exceptions, again, it's the same, it's just two, three and four are just a recognition of practicality of these other buildings, there's limitation. The only exception that allows them to get out of the PV requirement because of the poor roof design is exception five. But again, that's only a one-time pass and that's only for buildings that the master plan has been approved prior to effective date and the permits are pulled after the effective. Beyond that, that exception pretty much goes away.

On the question of -- I think your question was, oh, the ACH 50, the air leakage,

the current assumptions is 5 ACH at 50 pascals. The builders are routinely achieving three or less ACH. And you know, if they choose to they can get planned credit for that. But you know, they can achieve three or even two currently, which is a good thing.

And the other thing I wanted to share with you was this idea that doing a good job on cooling will negate the need for battery storage system. If you look at -- I don't know, you probably -- you know, these numbers are too small on these TVs, but the annual energy consumption of this house is about 5,200 kilowatt hours. Of that, only 400 kilowatt hours is coming from cooling.

So the good thing about batteries is that they actually swing the entire load of the house. Look down here, where are the biggest loads? It's not up here anymore. They've done a damn good job with the building and with open shell. You know, we're going to squeeze the hell out of heating and cooling, the stuff that we have control over. Where we're not, you know, being as saving a whole lot or maybe we don't have a choice is where the appliances are used,

lighting, TVs and so forth.

So this is where the biggy is, is down here, it's the 2,400 almost for plug loads, 1,000 for appliances and cooking and so forth. So the batteries can actually swing all those loads, not just space cooling, that's just one component.

This is 12, Sacramento, where we have -- we don't exactly have spring-like conditions in August.

Any other questions in the room? What about online?

MR. WILCHERT: Yeah, we have a few online.

Geoffrey, I'm going to un-mute you. Can you state your name and affiliation? Geoffrey, are you there? You're un-muted.

Okay, we'll move on to George. Go ahead and state your name and affiliation.

MR. NESBITT: Yeah. George Nesbitt, HERS. Can you hear me?

MR. WILCHERT: Yeah, we can hear you. Go ahead.

MR. NESBITT: Okay. I'd like (indiscernible). And I'm getting feedback. Just one second.

MR. SHIRAKH: You're cutting out every other word, George.

MR. NESBITT: Okay. Well, you have to mute all the mikes on your end while I'm speaking.

MR. SHIRAKH: Now we can hear you.

MR. NESBITT: That's my -- yeah. So I'm going to start on the carbon emissions (indiscernible).

MR. SHIRAKH: You're cutting out. We can't hear you, George.

MR. NESBITT: Yeah. Okay. Great.

MR. SHIRAKH: Can you type it and we'll --

MR. WILCHERT: I have -- I can read your questions if you want, George, or if you want to try again, if you --

MR. NESBITT: Well, I don't have everything written but --

MR. WILCHERT: Go ahead and just --

MR. NESBITT: (Indiscernible) remote participation but --

MR. SHIRAKH: You're cutting out. We can't hear you.

MR. NESBITT: If you mute all the mikes

in your room, you should be able to hear me without echo.

MR. SHIRAKH: There is --

MR. NESBITT: That's my observation from lots of remote participation.

MR. WILCHERT: We can hear you pretty well now. Why don't you go ahead and just try to get through your questions?

MR. NESBITT: Yeah. Okay. I wanted to start with the carbon emissions. This is something I think we've all -- many of us have been asking for since the start of the CBECC development. It's also something that we've had in the HERS rating system that was approved in 2008.

One thing I would like to ask is that you create a chart the same as the energy use details for the energy design rating with the carbon emissions for each end us, gas and electric. That would be a lot more usable and helpful.

MR. SHIRAKH: We actually have that tab in our research version. We can add it to the public version.

MR. NESBITT: Okay. Great. Second, community solar, I'd also like to thank the

Commission for having the foresight to include something that doesn't exist in reality yet, just like with the charge indicator light. Whether it will come to market and when, I don't know, but I hope it does. And it certainly can because we have virtual metering already. So the solar system and the meter do not have to be physically connected. It's the regulatory problem.

And three, PV exceptions, are there any requirements for additional efficiency measures if you invoke any of the PV exceptions. And then in related, if community solar is a viable option, why would you be able to invoke an exception?

Those are questions.

MR. SHIRAKH: The answer to your first question is if the PV is waived, the requirement is exempted, are there more requirements for energy efficiency? The answer is, no.

And your second question is if a building is eligible for an exception for onsite PV system, why should they be exempt from a community solar? The reason for that is that --

MR. NESBITT: No, the other way around.

MR. SHIRAKH: -- well --

MR. NESBITT: Yeah.

MR. SHIRAKH: -- the way it works, the amount of community solar credit, the size of the PV system for a community solar is determined by the CBECC software using the exceptions, so that's the way we've set it up. And it's partly because, you know, we couldn't tell builders that you can't put a PV, go put in community solar when we're not even sure if there's going to be a community solar requirement.

So to have an exception for onsite PV and then force the builders to enter into a community solar program that doesn't exist didn't seem like the right thing to do at the time but that --

MR. NESBITT: Yeah. My --

MR. SHIRAKH: -- (indiscernible).

MR. NESBITT: -- my only concern is that some people are going to have to invest in solar. They also reap benefits. But some people aren't and we're going to give them free ride. They get to reap the benefits but they also don't -- anyway.

So next issue.

MR. SHIRAKH: So you're cutting our again but the --

MR. NESBITT: Yeah.

MR. SHIRAKH: Oh, sorry, I think my -- I have to re-mute my --

MR. NESBITT: Yeah, that's fine.

So next issue is the standard budget and tradeoff. As you said, Mazi, you know, we have an efficient building enclosure, and then you mention passive house. Well, in passive house, you cannot trade off the efficiency of the building enclosure, whereas in California Energy Code you can trade off heating, cooling, ventilation and water heating budgets. And even though our baseline prescriptive package that becomes the standard budget is an efficient enclosure, because of federal exceptions on equipment, you can put in high-efficiency heating and cooling and water heating equipment, and you can trade off a significant portion.

And I just want to reiterate that we really do need an efficient building first. Equipment gets upgraded on shorter timeframes and it cheaper to upgrade than the building.

So the last issue is the energy design rating. And I'm just wondering how it complies with the Public Resources Code directing the

Energy Commission to have an energy rating system, a single energy rating system for new and existing homes, and how does it comply with the Energy Commission's Title 20 HERS Regulations, including the HERS rating system?

And that will preclude my questions and comments for now.

MR. SHIRAKH: Well, thank you. I don't understand that last comment, meaning we didn't see any conflict between any energy design rating and any of the statutes that govern our authority, so I'm not aware of any conflicts there.

I don't know if anybody in the audience, Christopher or Bill, want to chime in on that?

MR. MEYER: Yeah. This is Christopher Meyer, Manager of the Buildings Standards Office.

Yeah, we're using the EDR as to verify compliance with the standards, not as a rating. That was to be in conflict with that rule of one system. So that's something, you know, we have looked into and that's why we're using it as we are, as a compliance tool, rather than putting it out as a rating system for, you know, new and existing buildings.

MR. SHIRAKH: Thank you, Christopher.

Thank you, George.

Any other online comments, RJ?

MR. WILCHERT: Yeah. Next we'll go to Jeremiah. I'll un-mute now.

MR. ELLIS: Good morning everyone. Jeremiah Ellis, Duct Testers. I had a real quick question.

Mazi, in your presentation, you were showing the energy design rating score on an index of sorts, similar to the RESNET scale. And I was wondering if that is something that's going to be developed into the software as part of the reporting, the final reporting that are available from the software? Because the builders would love to see that.

MR. SHIRAKH: Sorry. I have to mute myself, then un-mute.

Yeah, I think you were referring to this screen. Is that what you were referring to?

MR. ELLIS: Correct. Right.

MR. SHIRAKH: And so on the right, you know, this is not part of our requirements. You know, that's just a chart, shows where we are on the EDR score, although it's possible to, you

know, come up with some kind of like an ENERGY STAR-type of a label. I mean, that, you know, we can do that. So you know, the software will report your EDR score, the CF1R does, and so you'll get a report currently that includes an EDR score for both energy efficiency, the PV plus flexibility, and a final EDR. So that report is already available.

Bruce Wilcox wants to either correct me or add something to it.

MR. WILCOX: Well, we're currently in the process of revising the printed CFR report, all the reporting, actually, using a new software system for that. And so the 2019 software that we released for review does not have final versions of any of those reports in there. So the onscreen reports are pretty much the way you've shown them, Mazi.

MR. SHIRAKH: Yeah. The onscreen reports, you know, they show that, you know, we will expect that ultimately they will be on CF1R. Is that your expectation?

MR. WILCOX: CF1Rs are being revised but they're -- you can actually see two different versions of the CF1Rs, the old one that doesn't -

- isn't right and the new one that isn't right. And so don't get excited about the fact that they don't agree or that they're not right because those are in process.

MR. MEYER: Yeah. This is Christopher Meyer again. Just going back to the last comment we received on what the other offices are doing on, you know, the HERS 2 rulemaking that will be coming up in the future. That's why this was designed as a part of the compliance tool just to -- we wanted to align with the RESNET. But if we start using this as some sort of a sticker you put on the side of your house, then, you know, we need to, you know, work through a different process because then it's used as a rating system for the house rather than a metric, basically, to determine whether you're in or out of compliance for our standards.

MR. SHIRAKH: It would actually be nice if we can come up with a label that has the elements of this, what I have. Again, this is not required per our standards. I just put this because it's got cool colors and it's good information, but it can also show the EDR score of your house. So like in here it says 2019,

efficiency is 15 to 27, but this house is at 8. I mean, that would be good information but that's not related to this workshop.

Any other comes online?

MR. WILCHERT: Yeah. I'm going to read a couple here.

This one is from Geoffrey Yamasaki. "For three-story multifamily developments with no shading, full solar access, I understand that there will be a user input for the proposed PV capacity based on the calculation. My question is whether the software will account for the roof area in the baseline, especially for pitched roofs where essentially half of the area is unusable due to orientation?"

MR. SHIRAKH: That's the -- this exception, was it a three story? So that's the exception for here. So what this exception does, it modifies the PV requirement, both prescriptively and in the performance software, to reduce the PV requirement baseline down to a 0.8 watt per square foot of conditioned area. So this would be roughly, I think like a 2.4 kilowatt PV system for this prototype. And that takes up about 150 square feet of roof area.

So we did look at many different plans that architects sent to us and we found that most of them could easily meet this requirement. You know, even if half of the roof is shaded, you still have the other half to work with. And it's not that difficult to come up with, you know, 120 to 140 square foot to accommodate this requirement, given that, you know, the requirement is that you have to think about your roof lines when you're designing this building and the location of chimneys and other -- all the other obstructions. And so if that is the case and there are no external shading and obstruction issues, like trees and adjacent buildings, we didn't even identify -- we couldn't identify any scenarios where this requirement was a problem.

MR. WILCHERT: Okay. I have one more from Kelly Gamino. "Will this model take into consideration emissions reductions co-benefits in addition to the carbon emissions, and in particular, NOx? And additionally, I would like to recommend, since all the data will be available, the co-benefits also be quantified so that they can be taken into consideration when determining energy efficiency options."

MR. SHIRAKH: Actually, when you talk about NOx, you know, we've considered CO2 issues. We're considered refrigerant leaks. And the only way we can capture the consequences of these externalities is by including their cost into our TDV metric. There are currently cost consequences for CO2 emissions. And there are numbers and algorithms that have been approved by the CPUC. None exist for other kind of pollutants. If and when they become available it is possible to incorporate them into the TDV metric.

We are talking to the CARB, the Air Resources Board, about how to capture the implications of GHG consequences, of refrigerant leaks from heat pumps, all the refrigerant equipment that use a compressor.

So, yeah, in theory it's possible but we have to have the right numbers and methodology before we can incorporate it.

So that's all the questions we have for this section. I thank you and I'll turn it back over to Larry.

MR. FROESS: Yeah. Thank you very much to the commenters. Why don't we take a 15-minute

break before we start into the next section, so why don't we return here at 11:15.

(Off the record at 11:00 a.m.)

(On the record at 11:21 a.m.)

MR. FROESS: Okay, welcome back. We're going to start the next section which will be envelope, HVAC and water heating. After that, we're going to have another public comment session. We have on our schedule to have a lunch break but we are anticipating the third session, going HERS and miscellaneous topics, won't take more than 15 minutes, so we're going to propose to not do a lunch break but we'll do the public comments after this next round. Then we go right to the end with a final round of questions and we should be out of here, maybe by 12:30 or 1:00.

So the next session is going to be envelope topic. And Dee Anne Ross will be our presenter.

MS. ROSS: So I'm Dee Anne Ross. I'm usually CBECC-Res support. And the rulemaking is over so we're not revisiting any envelope requirements. This is just an overview of what's in the software and the ACM Reference Manual.

So R-19 in roof deck insulation, below

roof deck insulation, it used to be R-13. And Option A is -- well, actually, that's not really relevant but Option A doesn't exist anymore, but you can still model above deck roof insulation.

And this is ceiling, attic, ceiling, oh, this is in multifamily. Multifamily category didn't previously exist. We added that table. And so in Climate Zones 10 and 16, it has R-13 below roof deck insulation. And that's about the highlight of that.

And in walls, it was previously R-19 plus R-5, and that was an 0.51 U-factor and now it's 0.48 in most of the climate zones, and 6 and 7, they did not change. And multifamily is still 0.51 in most of the climate zones. And in Climate Zones 6 and 7, it's 0.65. And that's about the highlight of what's changed there. And I do have on here, when you -- if you download the slides later, the ACM section where this is in -- documented in the ACM.

And demising walls or garage walls, they have the same cavity insulation value as is normally required in the wall, just no continuous insulation. And we have documented in the ACM the exceptions for additions where either an

extension of the wall or an existing wall without siding removed. And the U-factor for windows is now 030 instead of 0.32, 0.32, I'm sorry, I'm not speaking very clearly. And the SHGC in most climate zones that was 0.25 is now 0.23. And in Climate Zones 1, 3, 5 and 16, 16 changed from a low SHGC Climate Zone to what's referred to as NR in the packages, those are all 0.35, whereas it used to be 0.50 for no requirement SHGC.

And QII is required for single-family -- I'm sorry, not required but it's part of the standard design for all climate zones and single-family construction and additions greater than 700 square feet, and in multifamily, it's all climate zones except 7 for both new construction and additions greater than 700 square feet.

And that's it for me.

(Colloquy)

MS. ROSS: I'll do it. Additions, so addition compliance is expressed in TDV, not EDR. And PV is not required for additions. And then I just included the language that's in section 1.3 to prove it's really in there.

MR. FROESS: So the next topic we're going to talk about is HVAC. The first one here

is for two new space conditioning airflow requirements. Small duct high-velocity systems can now meet an airflow requirement of greater than 250 CFM per ton. Previously, they didn't have a requirement but they had to size themselves through a prescriptive version. And for systems with less than 350 CFM per ton for a zoning controlled single-speed compressor, those will requirement HERS verifications and they can not be -- use the group sampling method. They have to be tested on 100 percent cast-by-case basis.

We have a verified air handling unit fan efficacy change. Small duct high-velocity systems must verify to a fan efficacy of less than or equal to 0.62 watts per CFM. A new change for gas-fried furnaces, anyone manufactured after July 3rd of 2019 will now have an efficacy requirement of less than or equal to 0.45 watts per CFM. All other systems, such as heat pumps, will remain at the less than or equal 2.58 watt per CFM.

We're going to improve the user interface for buried ducts. We updated the table to account for the new R values and mandatory

requirements for duct insulation. They're clarified, the qualification criteria for buried ducts. Deeply buried ducts can now be available without lowing the duct chase. And currently we were trying to get a new user interface into this alpha version of the software but didn't quite make it. So in the next version, we're going to have a user input screen where they can just input duct lengths, R values and what zones they're in and it will do all the math for you. Currently, you have to do a side calculation and then input the resulting values into the software.

Whole house fans, a little bit of a change. Currently, for 2016 the standard design is a 1.5 CFM per square foot of conditioned floor area and a 0.1 watt per CFM. We've increased that fan efficacy to a 0.14 watt per CFM now. You can get credit if your installation has more than 1.5 watts per CFM and/or less than the 0.14 watt per CFM without having a HERS verification. You can get additional credit with a HERS verification wherein the software essentially increases your airflow by one-and-a-half times. And a new feature is we have the ability to model

a whole house fan in a cathedral ceiling. So houses that don't have attics, previously you couldn't model them but now you can if you use an approved fan.

Central fan ventilation cooling system, there is some credit available due to the ventilation, airflow and fan efficacy which reduces the cooling energy.

Water heating, there's some new compliance credits. The first one is a compact hot water distribution. And within that, there are three selections, none which is on credit, you can do a compact distribution basic credit which does not require a HERS verification, and the third one is a compact distribution expanded credit which does require a HERS verification. And that's -- there's a screenshot there where that's done. That's in the DHW System Data tab and you just select the distribution compactness and make your selection.

The next one is drain water heat recovery system. This is a new feature as well. There's three configuration choices available. One is equal flow and this is where you have your drain water heat recovery device after the drain and

the water returns back to the water heater and also partially close up the shower. The next one is an unequal flow where all of the heat exchange water flows back to the water heater. And the third is an unequal flow where all the water flows back to the inlet of the shower. The efficiency input is based on the CSA rated efficiency based on the manufacturer. And you can configure this with multiple showers, multiple configurations, you can mix and match them, so there's a lot of flexibility with that option.

Here's another screenshot. You input -- it actually shows up as a new object and a device right below the water heaters. You can see that on the bottom left. So you're actually creating a new device and defining the efficiency of like DHWR-1 and 2, for example. And then under the drain water heat recovery tab under the DHW System Data tab, this is where you select how many showers are available to be used. And you can then start selecting which drain water heat recovery devices is going to be attached and which configuration and how many showers is serves, et cetera. So there's, again, a lot of

flexibility to use that.

There's a new update for the standard design for water heating. We've implemented a new way to allow an all-electric house. If you -- currently, in 2016, you always have gas-fired instantaneous water heater as your baseline. Now, if you've selected an electric water heater as a proposed system the standard design will switch to a 2.0 UEF heat pump water heater, along with the basic compact hot water distribution, and a drain water heat recovery system. It doesn't necessarily mean you have to design the house to include those because generally a NEA rated Tier 3 water heater would be pretty equivalent to meeting that.

For a multi-dwelling unit, electric water heating without recirculation, this would be like for a small like duplex, quadplex or so, without a recirc but it happens to have one central hot water heating device, the standard design will use a 2.0 UEF U-pump water heater. But for the larger multifamily dwelling units that has a recirculation system, the standard design is still a gas-fired water heater.

And that would round up that portion.

Are there any questions in person?

And just to remind you this, state your name and affiliation.

MR. SPLITT: Okay. It's Pat Splitt from App-Tech again.

There's currently, I don't know when it first appeared but not that long ago, it seems like there's more credit now given in the current code for heat recovery ventilators. So if I have a new home that -- a small home that maybe required 40 CFM of constant ventilation and I put a heat recovery ventilator that was 50 percent efficient, you could say it gives us 50 percent lower energy use, then I can see that you should get a credit for that.

But what many energy consultants have discovered is there is no upper limit. So a lot of times they're getting a lot of input from their clients that they want to remove completely all the exterior insulation or some other feature they want to change. Well, it's been discovered that if you put in this heat recovery ventilator credit, you get some credit. But if that's not enough you just put a bigger heat recovery ventilator in. So instead of 40 CFM you put in

400 CFM, all of a sudden it passes easily and you don't need any of these features that the builder didn't want to build. And if you take a model that had all -- was modeled like that and you just take out the heat recovery ventilator, it might fail by 40 percent of hitting the energy budget. That's huge.

And so not only -- so obviously, I don't want this in the new code, we want some fix, but it also has to be changed from the present code. And my suggestion is, since the program already knows the required actually ventilation rate is, that they limit the credit to 150 percent of that CFM. That gives them a little room to oversize because you can't always hit the number exactly but not a ridiculous amount, so there still is some incentive to put in the HRV ERV but it's no longer just a trick to get out of having an energy compliant envelope. It's just a big problem. It's spreading around. People are learning about it and they're all laughing, why do you pay for credit?

MR. FERRIS: Yeah. Well, they're cheating.

MR. SPLITT: But it's a big problem.

MR. FERRIS: Yeah. Okay. So I mean, we can -- sorry. So we can absolutely talk about putting in some limits to, you know, if -- you know, the engineers can decide if 150 percent is --

MR. SPLITT: Well, you picked the right number.

MR. FERRIS: -- accurate or --

MR. SPLITT: But, you know, nothing exorbitant, but the -- you know, if they have to pick a little bit size because that's the closest one they can get to provide the ASHRAE number, they shouldn't get penalized for it. But otherwise, they shouldn't get credit for it. And I think just -- I think just limiting the CFM is enough to do the job.

MR. FROESS: That's a good comment.

Anybody else in the room?

MR. DELFORGE: Pierre DelForge with NRDC.

So I wanted to make the comment around demand management or DR credit for water heating. So the, you know, the concept is that now that the code, you know, facilitates the -- or at least, you know, allows the use of electric water

heating, particularly heat pump water heaters in the code, that there's an opportunity to use this water heater as a storage device, more storage device and able to, you know, load up during the middle of the day when there's low-carbon and potentially low-cost electricity and coast with the evening peak. And you know, this is an important, you know, opportunity as we know that we have the duck curve to tackle and we're trying to, you know, harmonize with the grid to make sure that as we put these heat pump water heaters in they are, you know, as grid friendly as possible.

So we've been, you know, working with, you know, appreciate working with the staff on this. And I know that, you know, we have indicated in previous workshops, and I've had Commissioner McAllister, as well, that this would be part of the codes. I just wanted to, you know, ask about the status of that and next step because we didn't cover it this morning?

MR. FROESS: Thank you, Pierre. Yeah, we are aware of that. We just had a big enough workload to get to this point and we didn't have time to effectively work on that one, but we are

aware of it. Danny Tam, who is actually our water heater expert, is out on paternity leave. So when he gets back, I think that's going to be one of his tasks, is to get started working on that. But we're not ignoring it. We know it exists and we just need time to develop it.

MR. DELFORGE: Okay. Thank you. And can you give us an estimate of the timeline of what the, you know, what the next -- when we might see this implemented in a research version of the software?

MR. FROESS: That will be hard to say, to pick it. We're not sure how much time it will take to develop it and we have to work it or whatever we need to do to get that into the software. I'd say many months. But because this is an ACM, it's a living document and software --

MR. DELFORGE: Um-hmm.

MR. FROESS: -- it's not like since you're not in the software today, you never will be. It's just whenever it's ready to come in, it will go in at that point.

MR. DELFORGE: Okay. Thank you.

MR. SEVERANCE: I had a question about the -- I'm sorry. Bruce Severance, Mitsubishi

Electric. I apologize. I already gave my card earlier.

A question about buried ducts and if you're allowing buried ducts to exist without dropping them into soffits or recesses? You're still requiring insulation at the roof deck regardless. And you've eliminated Option A, so we're no longer doing above deck insulation; is that correct?

MR. FROESS: Well, no, it is -- yeah. Correct it's not a prescriptive requirement anymore but you can still model it if the house actually has it in a proposed design.

MR. SEVERANCE: Oh, okay. So you know, I guess just a couple things is that, you know, again, having seen retrofits and really looking at cost effectiveness, and I've talked to a lot of energy analysts and BPI contractors that have done this in the field, even some that have done research for CEC, and there's a sense in the community of people that I happen to have talked to that roof deck insulation is somewhat overrated, you know, that there's a lot of cost involved in putting under deck insulation and that burying ducts in an attic under like R-60 is

far less expensive.

If you look at the difference in costs between R-38 and R-60, you go out and get bids and you're looking at about a buck a square foot in most of California, economics are different in different regions a bit, but to go from R-38 to R-60 blow-in insulation where you get very little possibility of cavities if you do it right, the cost differential might be $.25 or $.30 a square foot, $.45 a square foot on the outside. So you know, just cost comparison-wise the under deck insulation is fairly expensive.

And in retrofit situations, I've seen enormous efficiencies gained just by doing proper attic ventilation. And I'm seeing reports of a lot of failure modes with under deck blown insulation. And it seems to me that CEC might want to publish a set of recommendations because we've been experimenting with a lot of different approaches and we're seeing data in the field of, you know, roofs that aren't more than two or three years old, the OSB decking getting soggy because of blown ISOFOAM underneath that deck and the incidents of vapor drive tending to run to the ridge of the structure.

And so, you know, we experimented with sealed attics. And I think sealed attics are, you know, in our climate zones are not necessarily a good idea, most of them at least. I mean, Climate Zone 16 might be an exception. So just because there's been a lot of experimentation with these things, I think it's really important that we look at the hard data and that, again, we're making recommendations to builders that are maximizing cost effectiveness relative to the efficiencies that we're gaining.

And you know, the anecdotal evidence, I've just seen houses that were super overheating by three o'clock in the afternoon in 100 degree weather. And when you deeply bury ducts and air seal the attic plain properly the temperatures are 75 degrees at three o'clock in the afternoon and the air conditioner hasn't even turned on yet. So you know, in old structures, I've seen that work. I have to assume it works in new structures, as well.

So I would just ask that we're substantiating those kinds of mandatory measure with real-world data and cost tradeoff analysis, so we're really looking at what it costs in the

field to do these things. We're not forcing builders to spend an extra $1,000 unnecessarily.

And the third point that I would say is just that service ability is key. If we're going to bury ducts in the attic there should be a standard for hanging pink flags from the ceiling in the attic, which has been a standard procedure for many of the contractors that I know, and many don't do this. So -- and having access gangplanks in the attic is something that adds about $200 in cost to a job in general. It's very easy to do. So serviceability.

And if we're going to put ducts in conditioned space, I feel very strongly we shouldn't be burying flex ducts in floor assemblies. We should be doing hard metal ducting in-floor assemblies with mastic and building that so it lasts. I've just been in too many houses that are 25, 30 years old and the duct leakage is crazy. And you have to remove the ceiling in ten rooms. And people live there and they just say, no, we're just not going to do that. And you know, the duct leakage is 40 percent and there's nothing you can do about it.

So serviceability to me is very, very

important. And we should be building stuff with those kinds of eventual failure modes in mind. You know, even with, you know, two percent duct leakage on flex duct today, we can imagine over time that that's going to degrade and 30, 40 years down the road we're going to have to get to it.

So I would ask that your procedures take all those things into consideration. Thank you.

MR. FROESS: Thank you. And I'm not sure that this is the workshop to address that. That's more of like a standards development issue.

MR. SEVERANCE: Well --

MR. FROESS: The software just takes the standards that were adopted and puts them into the software. So everything that you're mentioning can be modeled but it doesn't take into account the concerns you're talking about.

MR. SEVERANCE: Well, I guess what I'm -- I'm saying is that there's, you know, certain assumptions that are being made in the modeling that, you know, these things are the most cost effective. And I question that they are the most cost effective just because I've had experience

in the field that contradicts that, and I've spoken to other people that feel the same way.

So my sense is that whatever we're requiring as a mandatory measure in the modeling, that the CEC should be vetting that application or that measure, looking at cost tradeoff data, maybe, you know, talking to a builder or a consultant that does a lot of estimating that can really evaluate the bang for your buck that you're getting by requiring under deck insulation, for example, you know?

MR. FROESS: Again, this isn't the venue for that. That's a standards development.

MR. SEVERANCE: Okay. Well, nevertheless, you know, I just thank you very much for requiring HERS rating and not doing sampling on, you know, tract houses. I just, I'm very happy to see you roll around to that and I've seen --

MR. FROESS: Definitely for that one verification. There's still -- sampling is allowed, just for that one specific verification that is not allowed to be sampled.

MR. SEVERANCE: Yeah. Well, that's a step in the right direction. Yeah.

MR. FROESS: Thank you, Bruce.

MR. STRAIT: So this is Peter Strait. I'm the Supervisor of the Standards Development Unit.

I just wanted you to -- I wanted to invite you to participate in the upcoming 2022 code cycle. That will be where we actually go under the hood for changes to the code itself and that's where all the cost effective analysis is found. So for our prior rulemakings, you can go online and find where all the cost analysis behind all of the measures in Part 6 resides. And if there are further improvements to make to those, then that would be the forum for it.

We are just now starting to have a conversation with stakeholders about the code change proposals we'll likely be submitting in the -- for the next iteration of the code. So if you're not already signed up for our mailing list, please do so. And otherwise, that would be the forum for raising some of those concerns.

MR. SHIRAKH: Mazi Shirakh, Energy Commission.

Just to add a little bit to that, the software hasn't -- doesn't consider cost. And

our job in the software is to provide the proper tradeoff algorithms. So you know, you can just as easily model ducts and conditioned space, below deck insulation, above deck roof insulation, or buried ducts. And I think, you know, we've done a good job of capturing the savings. The choice of which option to go with is really the builders and that's where the cost implications come in and other aspects of different choices. But you know, as far as we know the software actually calculates the correct savings for each of those measures. And so if there's a problem with that, we'd like to know.

But you know, the cost is not part of this. The prescriptive path was developed using, you know, the below deck roof insulation. That was determined to be cost effective, maybe not the most cost effective but it is cost effective. And if there are other options that captures the savings at a lower cost, the builders will go for that.

Thank you.

MR. HODGSON: Mike Hodgson, ConSol, representing CBIA.

Bruce, where are you? There you are.

I'm really interested in your comments because we have been looking at the difficulties of installing high-performance attics for the last three to six years. And there have been a variety of research projects and investor owned utilities sponsored projects where I would guess there were over 20 installations of high-performance attics and we do not have documentation of moisture issues.

So if you have data on new construction, production home building that shows that, we would love to see it because that's the last thing we want to happen in our subdivisions. So we invite you to share not only with the building industry, but also with the Energy Commission if there are significant problems with moisture. We don't know about them. We have been trying to find those out and that is one of our Achilles Heels. We're very concerned about it. So look forward to talking to you.

MS. CHOWDHARY: Hi. This is Meghna from SolarEdge. I had a question in regards to PV and shading.

So currently, more than 80 percent of the res EPV market is dominated by power optimizers

and micro importers. And since these systems, with these technology we're able to track the maximum power point per module. The effects of shading on the overall system production are a lot less compared to other technologies.

So, so far I didn't notice if the software takes into account such technologies. And I recommend that we add that to the software so we can simulate the PV system production better.

Thank you.

MR. WILCOX: Hello. This is Bruce Wilcox. We recently added power optimizers, et cetera, as an option in the detailed inputs for the PV systems. So it wasn't shown on the slides but it is actually there. So please take a look at that and tell us whether we did it right.

MS. CHOWDHARY: That's great. Thank you.

MR. CAIN: Joe Cain with SEIA. I know that we -- that kind of jumped -- that topic jumped back a little bit. But can I ask in terms of what we can expect for Appendix C to the ACM Reference Manual, is that still to be expanded or where are we with Appendix C?

And in terms of detailed algorithms or

where we can go and look to see what the software is actually doing, as Ken would say, under the hood, will that be in changes to appendix -- what used to be Appendix E and is now Appendix F? Would anything appear in there or is all of this related to PV and batteries going to be detailed in Appendix C, including methodology and algorithms to support all of the -- what we've seen.

MR. FROESS: Good question.

MR. CAIN: Okay. I'll leave that as a good question.

MR. FROESS: Yeah. Thank you. Yeah.

It looks like that's all that's in the room, I guess. Are there any online?

MR. WILCHERT: Yeah. Geoffrey, I'm going to try to un-mute you. And if this doesn't work, I can read your question. Go ahead.

MR. YAMASAKI: Can you hear me?

MR. WILCHERT: Yeah.

MR. YAMASAKI: Okay. So I'm just wondering, multifamily (indiscernible) residential standard framed walls that have combined the wood and metal (indiscernible). I was wondering if there was a reason for that, you

know, from looking at using non-framed walls for (indiscernible).

MR. FROESS: I have to interrupt. We're having a hard time hearing you. Can you speak up?

(Colloquy)

MR. FROESS: Can you start over?

MR. YAMASAKI: Sure. My question was about the prescriptive wall assembly requirements. The wood and metal framed category is now combined to just framed walls, residential. Is there a reason for that?

MS. ROSS: Metal frame can be modeled. The standard design is wood framed. And anything, those in my slides on the envelope, that was wood framed walls. But you can still model metal framed walls, yet they still have to meet the mandatory requirement.

MR. YAMASAKI: Right. My question was just why the framed wall category is now one instead of separating wood and metal framing as their own categories? Because when you use metal framing for multifamily projects and you're comparing to the wood frames, it's just tougher to meet that requirement. It seems like, you

know, metal frames for residential is difficult to comply with. I was wondering if there was history behind that, other than single-families don't user metal framing.

MR. WILCOX: Well, this is Bruce Wilcox. I understand your question is why isn't the standard design in multifamily buildings a metal framed wall? Is that what you're saying?

MR. YAMASAKI: Yeah. Or why doesn't that -- isn't that an option, right, as a separate option before the metal framing and wood framing, but now they're grouped together.

MR. WILCOX: I mean, that's simply a policy question that the Commission has to decide about how to do the standard design. And currently, it's always wood frame in the standard design.

MS. ROSS: The standard design table refers to a U-factor. So that -- the stand design is that U-factor. It's typically, I think it was 0.51. How you meet that is up to you. I mean, well, I mean, you can exceed it, but you have to -- you get a penalty.

MR. YAMASAKI: Right. And that penalty didn't exist in the previous code, so I was just

wondering if there was a history behind --

MS. ROSS: This --

MR. YAMASAKI: -- that change?

MS. ROSS: -- it did exist. The standard design has always been a wood framed wall and the U-factor in Table 150.1(a).

MR. YAMASAKI: Okay.

MS. ROSS: 150.1(b) is new.

MR. YAMASAKI: Okay.

MR. FROESS: Cathy, we're going to go to y0uo. Your un-muted now.

MS. CHAPPELL: Hi. Cathy Chappell.

MR. WILCHERT: Hi. Go ahead.

MS. CHAPPELL: Hi. My comment was just that I couldn't hear that previous speaker, but Larry clarified that. Thank you.

MR. WILCHERT: Oh. Sorry.

MR. FROESS: Okay. That sounds like that's all the questions we had for those.

So as we stated, we're not going to do a lunch break. We're just going to continue on with the last session on here. And the next presenter will be Todd Ferris, who is the Supervisor of the Software Tools Unit.

MR. FERRIS: Hello everybody. I'm Todd Ferris with the Software Tools Unit. I'm going to talk to you about some of the changes to the HERS field verification.

So for 2019, we have changes to the CFM requirement for single-dwelling unit ventilation. Basically, we've a line to the new ASHRAE 622. There's also an additional testing protocol for a supply exhaust balance system. Big changes in multifamily. If you're installing a supply or exhaust unbalanced system a new envelope tightness verification is required in order to use that type of exhaust or supply system.

Kitchen range hoods for 2019 are having a -- they're not a performance verification but they are a rated verification. So expectation would be that the installed device would be compared against its rating from HVI to verify that it meets, for instance, for the traditional fans, 100 CFM and 0.3 zones or three zones, I'm sorry. We're verifying heat pump efficiency. In past code when you specified a higher HSPF, there was no verification, even though we were requiring it for air conditioners when they had a higher SEER or NEER. We fixed that for 2019.

We're also verifying the output of the heat pump. You can, as kind of Pat was referring to with the heat recovery ventilators, you can game the system. We were finding that people were gaming the system by putting in very large heating outputs for their heat pumps that weren't either logical or realistic to get extra compliance credit. So now there's an expectation that was modeled in the Title 24 should be installed in the field.

Too many moving parts.

Larry touched on it before, so in 2016 there was really no compliance pathway for small duct high velocity. And so they, to meet the airflow requirements, they basically were forced to use the prescriptive return air and return air grill and duct sizing. We fixed that for 2019. Now there's a special consideration for their lower CFM per ton. And as Larry touched on, for single zone or for zone way controlled single-speed systems, we're proposing that they not be allowed to use group sampling and they would be then 100 percent tested.

This is not a new -- the verified air handling fan efficacy is not a new HERS measure,

they just have new targets. So the small duct high velocities have a 0.6 -- 0.62, less than or equal to 0.62. Gas furnaces have been reduced to 0.45. And I forgot to put it on here, the heat pumps are 0.58 like they've always been.

Full house fans, it was our intent to actually require HERS testing on all whole house fans but cost effective analysis wasn't -- wouldn't allow that. So basically, what we've done is added an extra credit if you HERS verify the whole house fan performance. Our hope was to get builders to move in that direction for that extra credit for operating.

Central fan ventilation cooling, again, another area where the original intent was that they were to be HERS verified and we got that into it.

QII, not a new HERS verification. What's new is that your standard house has QII, so we would expect most houses will be doing QIIs because it's a very hard thing to trade off.

And then for the compact design, if you do the enhanced -- if you do -- if you take credit for the enhanced system at CBECC, there will be an expectation for HERS verification

design.

And the last one, I think, drain water heat recovery, if you decide to take that -- if the designers decide that in their systems, there will be a HERS verification requirement to make sure that device is installed.

The last part is basically related to the output of CBECC. So the output report that's currently being used from CBECC is not optimized of the HERS providers. There's a lot of data in that report that is not necessary. It wasn't based on our standard data dictionary so it required the HERS providers to translate a lot of the values that were in that report and it basically caused them headache and the CEC a lot of maintenance costs.

So 2015, we talked to the HERS providers and said that we'd like to come up with a new format for the report, have it be schema controlled which would -- it was recommended that we go in that direction so that we validated the parent data piece that would be put into a repository. And -- but we all decided it would really disrupt the industry if we changed midcycle. So for 2019, we'll have a new format

for what was called the Analysis-Results BEES that will be based on the standard data dictionary, 100 percent focused on the HERS data points that they need. And it should actually provide us the ability to have a better product.

Many of you who are in the working side of the industry dealt with versions of CBECC that, you know, we released a new version and all of a sudden one of the reporting flags for HERS wasn't working. This gives us -- because the new output is schema controlled, we can double check all that before we release software without looking through pages of XML code.

One of the things that I'm interested to know from industry is we can change the name of this. The current alpha version uses the project name dash CF1RPRF01E, X and L. We can go back to the original AnalysisResults BEES if industry thinks that better. We can come up with a name, you know, HERS upload report, I don't know. So you know, if you guys can give me your two cents, at this point we're at a stage where we can call it anything we want.

That's it.

MR. FROESS: Thank you, Todd.

So this is the last slide here. I just want to go over a couple miscellaneous items about the software.

With the PV requirements and target -- the target EDR finder, the runtimes would be improved -- or increased, I'm sorry.

I ran this on my computer and I was pointing out that it must be pretty slow, which is probably the case, but I ran the 2,100 square foot prototype for Climate Zone 12. And just by doing the standard compliance run with the standard PV scaling without the target EDR, there's a 48-second run start to finish. When I do the target EDR score of 20, that initiates several more runs as the software tries to do some iterations to narrow down what it takes to hit 20, so that increased the runtime to a minute and 33 seconds. When I set the EDR target to zero, it needed to do one or two more iteration runs to get it to that mark, so that was 2 minutes and 15 seconds.

So the point of this is just to let the consultants know and energy modelers know that runtimes could be increased. But I always want to point out, too, that the target EDR is not a

requirement, that's just a benefit to the modeler. But just be aware that these new features would increase runtimes and just to account for that in your workflow.

The existing, post-addition and alteration of feature is not fully functional in this alpha version at the moment. We were focused on getting the single-family and multifamily operational, so -- but this will be fixed in the future release in the next couple months. And as Bruce pointed out, the reporting of a CF1R, the .pdf report is not accurate for what it reports, as well. That will be completed at the final version that we present for the Energy Commission for approval.

Which leads me to this slide. This is our timeline. Currently, we have the alpha release out which is available for the public and that was released in January of 2019. Our next release will be what we call the release candidate and that will be released before the Energy Commission business meeting, several weeks before the business meeting. So that, again, will be similar to how we just did this release here but we won't have a workshop, so it's

available for the public to review and comment on. And then we present it to the Energy Commission's business meeting in May to present it for approval.

And then if it is approved it will become certified. It will be called the 2019 1.0 software. At that point the existing plus addition an alterations will be fixed, and the CF1R reporting and, hopefully, Todd's XML reporting file will be working, as well.

So that's the end of our workshop. We'll have -- we'll do -- yeah, we will, we'll have one more -- yeah, there it is. So I just wanted to point out before the comments that we strongly encourage written comments to be filed by March 1st, the sooner the better because the later it gets past March the lower the priority that may become, so try to get it to us as fast as possible. And here's the information to do it with the dockets and the hyperlinks. And, sorry, Pat.

And so now we are open to any further questions about anything that we presented today.

MR. SPLITT: Pat Splitt from App-Tech. You know, I haven't been here for a while, so

I've got a bunch of comments saved up.

Just two things. One has to do with water heating and -- water heating and small storage tanks. If I did a tankless water heater, I am not sure about this, but sometimes I have to model at least one gallon of storage or it won't run or other times I can model that. And I was always under the impression that that means, if you model any storage there, that's a volume of water that's constantly maintained at a certain temperature, not just a tank that water goes through. So it doesn't always seem to work the way I think it should.

But lately there have been a lot of direct vent, not a lot but some direct vent tankless water heater that have a tank in them and they're used for different things. There's one from Navien that you can actually program to do different things. It has a pump in it. You can program it to be an on-demand research system which is good, but you can also program it to constantly keep that little tank of water inside there hot. So is that still a tankless water system with a tank in it? Is there some special qualification there? I don't know.

But also on the other side of that, since it's federally regulated and there's already efficiency for it, could the Commission even do anything about that tank being in there?

So there's some more hybrid water heating systems coming out now that I'm not sure fit into the software right now, so that was that comment.

MR. WILCOX: I think that little tank that's in there is an input was because of those hybrid systems two cycles ago when they first started bringing in the tankless gas water heaters. This, I think, intended in the CBECC software to add an extra loss component.

MR. SPLITT: But I shouldn't get penalized for loss of it if it really isn't constantly maintaining the water temperature.

MR. WILCOX: Well, what is it doing?

MR. SPLITT: It just heats the water when the -- when there's a demand and then the burner turns off. There's some water stored inside the unit but it just cools off. It's not being constantly heated.

MR. WILCOX: Right. Okay. Well, so, yeah, maybe you should send us the ones that you don't think are working right and we can look at

it because if you put a tank in there, it's going to get maintained, I believe.

MR. SPLITT: Right, but can you model it because it's in this federally regulated thing. Can you penalize -- you know, I'm saying if it was outside, you could do that. But can you actually do some special penalty because --

MS. ROSS: Isn't that a mini tank? Although, you use EnergyPro. But in CBECC, there's a mini tank.

MR. WILCOX: Yeah. This is a very complicated subject, so why don't you give us some examples.

MR. SPLITT: Okay. And the other comment is something I mentioned before but, can I say, running into a lot of problems with things just aren't checked in the field. And I mentioned this before and I'll mention it again, I think that, especially since the scope of the HERS raters' work is being expanded, they had QII, there's more things, they're always going to be out on these projects anyway. Why not just make them an Energy Special Inspector and let them be responsible for all the energy checking, not just the HERS measures, and just give them a form

that, once they've decided everything is right, they give it to the building official and they're happy. Things have been met, they didn't have to go out there and scrutinize things that they don't think are important because they're not health and safety, I think it would be a great idea.

MR. FROESS: Thank you, Pat.

Any other in-person questions or comments?

MR. WILCHERT: Eric, I'm going to un-mute you now.

MR. FROESS: We've got one more RJ.

MR. WILCHERT: Okay. We have more in person. Okay. We'll go ahead.

Eric, I'll un-mute you now. Go ahead and state your name and affiliation.

MR. ADAIR: Hi. My name is Eric Adair. I'm currently working on behalf of the Hearth, Patio and Barbecue Association. I have a comment and I have a couple of questions that kind of go with it.

The HPBA believes the hearths, stoves, fireplaces, and similar appliances provide an energy benefit when used as a zone heater in a

home. This effect, in turn, is compounded when combined with the new energy efficiency envelope requirements coming up in the code. Hearth appliances are typically installed in high occupancy rooms where the heating demand is the greatest, family rooms, great rooms and the like. And their use can take the energy burden off of the central heater, so we believe there's a net benefit here for everybody, all parties involved. This leads into a couple of my questions.

Zone heating; right now, to the best of my understanding, and I really admit I could be mistaken on this, but to the best of my understanding zone heaters cannot be currently modeled in the CBECC software as a subzone of a central furnace. You can make them a separate zone but not a zone within the zone that it's already serving. I believe it's essentially ignored if it's modeled that way. And this is exactly what is typically installed in an actual home.

Can creating a subzone be included in the CBECC software to better model the energy efficiency and use the hearth appliances? That's question one.

Question two is tied closely to it. The zone heating credit, we have the living versus sleeping zones currently allowed in the CBECC software. What we would like to have is a better understanding of the calculations that go into the zone heating credit. Is the algorithm or the calculation details available somewhere and can we look at that? Currently, there's only a checkbox in the CBECC software. And the results output on this seems to be fairly minimal, which is the reason why we'd like to take a closer look at it. Because in practice we seem to see much greater energy savings in real use but the software is not modeling it that way, and I just -- we're trying to resolve the two.

Lastly, radiant heat, fireplaces and hearth stoves provide significant measure of radiant heat, that nice sensible heat you feel. Currently, CBECC software does not factor in radiant heat into its calculations. Can this be applied so we can better reflect the energy efficiency and the energy provided from hearths, appliances, and similar applications -- or appliances?

That's what I've got.

MR. WILCOX: Bruce Wilcox. Not in the order you asked the questions.

The ACM Manual documents, the thermostat subpoints that are used for the heating and zoning credit. And so I think you could find that.

I'm not sure I completely understood your first question. I think you were talking about putting multiple heating systems in the same zone. And the way the ACM rules are written the software assumes that the load is being met by the system that has the worst performance. This has been a rule for 40 years probably. So you know, that limits the kind of tradeoffs that you were talking about. I mean, that potentially could be introduced as a new measure that the Commission could look at in the future but I don't think that's possible under the current rules. And it's not implemented in the current software.

MR. ADAIR: Okay.

MR. WILCOX: Radiant heat, so we don't have any special modeling for radiant heat. The models include radiant effects and they were written in a very detailed way but we don't have

any special radiant thermostats or any of that for either heating or cooling. And I think in most buildings that are insulated, as well as we're requiring for stuff for new buildings -- stuff -- new buildings in California, as far as I know the evidence is that there's not a big difference between things that are controlled radiantly or not. If, you know, if there's some evidence that that's not true, then we'd be interested in -- for you to present it. But I don't know, I mean, just offhand.

MR. ADAIR: Okay.

MR. FROESS: That's all the online questions. If there's no -- oh.

Bruce, you had one more inside here?

MR. SEVERANCE: Okay. There. Okay. Sorry. Bruce Severance, Mitsubishi Electric.

In the past code cycle, radiant in-slab systems have not been required to have full under slab insulation. I think even in Climate Zone 16, you are required to have stem wall insulation and four feet from the stem wall, horizontal insulation. And yet those types of radiant systems were given ducts in conditioned space credit, if I'm not mistaken.

And I was wondering, you know, I ran my own heat load calcs on this just by hand and came up with heat loss to ground that resembles, you know, like R-6 insulation in attics that are unconditioned. And I just don't understand how the math works out to give radiant systems this credit, you know, a compliance credit boost which is very significant. And I just don't understand how that math could possibly work out to have that be advantageous from an energy standpoint. Certainly, it precludes in-slab radiant from really ever going to an electric source.

And if the state is really looking at, you know, trying to eventually, you know, electrify, as so many people that are looking at SB 100 compliance and how we eventually get there, it seems that under slab insulation should -- it's not even a modeling option right now in CBECC. You're not -- there's no button that allows you to do full slab insulation of different thicknesses. And it's not modeled. And I just, I know from passive house design that this has been a big factor in how homes perform. And you know, in a passive house scenario it's very unfavorable to put in-slab radiant at all

because you're precluding that from having a delta t that would allow that to absorb excess heat and rerelease it as needed. So it actually prevents the passive house features from working to put in-slab radiant in. And I don't see that discussed anywhere.

So the reason that's relevant to, you know, air source heat pumps is that for the -- you know, up until now we have not enjoyed any duct in conditioned space credit and yet were, you know, ductless heat pumps are ductless, so it doesn't really -- you know, it's kind of extremely difficult from our perspective to understand why those kinds of tilts in the playing field would even be built into the software. You know, I guess I would love an explanation.

I heard one CEA theorize that, well, the ground probably heats up and there's this cushion of hot earth underneath the house, and so it only loses so many BTUs and then that loss tapers off. I've never heard of any data collected on that. I mean, that was just somebody throwing out a theory.

Has there been any data collected on

this?

MR. WILCOX: This is Bruce Wilcox. Modeling slab losses and ground losses is a complicated subject. And there's a long history of these systems in California and I think kind of the approach we have on software is what's been being done for 20-plus years. There has not been a move to change that. We've been recently doing work on improving the models in CBECC-Res to handle ground losses better but that hasn't made it into the compliance versions yet. That's on our list of things to do. And also, we put under slab insulation as part of that.

MR. SEVERANCE: Yeah.

MR. WILCOX: And so we're going to move forward on that. It's -- you know, if there's a general groundswell of opinion that we should do that sooner rather than later, that wouldn't hurt getting it done. But we are also --

MR. SEVERANCE: So will everybody in the room write a letter today or --

MR. WILCOX: Well, you know, I'm sure Pat Splitt could get up and argue with you if you wanted him to do that.

MR. SPLITT: We probably argued over that

last week.

MR. WILCOX: Not here though.

MR. SEVERANCE: Well, I guess, you know, one way to solve that would be to just require under slab insulation and, you know, minimum R-10 if you're going to do --

MR. WILCOX: So this is --

MR. SEVERANCE: -- in-slab radiant, you know?

MR. WILCOX: Bruce, you would could with the case teams and make this a proposal for the 2022 standards.

MR. SEVERANCE: Yeah. Okay. I will.

MR. WILCOX: I imagine they've considered this --

MR. SEVERANCE: Yeah.

MR. WILCOX: -- in the past.

MR. SEVERANCE: Well, it would, you know, it would just be wonderfully helpful if CBECC was capable of modeling full slab insulation.

MR. WILCOX: Yeah. Agreed.

MR. SEVERANCE: You know, it would be wonderful if it was able to model that. This is kind of a wildcard variable in my mind and it's one that puts radiant -- it gives radiant a

compliance credit that's completely out of scale with what's been done to ductless systems historically. So just appreciate your consideration on that.

MR. FROESS: Thank you. Okay, I think that's it. I just wanted to thank everybody for attending today. Your comments and questions are very useful to us to help determine, you know, what the public is thinking.

So this is the finale. I'd like to thank everyone for spending their Valentine's Day with us here. We'll have transcripts available in a couple weeks, I believe. And we will be posting our presentations maybe by tomorrow, or I'll just say a couple days.

So thank you very much and drive safely on this nice rainy day.

(The workshop adjourned at 12:24 p.m.)

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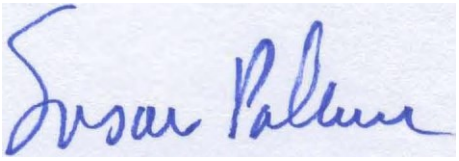

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Myra Severtson
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