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CALIFORNIA ENERGY COMMISSION

In the matter of:

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STAFF WORKSHOP:

2025 ENERGY CODE HEAT PUMP BASELINES AND

SOLAR PHOTOVOLTAIC SYSTEM REQUIREMENTS

REMOTE ACCESS VIA ZOOM

THURSDAY, JULY 27, 2023

9:00 A.M.

Reported by:

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P R O C E E D I N G S

9:05 a.m.

THURSDAY, JULY 27, 2023

MR. BOZORGCHAMI: Good morning, everyone. This is Payam Bozorgchami, one of the senior engineers in the building standards branch here at the energy commission. We're going to start the pre-rule making workshop in about five minutes. Just want to make sure we allow everyone to get on and get settled and be ready to go. So, thank you so much. So Good morning, everyone. Welcome to the Pre-Rulemaking Workshop on the Heat Pump Baselines and Solar Photovoltaic and Energy Storage System Requirements for the Proposed 2025 Energy Standards. Before we start the workshop, we've got some housekeeping rules, and I just want to go over those real quick.

First of all, this workshop is being recorded. And we do have a court reporter on hand that's going to be recording and transcribing the notes from today.

So in doing so, after every works presentation, you are more than welcome to raise your hand and we will mute you or unmute you, and please state your name and your affiliation. And we're asking if we could have one speaker from every affiliation speak today. There's going to be a lot of happening and there's going to be a lot of discussions happening.

If we do not get to your comments or your questions today, we're more than happy to have you submit your comments in writing to us and we will be able to review and respond back to you.

If you're on the phone and you want to have a have a discussion with us, you could press the star nine and raise your hand and we will unmute you, and you need to, on your side, press star six to mute and unmute yourself. Again when you do get on to speak, please first state your name and your affiliation. And I will apologize right now, if you don't, I'm probably going to have to stop you and have you do that.

So we got a full schedule for today. And I really want to apologize right now. We were to get the agenda out on the -- or the noticed agenda on the docket, and unfortunately staff were working late -- or, actually, early, until this morning, working on these slides and the agenda and we were not able to get that posted in a timely manner. I rest assured that we will have them done properly from here on, but for the first one, I apologize.

So before we start, let me -- here's the agenda.

Javier Perez, our Project Manager for the 2025 Energy Standards, will do the introduction, give a little bit of discussion on the timeline, the metric, and the authority that allows us to do what we're doing.

Bach Tsan, who is one of our Senior Mechanical Engineers responsible for the heat pump baseline for single-family, multifamily, and nonresidential, will give us a quick briefing on single-family nonresidential.

And Danny Tam, one of our Mechanical Engineers and our subject matter expert on heat pumps and water heating, will also do a quick discussion presentation on multifamily.

Then we have Muhammad Saeed, he's our Senior Electrical Engineer with the Building Standards Branch, and he will be giving us a quick presentation on the solar fault solar photovoltaic system and energy storage store systems that we're looking into for 2025.

And we will have, at the end, we will have a quick Q&A session on everything.

But after every presenter speaks there's going to be a time for ask questions and we will try to respond to you and, if we cannot, we will get back to you.

With that, I'm going to stop talking and I'm going to let Javier Perez take it from here.

MR. PEREZ: Alright. Okay. Can you hear me okay? Okay. Great. I'm going to take the screen sharing and I'm going to share my screen.

MR. BOZORGCHAMI: Please do.

MR. PEREZ: Let me know if you can see my screen.

Okay. Alright. Let's get going. Thanks.

Hi. My name is Javier Perez and I'm with California Energy Commission. I'm the Project Manager for the 2025 Energy Code, and today, I'll briefly go over our authority and process, some of the drivers behind the Energy Code, the underlying energy metrics of our Code, and finally, timelines for the 2025 Energy Code update.

I want to take some time to thank you all for taking time out of your day to participate in this pre-rulemaking workshop, and hope that through your participation and collaboration with us, that we can make great strides in terms of energy efficiency and long-term state goals with this 2025 Energy Code update.

Alright, now let's start with the Energy Commission's authority and process. This slide is a little bit loaded, so I'll bring it up in segments to, hopefully, train your eyes to what I'm speaking to.

So two California Assemblymen, Charles Warren and Al Alquist, authored the Warren Alquist Act. And this Act authorizes the Energy Commission to develop and update the Energy Code on a triennial basis, and for local jurisdictions to enforce the Energy Code through the building permit process.

The Energy Code was developed at the direction of the Warren-Alquist Act to reduce the wasteful, uneconomic,

inefficient, and unnecessary consumption of energy.

Now on the right, you're seeing a chart that compares site energy consumption of single-family residential -- of a single-family residential building when built to the 2021 International Energy Conservation Code in blue, and then that same building built to the 2022 Energy Code requirements in green. On the bottom, you've got 16 climate zones that represent variations in climates that we have in California.

Now nonresidential buildings are a lot more complex and would take a lot more slides because of various variations in building types, so we're only going to go over a single-family buildings for this segment.

Now if you take a few points away from this graph, one should be that averaging across all climate zones, single-family buildings built to California's Energy Code use an estimated 52 percent less site energy than those built to the 2021 International Energy Conservation Code. For the 2022 cycle, we used time-dependent valuation energy, or TDV energy, as the underlying energy metric. And in TDV, which values energy differently depending on the time of day and day of the year, the Energy Codes requirements led to single-family buildings consuming 45 percent less TDV energy than if they were built to the 2021 IECC.

The last takeaway I'd like to leave this slide with is that while our buildings are becoming increasingly more efficient over time and outpacing national standards significantly, our buildings natural gas consumption, which is represented by the light green segments of the bars, are a large portion of our buildings overall energy consumption. Our state has lofty greenhouse gas emission reduction goals and buildings play a part in those goals. Our state also has clean energy requirements for electricity retail sales over the next couple decades that we'll go along -- that we'll go over on the next slide.

Now if you want to learn more about how the 2022 Energy Code compares to the federal standards, our 2022 impact analysis report can be found at the link below. These slides will be posted as soon as possible. We intend on documenting them tomorrow, Friday, July 28th, barring any complications, so stay tuned.

Alright, now let's talk about those state drivers and some of the themes of the 2025 Energy Code.

We're obligated to contribute to the state's greenhouse gas reduction goals, and one of those goals is Senate Bill 100 or the 100 Percent Clean Energy Act of 2018 which states that by 2045, 100 percent of electricity retail sales must come from clean energy sources. Now this will make electricity significantly cleaner over time and

will also have substantially positive impacts on the state's greenhouse gas reduction goals.

Another driver is Governor Brown's Carbon Neutral Executive Order to achieve carbon neutrality by 2045.

So the Energy Code is tasked with contributing to these goals and must do so by increasing building energy efficiency requirements, all while proving measures to be cost-effective and technically feasible.

Now how do we plan to contribute to these state goals with the 2025 Energy Code?

We'll continue to explore where highly efficient heat pumps can be introduced as a prescriptive baseline for space and water heating systems. You'll hear some of that today. And we'll continue to promote demand flexibility. And in 2019, we introduced solar photovoltaic system requirements for low-rise residential buildings, and in 2022 we introduced similar requirements for some nonresidential, high-rise residential, and hotel/motel buildings, and also added energy storage system requirements. And in 2025, we'll continue to work towards including these systems and considering where their use can be expanded.

Now for the purposes of the Energy Code, a process is an activity or treatment that is not related to human occupancy, and a covered process, it's just one of

those processes that we have requirements for or that we cover. Our processes can consume large amounts of energy. And as with all items identified on this list, we want to continue to make strides and look at these systems and to find efficiencies where possible.

We're going to make sure that our standards continue to serve as protection for affordable housing. When our standards increase energy efficiency they raise the bar for newly-constructed buildings and, in doing so, they bring affordable housing construction along with them. We're looking at affordable housing programs and the compliance tools that they use and hope to streamline some of their efforts to make it easier for the designers of these buildings to demonstrate compliance with our Code and demonstrate compliance with the requirements for affordable housing programs.

Existing buildings will continue to be a focus of the Energy Code. And we're also looking at smaller homes, or ADUs, and how our requirements fit for those smaller dwellings.

And we'll continue to collaborate with the Air Resources Board, the Department of Housing and Community Development, and the Building Standards Commission to ensure that our buildings continue to meet acceptable levels of indoor air quality. And we'll support these

agencies as the transportation industry continues to move towards electrification.

Alright, now let's go over our underlying energy metrics that help determine energy savings.

Now for the 2025 Energy Code cycle, we're pivoting from using time-dependent valuation energy, or TDV energy, using long-term system costs. Long-term system costs is the cost effectiveness and energy valuation methodology used in the development and implementation of the Energy Code. LSE factors are converted, are used to convert predicted site energy to long-term dollar costs to California's energy system. The underlying varying valuation of energy depending on the time of day and the day of year that was used for TDV still remains but we've converted those energy savings to long-term system cost savings to better reflect the actual cost of the energy to consumers, the utility system, and to society.

This graph represents an average day's dollars per megawatt hour and how that cost varies by time of day and the different inputs that go into that cost.

The source energy metric was introduced during the 2022 Energy Code cycle and is defined as the source energy of fossil fuels following the long-term effects and any associated changes in resource procurements. It focuses specifically on the amount of fossil fuels that are

combusted in association with demand side energy consumption and to calculate source energy for any given hour, and the value in that hour for each forecasted year is average to get a lifetime average source energy.

Now because a buildings energy use depends partially on weather conditions which differ throughout the state, the Energy Commission established 16 climate zones representing distinct climates within California. This is not new for this cycle but hopefully it serves as a refresher if you're already up to speed on California's Energy Code. As a result of having 16 climate zones, requirements can vary significantly from zone to zone since when energy savings vary, measures are found to be more or less cost-effective.

Now let's go over where we are in this cycle and where we're going over the next few years.

So from June of 2021 to May of 2022 the Codes and Standards Enhancement Team, or the CASE Team, requested and received over 700 measure proposal ideas. Now in the months that followed the Energy Commission collaborated with the CASE Team, got that list down to 80 measures, and further down to 40 as the work progressed. From March to November of 2022, the Energy Commission updated weather data and LSE and source energy metrics, and the CASE Team then held their workshops, their welcome webinars in

October of 2022, and followed that with workshops on measure proposals through May of this year.

In parallel, from November '22 to now, the Energy Commission has worked feverishly on 2025 heat pump and PV system measures for the 2025 cycle, which you'll be hearing about today.

From May to July of this year the CASE Team published their draft Measure Proposal Reports and held public comment periods to solicit feedback for those measures. If you'd like to view those draft reports, and in the near future view the final reports, visit the link at the bottom of the slide. Again, we hope to have these slides posted tomorrow. Otherwise, maybe a screenshot, convert that picture to text recognition, and then click on the link. But maybe we'll get that to you faster than we think.

Alright, now what's to come?

The CASE Team will be publishing final Measure Proposal Reports through August of this year. And the Energy Commission will take proposals from the CASE Team and other stakeholders and review, propose, and workshop those measures during this pre-rulemaking workshop phase through the end of August.

The Commission will then publish draft updates to the 2025 Energy Code or draft express terms in October of

this year and open rulemaking for the 2025 Energy Code in January of 2024. And we expect to adopt the 2025 Energy Code in June of 2024. And the Building Standards Commission should have their approval for updates to all parts of Title 24 in December of 2024. The effective dates of the 2025 Energy Code will be January 1, 2026.

Now on the topic of the Building Standards Commission, you know, we very much feel for the work that they have to do with intervening Code cycles. They've got workshops scheduled for August 1st through the 3rd next week, so we won't be having any workshops to make sure that we're not in conflict with that, those workshops and those stakeholders.

So our next workshop, we're routing notices now, we expect to have that published today, is scheduled for August 10th, same time, 9:00 a.m. to 3:00 or earlier, depending on when that ends. From there on, we'll have workshops weekly, we'll have notices out two weeks before the workshop date, but we're still finalizing the review of the measures that are to be proposed so appreciate your patience with that.

Now if you'd like to participate in the workshops that the Building Standards Commission is going through, next week, there's a link at the bottom of this slide, again, August 1st through the 3rd, visit that link and you

can sign up for their webmail.

Alright, now for this Code cycle, this is a list of senior staff in the Building Standards Branch at the Energy Commission. If you're as bad with names as I am, again, my name is Javier and I'm the Project Manager for the 2025 Energy Code. Payam Bozorgchami is our Technical Lead and specializes on building envelope, additions, and alterations to existing buildings and accessory dwelling units or smaller dwelling units. Hailie Bucaneg is our Lead on covered processes, demand response controls, and our nonresidential and residential alternatives, alternative calculations methods work. And Muhammad Saeed is our Solar PV and Energy Storage Systems Lead. And Bach Tsan is the Lead on HVAC Systems and Refrigeration.

And if you'd like to reach out, our email convention at the Energy Commission is firstname.lastname@energy.ca.gov. Our goal through all of this work is to build consensus through these workshops and through this public process and your participation, your comments, all of this goes a long way to help with that goal. So we hope to hear from you now, today, and hopefully in the coming months. We hope to make something that we can all agree upon and make great strides for the next Code cycle.

So with that, I'll send it back to Payam and

continue with today's workshop.

Thanks, Payam.

Thanks, everyone.

MR. BOZORGCHAMI: Thank you, Javier.

One thing I forgot to mention as housekeeping is even though we're not doing in-person meetings at this time, there's a few of our staff members, presenters here in the office today. And if there's a case of an emergency or the fire alarm goes off and we have to vacate, we're on the 15th floor, and by the time we get down and get the all clear to come back into the office, it will be about 30 or 45 minutes. So we're going to probably leave the system running for 45 minutes and we'll just come right back and try to get as much as we can done. If not, we'll extend it to our next workshop, which is happening on August 10th. So just wanted to give you that heads up.

And one more thing, please, for today's workshop, please provide comments and be active in providing feedback. The more we get sooner from you, the better it is for us to do a decent job in the workshop and the rulemaking process.

With that said, I'm going to hand it off to Bach Tsan, our Senior Mechanical Engineer with the Building Standards Branch and he's going to walk us through the residential single-family heat pumps.

MR. TSAN: Alright. Good morning. Hopefully everyone can hear me. Great.

Welcome to the 2025 Energy Code Pre-Rulemaking Workshop. I am Bach Tsan, the Senior Mechanical Engineer with the Building Standards Branch. I'm up first today, so I'm going to walk us through our proposal for the heat pump baselines for newly-constructed single-family homes. And I believe there's going to be question and answer section at the end, so I know we'll cover that.

Alright, so here's a look at the agenda for this morning and this workshop session and the following workshop session. Sorry. The agenda will follow the same framework for the different topics I'll be presenting this morning.

Quickly, we'll go over the baseline overview. Heat pump, I'm going to give a little bit of talk on the heat pump market. I'll go over the 2022 prescriptive baseline as they are today, and the 2025 proposal, energy savings methodology, the energy savings results that we've gotten, cost analysis, and the performance approach options.

Alright, so I'll start briefly by describing the technology that's being used to help meet state goals.

Heat pump space heaters and heat pump water heaters are the main tools that are being used for setting

the energy performance (indiscernible), also known as the baselines. The research operation of the -- the reversible operation of the heat pumps allows them to function in both heating and cooling systems depending on the mode selected. It uses the same technology as an air conditioner which operates in reverse to provide warmth into the indoor space. In the discussion, we refer to heat pump space heaters mainly because of their heating function as we're comparing to a traditional furnace. The coefficient of performance that's used to measure the efficiency of the heat pump, COP indicates how much heating a pump can provide and compared to the energy it consumes.

So similar to vapor compression system in a cooling system with a reversing valve, it reverses the process by heating and cooling in a single package. It's a key technology to achieve the, you know, decarbonization goals, and we'd leverage it to -- and leverage increasingly clean electricity. They're efficient. We're looking at COPs of excess of three and, thus, helps us decrease energy consumption and greenhouse gases. And throughout this presentation, we'll talk about feasibility and cost-effectiveness heat pumps.

Alright, so I wanted to highlight this event that happened this year, in 2023, I believe in April and May. The California Billing Industry of America, with Consol

and partnered with Southern California Edison and the California Investor-Owned Utilities, along with SMUD, put on the heat pump forums. They were focused on space and water heating, but we had two forums, one was in Northern California in Sacramento's SMUD facilities, and another one in Southern California, the Newport Beach location.

Those that were in the audience were members of the TVIA (phonetic) and representatives of the building industry. We had manufacturers and other stakeholders at the meeting. The forum focused on the heat pump market, market availability, the technology, the systems and infrastructure that needs to support heat pumps.

Many interesting issues were discussed, but one of the main points we noticed, we learned that the heat pump market was healthy and it's showing growth since 2020. So with 50 percent of the market for heat pump space conditioning systems in single-family homes reaching Q4 2022, and also, you know, we had in 2020, early 2020, we had a little bit more than 4 percent and now we're looking at about 16 percent market share. These are pulling from our registry data and it shows a pretty healthy market open.

Alright, so jumping into our current prescriptive HVAC and domestic hot water requirements for the ’20 -- for single-family homes if you're looking at all the climate

zones. And, you know, the 2022 Energy Code already establishes heat pump baselines for a majority of the climate zones. And so, you know, you can see here already that we have domestic hot water heating systems as heat pumps for everything except for 3, 4, 13 and 14, and heat pump space seating in those subsequent spaces 3, 4, 13, 14, and so the gas furnaces and split ACs are currently what the systems of choice are for our standard baselines for 2020 Code cycle.

Alright, so here are the considerations to establish a heat pump baselines. As Javier mentioned earlier, showing the long-term system costs, so looking at the total energy savings or dollar savings over the 30 year of the building, we need to show source savings when compared to the 2022 Energy Code. We are going to demonstrate the measure is cost-effective in for -- to that particular building type in all the climate zones, and ensure that it's technically feasible for mixed-fuel and all-electric to a lot of compliance flexibility.

Alright, so now this is our proposal for 2025. Red in -- excuse me. And the graphic shows, you know, the proposed baselines for 2025. Red is where there's a change from the 2022 prescriptive standard to a heat pump equivalent. It's either a space -- a heat pump space conditioner or a heat pump water heater. Our analysis is

still ongoing but our current analysis shows that Climate Zone 15 is a little challenging and we'll talk a little bit about that later but, you know, that this is the proposal.

So we'll jump to the next slide.

And here are some assumptions that we have for the heat pump baselines. So the building energy model prototypes used the 2022 Energy Code prescribed requirements where the analysis was done using the CBECC-Res 2025 research version, so you can download that from our Energy Code website or the CBECC-Res website. Minimum efficiencies are shown here with heat pump space heaters that are using the SEER2 of 42.3. You've got water heaters and UEF 2.0, and the a/c furnace combinations are the SEER and EER shown here -- sorry, that's EER2. And then instantaneous water heater of 0.81 and UEF.

So the energy savings impact is shown on this slide. You can see that the fresh air, you see the fresh air electricity and gas savings, along with the source and LSE savings. The fresh air energy savings show higher electric use, mainly due to the fuel substitution change. However, the combined electric and therms savings show positive overall impact. So they are source savings, and then LSE savings over 30 years. Climate Zone 1, you're ranging from 377 to 17,000 over the course of 30 years.

Alright, so that's the -- that was a tabular

form. This is the graphical form on long-term system cost savings. The total savings over 30 years of life is shown here per climate zone. You know, basically the previous table showed, this is the LSE column in the graphic form. As you can see, every climate zone, we have positive long-term things for both. So the yellow and, I guess, dark blue or dark bars and yellow bars show where -- (clears throat) sorry -- where the transition from -- or the split from heat pump from a gas tankless water heater to a heat pump water heater, and then the dark bars are from gas a/c to a heat pump space heater.

Alright, so getting into costs. So these are the costs that are incremental costs, you know, for cooling-dominated climate zones. You know, most of these costs are received from the Codes and Standards Management Team and extrapolated based on equipment costs. So the cooling-dominated climate zones compared between mixed-fuels and heat pumps a seating systems here, the -- for cooling-dominated climates it's the equipment sizing is based on cooling load. And, you know, the costs here show all present value numbers.

So, yeah, with the possible exception of the coldest climates and Climate Zone 6, the compressor is sized to meet them heating load design. I'll kind of show the heating costs in the heating-dominated climates. And

these are heating-dominated climate capacities based on CBECC-Res, the equipment is, the sizing is based on heating. And so in this table you're looking at a gas a/c system that would have a cooling capacity of one and a half tons. However, if you're going to be sizing a heat pump that has -- that sizing should be based on the heating loads. So the heat pump, with some strip heat, gives you the equipment capacity here. So in climates, for example, in Climate Zone 1 where you would have a one and a half ton a/c system, you have a heat pump you need an equivalent size heat pump at four times.

So, yeah, the heat pump needs to be sized to meet both heating and cooling loads. The heat pump with the same nominal capacity as the existing air condition may or may not be able to meet the heating loads without relying on auxiliary heat here. So these are the assumed costs. So there is a $600 increase for ultra low NOx furnaces, shown on the first cost of the -- for the replacement costs here.

Alright, so as we mentioned before, this is the cost factors for heat pump space heater, shown in a tabular -- in a graphical form. This is LSE savings and costs per home. So 3 and 4 and 13 and 14, that shows that their heat pump space heating is already a baseline. But you see for both the 2,100 and 2,700 prototypes, we have

positive large arm (phonetic) system costs. And 500-foot small-home prototypes are also positive here. So we did get -- for the most part, we are looking at the savings based on the heating side of things.

Alright, we'll go over to the heat pump water heating side. So this side shows -- follows the same logic as for heat pump space heating. You know, we're focusing mainly on 3, 4, 13 and 14 climate zones since the 2022 prescriptive baselines tankless water heaters. Let's see, from the cost here, it's for a single-family as the first cost are adjusted based on general contractor feedback.

The one consideration here, heat pump water heater is replaced at year 15, while the gas tank is at year 20, so that has some adjustments for the totals here. The water heaters in the garage is based on the garage installation. And then, yeah, for a 500-square-foot prototype the heat pump water heater is inside a conditioned space, so all costs are prefaced in value.

Again, showing cost-effectiveness in here. For the water, I think I -- let me jump back quite a bit. Let me jump back to this slide here.

So as I was speaking earlier for cost-effectiveness, if you looked at all the -- you know, we have cost-effectiveness across the climate zones for, you know, 1 and 2, 5 through 12, and 16. So for 15, we're

currently continuing the analysis, but due to the low heating loads, we are not able to get cost-effectiveness in Climate Zone 15, so that's below the line. So that there's a -- that's the current challenge we have/are continuing to explore.

Okay, I'll get, well, I'll get to this and then we'll get to questions. I'm sure we have a few there.

So as I mentioned, one of the requirements, we wanted -- we have to ensure that there is a performance approach. We're looking at three scenarios here. There could be more but, in general, we've -- we ran these scenarios that could be able to meet the 2025 prescriptive baseline.

So if you wanted to look at an equivalent, you would pick a mixed-fuel system. In Climate Zone 1 you have a large menu of items that would be required if you're putting in no heat pumps, so this is in case you're putting in a water heater, a gas furnace and a water heater. So you would have -- we -- in every climate zone, for a mixed-fuel system, we would have a solar fraction domestic hot water.

We're looking at, you know, a 70 -- sorry -- 70.7 solar refraction water heater. And, yeah, the first column shows the pathways that would build on both systems with mixed-fuel. Each of these solutions for climate zones

have, you know, the 0.7 solar fraction water heater; 70 percent, it basically means 70 percent energy needed to heat the waters provided by solar energy, where the remaining 30 percent comes from some kind of auxiliary backup. It includes triple-pane glass, you know, verified low-leakage ducts, a tight envelope, compact distribution water heating, R-60 attic, and heat recovery ventilation.

So there's a slight difference between Climate Zone 1 and the other climate zones. We're looking at a sensible recovery efficiency of 67 first in the area climate zones, and in Climate Zone 1, you're look at 73.

Alright, so as you can see, the Climate Zone 1 to 16 is -- has quite a few measures that need to be added to have equivalents, and the other climate zones are fairly manageable. So for a mix -- in the mixed-fuel case where you have one heat pump, you know, the -- you're looking at, also, high-efficiency equipment. The high-efficiency equipment we're looking at is 95 AFUE on the furnace, and a 16 SEER2 on the air conditioning unit, with the self-utilization (phonetic) credits.

For dual fuel heat pumps, I give the third one, you would think would still include a solar fraction water heater in most cases, but Climate Zone 16 is challenging with the triple-pane, verified low-leakage ducts, R-60 attic, and your current ventilation.

And so that's the presentation for the heat pump water heating. So I think there's a mention of comments due today, when the comments were due, it's August 9th by five o'clock. The docket here, you click through and my contact information is at the bottom Bach.Tsan@energy.ca.gov.

And I'll hand it back to Payam to see if there's any questions.

MR. BOZORGCHAMI: Sure. Sure. Thank you. Thank you, Bach.

So I think what we're going to do, we're going to do the raised hands first, then we're going to go to the Q&A, the question and answer sessions after that.

So with that, I think we have Bob Raymer who's raised his hand.

Bob, go ahead set your name and affiliation.

MR. RAYMER: Yes. Thank you. This is Bob Raymer with the California Building Industry Association, and the California Apartment Association. And the CEC is clearly going in the direction that we expected here.

One of the things that we would like to do with the CEC over the next, probably, six to eight weeks is take a hard look at the total package, and we'll get that in the coming workshops, and then figure out the cost of compliance, a typical cost of compliance that could be

expected if the builder decides to stick with gas and try to do the efficiency measures and the other measures to get over that, versus the cost of going with both electric heat pump space and water heating.

That is clearly going to be an analysis is going to help kind of make the transition here. And we'd like to get that done sooner than later so that we can start getting this information out to the membership to show them that, there, the path of least resistance is also the path of least cost.

So with that, Payam, thanks for the presentation, and we look forward to working with the CEC as this goes forward. Thank you.

MR. BOZORGCHAMI: Wonderful, Bob. We, too, also would look forward to working with CBIA and others on this topic. Thank you.

With that, Laura, I'm going to unmute you. Go ahead and state your name and your affiliation.

MS. PETRILLO-GROH: Hello. This is Laura Petrillo-Groh with the Air Conditioning Heating and Refrigeration Institute. I apologize, I was -- I joined the public meeting a little bit late, and I had also asked a question in the chat, if nonresidential heat pump baselines would be covered today?

MR. BOZORGCHAMI: Yes, they will be.

MS. PETRILLO-GROH: Oh, thank you. Thanks, Payam. I appreciate that.

And then, you know, looking back, for those of us who've been following along with baseline changes over the Code cycles, you know, it's, I think, a little a little bit difficult to keep up with the, you know, the change in cost that is -- that goes through when, you know, TDV was used before for part of the analysis and now we're switching, you know, metrics to those long-term system costs.

And apologies if I missed it there, but are there documents explaining, you know, these different cost effectiveness or energy cost savings measure metrics that CEC has used over the years?

MR. BOZORGCHAMI: Laura, I apologize, I'm just having a hard time hearing you. Can you maybe move the mic a little bit closer? I apologize. Sorry.

MS. PETRILLO-GROH: Sorry, Payam. Is this a little bit better?

MR. BOZORGCHAMI: I think so, yes.

MS. PETRILLO-GROH: Okay. Great. Apologies about that.

I was just having a little trouble keeping up, you know, comparing back to the 2022 documentation for heat pump baselines where TDV was used for energy cost savings analysis, and now it looks like you're switching to a

different metric.

MR. BOZORGCHAMI: Yes.

MS. PETRILLO-GROH: Is there any documentation that may have been presented at other meetings or that's on the docket that talks about the differences in these two --

MR. BOZORGCHAMI: Yes.

MS. PETRILLO-GROH: -- (indiscernible) techniques?

MR. BOZORGCHAMI: Yes. So, Laura --

MS. PETRILLO-GROH: Thank you.

MR. BOZORGCHAMI: -- we did a presentation on long-term system costs a while back. And I believe on our docket there's information on a long-term system cost versus TDV. I'll make a note and I'll send that to you.

MS. PETRILLO-GROH: Thank you so much, Payam.

MR. BOZORGCHAMI: Sure.

MS. PETRILLO-GROH: I just, you know, have been following these measures along and --

MR. BOZORGCHAMI: Sure.

MS. PETRILLO-GROH: -- and, you know, the (indiscernible) --

MR. BOZORGCHAMI: Sure, sure, sure.

MS. PETRILLO-GROH: -- because it's just, it will be necessary to really compare what's been done, because some of the, you know, I think performance options are

really eye-opening for, you know, continuing to use that as a mixed-fuel, even with one heat pump system, so a lot of batteries on that list. So I just wanted to really understand what you all are doing with that analysis, so apologies for missing that and thank you for making that documentation available. Appreciate it.

MR. BOZORGCHAMI: No worries. I will take care of it for you.

So with that, I think Jonny Kocher, you have a raised hand. I'm going to unmute you. Go ahead and state your name and affiliation, please.

MR. KOCHER: Yes. Jonny Kocher with Rocky Mountain Institute, and thank you for having this workshop today.

And I just wanted to thank the staff for doing such a really amazing analysis here and in moving towards having a dual heat pump baseline for residential buildings. And really glad to see how much energy savings we're going to be looking at and the long-term system cost savings. It's pretty clear that we're moving in the right direction on both for cost, as well as for climate. And, yeah, just really happy to see this today thank you.

Thank you.

MR. BOZORGCHAMI: Thank you.

If there's no more raised hands -- oh, one more.

Meg, I'm going to unmute you. Go ahead and state your name affiliation, please. Thank you.

MS. WALTNER: Hi. Can you hear me?

MR. BOZORGCHAMI: Yes.

MS. WALTNER: Meg Waltner from Energy 350 on behalf of NRDC.

I just wanted to echo Jonny's comments. We're also in strong support of this and, yeah, really happy to see all the work that's gone behind it and really moving in the right direction in terms of encouraging emissions reductions, and also lower overall system costs, so thanks for all the work that's gone into this.

MR. BOZORGCHAMI: Thank you. Thank you. I wish I could take credit but I can't. I'll leave that up to Bach and others.

With that, if there's no more raised hands, and if you do decide you have further questions, we'll come right back to you, but with that, we're going to pass it off to Mikey Shewmaker, who will handle the questions and answers that came to us.

MR. SHEWMAKER: Yeah. This is Michael Shewmaker with the Building Standards Branch. Yeah, we have several questions online.

The first question is from Robert Glass.

"Do space heating heat pumps cover, one, air-to-air

heat pumps, two, ground source heat pumps, and three, air-to-water heat pumps?"

COMMITTEE MEMBER STANHOFF: Sorry. Yeah, so when you mean covered, our analyses are looking at air to -- air-to-air heat pumps. I think, in general, heat pump space heating would include the other categories too.

MR. PEREZ: Yeah, and just to expand on that really quickly, the standard design --

MR. BOZORGCHAMI: I apologize. I'm going to have you state your name and affiliation, please.

MR. PEREZ: Sorry. This is Javier Perez, Energy Commission. I'll turn on my camera, Payam.

Yeah, the standard design will be based on air-to-air. That's not to say ground source or air-to-water can't be simulated, they just are going to be measured against air to air.

Thank, Payam.

MR. BOZORGCHAMI: Thank you, Javier.

Mikey?

MR. SHEWMAKER: Yeah. Our second question is from Ray Nalangan, and I apologize if I'm mispronouncing your last name, but their question is: "Does the system cost saving include bill savings?"

And I believe Will Vicent was going to answer that question.

MR. VICENT: Hey, Ray, thanks for the question. Hopefully you all can hear me okay. Will Vicent from the California Energy Commission, Deputy Director of the Building Standards Operations Division here.

So our long-term system cost does not include bill savings. It is intended to be more than that. We believe that today's costs do not adequately account for the state's long-term policies and statutes, such as Renewable Portfolio Standards, electric vehicle commitments, and also building decarbonization and electrification. And so we do a 30-year long-term costs that includes all those benefits to California. And documentation for that methodology can be found online.

We held two workshops on this topic last year, so heard your comment, and also Laura's, around the difficulty to follow, and so we can help direct you to those materials on the methodology online. And we do plan on publishing a comprehensive report on that methodology later this year. Hopefully that helps.

MR. BOZORGCHAMI: Thank you, Will.

MR. SHEWMAKER: And our next question is from Jay Madden. "Do the second rows represent replacement cost at NPV, at net present value" -- actually, this is a two-part question -- and then later on, Jay goes on to ask: "versus the first row of replacement costs?"

MR. BOZORGCHAMI: So Alea German, who's one of our consultants that helped us out, could you answer that question?

MS. GERMAN: Sure. Hi everyone. This is Alea German with Frontier Energy.

So, yeah, Jay, you're right. So the first replacement cost row here, it should be labeled the -- it's the future value of that replacement cost. So you'll see in most places, it's really similar to the first cost. The second row is taking that back to present value. So those two aren't additive. There are two ways of looking at that replacement cost. What gets added to the first cost to come up with the total incremental cost is that second line at that present value. So that lifetime incremental cost that that Bach showed applied in the cost effectiveness analysis is a 30-year present value cost.

MR. BOZORGCHAMI: Thank you Alea for answering that questions.

Mikey? I think Mikey may have some technical issues.

MR. SHEWMAKER: Sorry. Hard time with the mute button.

Our next question is from Meg Waltner. "Can you clarify what the two replacement costs shown are?"

And then, actually, the next question is very

similar. "Can you explain the difference between first and second replacement costs?"

MR. TSAN: I believe Alea just covered that; is that correct or -- in the two different replacements? One was future value, one was present value. I'm not sure if that got covered or it needed to be asked separately.

MR. BOZORGCHAMI: So, Meg, this is Payam. Could you raise your hand and I'll unmute you and you could ask your question in more detail?

MS. WALTNER: I'll just go off mute to say that she did answer my question, I think.

MR. BOZORGCHAMI: Oh, wonderful. So that was Meg Waltner with NRDC.

MS. WALTNER: On behalf of NRDC.

MR. BOZORGCHAMI: I'm sorry. I'm sorry.

MS. WALTNER: On behalf of NRDC. Thank you. Yeah.

MR. BOZORGCHAMI: Sorry.

MR. SHEWMAKER: Great. Okay then our next question is from Claire Warshaw.

"Will the Energy Code cover 120 volt plug-in heat pump water heater choices? Are there any noise specifications for any of the heat pump devices, HVAC, and heat pump water heater?"

MR. TSAN: Yeah, if I could ask Danny to review

that and respond?

MR. TAM: Hi. Danny Tam, CEC staff.

A 120 volt heat pump water heater can be modeled in CBECC. Again, the standard design will be set as the federal minimum generic heat pump water heater, but you're free to use any heat pump water heater that we have in the software.

MR. BOZORGCHAMI: Thank you, Danny.

MR. SHEWMAKER: Great. Our next question is from W. Geese (phonetic). I hope I'm pronouncing that correctly. It says,

> "Hello. I apologize for coming in late. Does solar thermal utilize solar fraction or SUEF, solar uniform energy factor, to measure efficiency?"

MR. TSAN: We are currently speculating on the solar fraction.

Go on, Danny.

MR. TAM: Yeah, any reference to solar water heating is measured in solar fraction, so it's typically less than one. So it represents how much, what's the fraction of the water heating energy supplied by the solar thermal system.

MR. BOZORGCHAMI: Thank you, Danny.

MR. SHEWMAKER: Okay. And our next question is from Nick Brown.

"Are there heat pump prescriptive standards being proposed for the small home prototypes as well? Were you able to show cost-effectiveness for those? I would suggest a heat pump water heater in a small home be modeled as outside location as space is such a premium there. Would the electric tankless water heater exception continue to be available to homes less than 500 square feet in the new Code?"

MR. TSAN: So the answer is, yes. Oops, go on. I think Danny was going to talk about the water heating.

MR. TAM: Hi. This is Danny again.

We're not planning to change the exception currently, so that exception should still be available for small ADUs.

MR. TSAN: And, Nick, yes, just, really, the first heat pump space heating. it does cause -- it does account for the small prototypes. So the heat pump requirements are going to be for both the 2,100, 2,700 -- or all three, 2,100, 2,700, and the 500-square-foot prototypes. Hopefully that answered your question.

MR. BOZORGCHAMI: Thank you. Thank you, Bach.

I'm going to go back real quick to see if there's any more raised hands out here. If not, I'm going to move on to the alteration sections. That's going to be in Part 11 for single-family.

MR. BOZORGCHAMI: We have one more question in the Q&A, and the question is from Jason Babrook (phonetic). "Can air-to-water heat pumps that serve both HVAC and domestic hot water loads be modeled?"

Go ahead, Danny. I think the answer is yes.

MR. TAM: Yeah. Danny Tam again.

We have some capability. We are improving a lot of those modeling capabilities. For example, you could model air-to-water heat pump that does all three functions. Some new ones, such as harvest thermal, that capability we just added to the latest version of CBECC.

In short, you could. And we're making improvements as we go along.

MR. BOZORGCHAMI: Thank you, Danny.

And then there's one more question from Laura Petrillo-Groh from HRI, and the question she asks is:

> "Will the technical support document break out cost/benefit calcs separately for the 500, 2,100, and 2,700 single-family homes?"

I'm going to answer that real quick. The 2,100 and 2,700 is a split. What we did was we split between a 45/55 split on those, and then the low or the small home, the 500-square-foot, is done separately.

So pretty much to answer, yes, it is done, and that will be presented or we'll show that to you later.

So as of now I don't see any raised hand. And I don't see any more questions in the Q&A portal.

So with that, Bach, go on and maybe start talking about the single-family alteration sections.

MR. TSAN: Great. Yeah. Thank you for all the questions and appreciate all the comments.

For those questions I haven't been asked or addressed, please submit the questions and comments via the docket.

Alright, so like we'll jump to the next part, the single-family alteration. So, again, I'm Bach Tsan with the California Energy Commission, Senior Mechanical Engineer at the Building Standards Branch. This part of the presentation will be on heat down baseline for the single-family alterations. It's also known as Part 11.

Alright, so we'll start talking about the CALGreen Building Standard Code. Just a quick history.

In 2007, the Building Standards Commission was directed to develop the Green Building Standards to meet the requirements of Assembly Bill 32, the Global Warming Solutions Act. This Act was required to a reduction of greenhouse gas production to 1990 levels by 2020. After the buildings -- after vehicles, buildings are the second greenhouse -- largest greenhouse gas emissions producers.

So following Assembly Bill 32, and in 2008,

Senate Bill 1473 gave the California Building Standards Commission (indiscernible) develop green standards for our communities where no other state has authority, so Housing and Community Development are responsible for the residential sector, CVSC for nonresidential, Division of the State Architect for Schools, health care access and information for hospitals and institutions, and the CEC for energy. So the CALGreen Code was published in 2008 and reviewed and updated every two years.

So the California -- the CALGreen Code requires that the measures to meet -- that measures meet the mandatory efficiency requirements in Part 6. They also set voluntary standards to all jurisdictions to choose from a menu of options to meet a higher target set for climate zones.

Alright, so, you know, just jumping into the proposed standard, so just wanted to mention, currently there is no requirement for alterations. So where replacements are to be -- replacements can either be gas or heat pump.

The proposal is set to -- this proposal is to set the voluntary standard for when an a/c is replaced, you can pick one of these three options. A heat pump by itself, you'd take out your existing a/c furnace and you would put in a heat pump. The second option is to put a heat pump

with the gas backup while the existing furnace may remain in place to provide and set up to provide back up heat. And third, an air conditioner that meets the specific requirements. That I'll be showing on the next slide.

Alright, so as stated in the previous slide, one of the, you know, one of one of these, the packet -- the packages that we are looking to prescriptively specify is a new a/c unit and you leave the furnace or install a new furnace. These additional measures are required for compliance. So new R-8 ducts with five percent leakage, 400 CFM per ton airflow for your blower, looking at the 0.35 watts for CFM fan efficacy, refrigerant charge, R-49 attic installation, and air sealing of the ceiling. So these are the voluntary performance purchase options for alterations.

So these savings here is in, also, efficiency LSE, you know, placed per climate zone. These are relative to the existing bell (phonetic) base of a 1,665 per -- 1,665-square-foot prototypes.

Okay, so this, we're showing the voluntary savings for -- the voluntary -- the energy savings for the voluntary proposal here. So for climate, it's very similar to the -- for newly-constructed buildings. The electricity savings are negative due to the fuel substitution, but you have savings in the first year of natural gas, you know,

source energy savings, along with the LSE savings.

Alright, so just to show just a couple points here is you're looking at savings over the course of 30 years. We're ranging and we have the same challenge at Climate Zone 15 where you're looking at LSE savings of $466, and then maximum savings in Climate Zone 16 of $17,000, mainly due to the heating loads in the two different climate zones.

Okay, so the costs are shown on this slide and it's -- these are -- what we like about the incremental cost for one -- incremental cost for the first heat pump is lower than the replacement for the a/c furnace. However, the replacement cost of failure is more expensive for the heat pump furnace because its lifetime is two and a half years shorter. So the a/c has an effective use of life of 17 and a half versus the 15-year furnace.

Also, the remaining use gets added to the a/c furnace whereas the heat pump has no theoretical remaining useful life. This is also a result in two and a half years of discount rate for the heat pump system.

And so overall, this is a chart that shows the cost effectiveness of putting in a heat pump space heater versus a gas furnace. It's cost effective in Climate Zones 1 through 14 and 16. So Climate Zones 15 has a negative benefit cost ratio due to lower heating needs.

So in both newly-constructed buildings and alterations, the system design operates long enough for heating to be able to claim the cost effectiveness over a glass (phonetic) furnace.

And with that, that's the presentation for alterations and for Part 11.

MR. BOZORGCHAMI: Thank you, Bach.

So with that, I'm going to go to the raised-hand session.

One request, and I apologize, I'm throwing this all at you, folks, when you do raise your hand and you're about to speak, please, when you state your name, also spell it for the first time. Our court reporter needs that information to make sure we get it right.

So with that said, any raised hand? Anybody have any questions you would like to verbally ask? With that -- oh, we got one.

Meg, I'm going to unmute you. And go ahead and state your name, your affiliation, and spell your last name, please.

MS. WALTNER: Hi. Meg Waltner, that's W-A-L-T-N-E-R, from Energy 350 on behalf of NRDC. I have some comments. Maybe I'll start with my question that I put in the chat around the energy savings numbers and just understanding what those energy savings represented.

You showed sort of three pathways. Are those from -- oh, it was like the heat pump-only, heat pump plus backup, or a/c plus complementary measures, what are the savings numbers represent, which of those pathways, or is it whatever the highest -- is it taking the highest savings per climate zone?

MR. TSAN: Oh, the energy savings here?

MS. WALTNER: Yeah.

MR. TSAN: Yeah. This corresponds to the largest -- I'm sorry, the LSE saving corresponds to the largest bars here. So this is looking at new space -- new heat pump space heater compared to an existing a/c furnace.

MS. WALTNER: Okay, but like in climate zone -- okay. And same for -- so it's the heat pump-only is what these numbers are showing numbers are showing compared to an a/c furnace?

MR. TSAN: Yes.

MS. WALTNER: Okay. Great.

And then just sort of more broadly, you know, thank you so much for all the work that's gone into this. Really great to see you looking into this. You know, I think from NRDC's perspective, we'd really like to continue the conversation about, you know, whether this could be considered in Part 6 as a prescriptive requirement. You know, I think putting it in Part 11, it is a lot less

effective in terms of getting the heat pumps that we need over the next decade into homes in California. And so that's something that we hope that you'll continue to consider going forward.

But, you know, thank you for the work that's one into this so far today. And great to see this analysis and all the different options that you've put forward here.

MR. BOZORGCHAMI: Thank you, Meg. And we're more than happy to work with you, with NRDC and others.

Next we have Jonny Kocher. Please stage your name and spell and your affiliation.

MR. KOCHER: Thank you. It's Jonny Kocher, K-O-C-H-E-R, and I work at Rocky Mountain Institute.

Yeah, I wanted to thank the CEC for going down this path and looking at the analysis for a/c to heat pump requirements. I want to echo a lot of what Meg said, like I think this is great analysis but I also think that it would be a lot more effective if it was in Title 24, Part 6 of the Energy Code versus a voluntary measure in Part 11.

You know, in order for us to hit our heat pump targets by 2030 we need to be doing interventions where it's most cost effective. And when people are replacing air conditioners, that is one of the most cost effective ways for us to be doing fuel switching to heat pumps because they're already going to be doing large equipment

replacement. And, yeah, in order to kind of align with the goals of zero emission-based heating requirements for both BAAQMD and CARB, it does feel like doing this type of intervention makes the most sense to be a mandatory measure in 2025 through Part 6.

So look forward to working with the CEC on trying to figure out how we can move this measure to Part 6 and any way in which we can support that by trying to provide more analysis or resources.

Thank you.

MR. TSAN: Thank you for your feedback.

MR. BOZORGCHAMI: Thank you.

Gina, go ahead and state your name and affiliations and spell your name.

MS. RODDA: Hello. My name is Gina Rodda, R-O-D-D-A, from Gabel Energy. And I'm going to bump the wave a little bit here.

And I work with a lot of homeowners of which if something like this was in Title 24 Part 6 they couldn't afford it. Usually you're replacing things because they broke down and usually right when you didn't have the money for them. And I already am seeing more and more work done without building permits to avoid what is going on here in the Energy Code.

I love the Energy Code. I believe in the Energy

Code. Some of this is causing major heartache for me on how I'm going to prepare my clients, my building departments, and my manufacturers for what might be coming.

So I do applaud that we are going to introduce this in Part 11, introduce it, get people maybe comfortable with it, see how it's going to look and feel before it becomes a requirement in the Energy Code as mandatory or prescriptive, shall we say, versus voluntary and CALGreen.

Thank you.

MR. BOZORGCHAMI: Thank you, Gina, for that comment.

Next, Ted, please state your name affiliation and spell your name.

MR. TIFFANY: Oh, sorry. Can you hear me now?

MR. BOZORGCHAMI: Yes.

MR. TIFFANY: Ted Tiffany, T-I-F-F-A-N-Y.

MR. BOZORGCHAMI: I apologize, Ted, that's my mistake. Go ahead and start all over.

MR. TIFFANY: I'm back again.

MR. BOZORGCHAMI: Sorry. Sorry.

MR. TIFFANY: Ted Tiffany, T-I-F-F-A-N-Y, Building Decarbonization Coalition.

I think Gina just highlighted all the elements of why it should be in Part 6 and the job of the Energy Commission to increase compliance improvement and

streamlining those strategies for these retrofits. And the voluntary element is not going to align with the timeline that the California Air Resources Board is going to have this replacement for gas appliances.

So this needs to be embedded into Part 6. And I encourage you guys to look at the strategies to embed this in Part 6 and streamline that effort for compliance documentation because moving that to Part 11 will complicate compliance at the local level as a voluntary element.

So I'm more than willing to help you guys look at that timeline. And I'm sure Gina with all our expertise will help us find an effective path for compliance in the retrofits under Part 6.

MR. BOZORGCHAMI: Thank you, Ted. And we will reach out to you and we'll have further discussion on this one.

MR. TIFFANY: No worries.

MR. BOZORGCHAMI: Matthew Vespa, please state your name, affiliation, and spell your name. Matthew, you're going to have to unmute yourself.

MR. VESPA: I see. Can you hear me now?

MR. BOZORGCHAMI: Yes.

MR. VESPA: Okay. Great. Matt Vespa for Earth Justice. M-A-T-T V, as in Victor, -E-S-P-A.

I want to also support moving this measure to Part 6. I'd just point out, there were actually quite a bit of cost savings your analysis showed and cost savings for not having to replace your furnace when that burns out.

And, you know, I support the comments of Meg and Jonny and Ted on this. And just to pull it back a little bit, I mean, I think it's just extremely alarming what's happening with the climate right now with record ocean temperatures, fires across the world, sea ice disappearing at just unbelievable rapidity, and we just don't have time to slow walk this. And we have to do everything we can to get off fossil fuels. And this is just really an important low-hanging fruit to reduce our gas dependency that saves money and avoids actually some of the complications of furnace replacements by doing it when you have a chance with the a/c.

So I really look forward to working with you on making this a mandatory measure. There are all sorts of reasons why we should be doing that and it should be part of Part 6 of the next Building Code cycle.

Thank you.

MR. BOZORGCHAMI: Thank you, Matthew.

Matt Baker, go ahead and state your name and affiliation.

MR. BAKER: Yes. Matt Baker, last name spelled

B-A-K-E-R, with Daikin Comfort Technologies.

I posted my question in the chat but I'll also state it here. I'm wondering if the cost effectiveness calculations for transition from a/c to heat pump consider the added cost for electrical panel upgrades, breakers, wiring, service disconnect, those sorts of additions?

MR. TSAN: Yes, they do. They include those items. It does not include the service to the building but it does include the wires and breakers.

MR. BAKER: Thank you.

MR. TSAN: Yes.

MR. BAKER: Yeah.

MR. BOZORGCHAMI: Thank you, Matt.

Thank you, Bach.

Joe Cain, please state your name and affiliation.

MR. CAIN: Sorry. I had to unmute. Joe Cain, last name C-A-I-N, with the Solar Energy Industries Association.

On the discussion of requirement for gas equipment being replaced with heat pump, I just, whether it's in Part 6 or Part 11, I just want to point out that there will be cases where there are emergency replacements of appliances. I have a personal experience with a water heater gas leak and being shut off by a technician in the afternoon on a Friday and trying to find replacement.

So anyway, one way or the other, I think that emergency replacement needs to be addressed. And a change out of a water heater or a furnace is much faster than a change out to heat pump. So I just want to bring that up.

Thank you.

MR. BOZORGCHAMI: Thank you, Joe.

I don't see any more raised hands on my side. So I'm going to -- oh, we got one more.

Luke, go ahead and state your name and affiliation and spell your name, please.

MR. MORTON: Yes. My name is Luke Morton, M-O-R-T-O-N, and today I'm calling on behalf of the California Association of Building Energy Consultants, and I'm on the Advocacy Committee. So I just wanted to echo some of the discussion already happening here.

I think that we'll be eager to work with the Commission if there's legs on the notion to develop Part 6 language, to craft it in such a way that we address some of the concerns already raised, you know, with practicalities on the ground, while still making it -- sort of moving the ball forward on that. I can personally think of a couple of -- personally have a couple of ideas on that front, which would address them, which acknowledge some of the concerns but still get at not explicitly in Part 11, but in the Part 6 where I believe it will have more depth to

broader implementation.

That's it, thanks.

MR. BOZORGCHAMI: Thank you, Luke.

And we have Karen also. Go ahead and state your name, last name, and please spell your name.

MS. KRISTIANSSON: Thanks, Payam. It's Karen Christensen, which is K-R-I-S-T-I-A-N-S-S-O-N. And you can get it from the chat, it's a tough one.

And I just, I did put my question in the chat but wanted to also raise it, which is on the practical side of just making sure that things work. I just want to make sure that when there's a heat pump installed along with an existing gas furnace that there's a smart thermostat or something to make sure that they are not simultaneously cooling and heating. And I just bring that up because I stayed at an Airbnb where that was a problem. And so I'd like to make sure that that's not wasting energy on both ends.

MR. BOZORGCHAMI: Sure.

MR. TSAN: Alright. Thank you for your comment. Yeah, we'll explore that. We're doing some additional exploration in terms of smart thermostats, but currently our analysis does not include smart thermostat operation.

MR. BOZORGCHAMI: Okay. Great. Thank you, Bach. Thank you, Karen.

I don't see any more raised hands. And if I accidentally lowered your hand by any mistake, that was not intentional, so I apologize. But with that -- and if you need to raise your hand, please do so.

With that, I'm going to pass it on to Mikey, Michael Shewmaker, excuse me, and he will read the questions and answers.

Yeah, so we got a few questions online.

Our first question is from Robert Glass. "On slide five, what about refrigerant charge?"

MR. TSAN: I think I'm just not sure what the specific question is, is it's a required -- it's a required verified refrigerant charge for the -- as a measure. I'm not sure if the question was is it required or what do we need, what is needed for refrigerant charge?

MR. BOZORGCHAMI: Well, it to make sure the refrigerant system is charged properly with the proper refrigerant?

MR. TSAN: Yes.

MR. BOZORGCHAMI: Yeah. Okay.

MR. SHEWMAKER: Yeah, Robert has raised his hand.

MR. TSAN: Okay.

MR. SHEWMAKER: Payam, can you unmute him?

MR. BOZORGCHAMI: Sure. Sure.

Go ahead, Robert, and state your name and

affiliation, please.

MR. GLASS: Okay. Robert Glass, G-L-A-S-S, Daikin Comfort Technologies.

Yeah, the question, the slide just said, "refrigerant charge," and when it was presented, it just said "refrigerant charge." There was nothing identifying what it is.

MR. TSAN: I understand.

MR. GLASS: So I was trying to understand what that reference to refrigerant charge is, because it wasn't clear on the slide nor during the presentation portion of that.

MR. TSAN: Thank you. I'll make a note on the slides when we post them.

MR. GLASS: Thank you.

MR. PEREZ: This is Javier with the Energy Commission.

Just really quickly, to add, refrigerant charge verification requirements are triggered. That's what that's intending to say. Currently, the Energy Code only requires refrigerant charge verification in climate zones where they have high mechanical cooling.

One of the proposals for 2025, for what it's worth, and you'll hear that in the coming weeks, is to require refrigerant charge verification in all climate

zones where a heat pump is installed, so that's a little bit of a variance. But, again, refrigerant charge verification where a heat pump is not installed is only applicable to climate zones where they have high cooling demand, too, in I think Climate Zones 2 and 8 through 15.

Thanks.

MR. BOZORGCHAMI: Thank you, Javier, for the clarification.

So, Mikey?

MR. SHEWMAKER: Yeah, our next question is from Dan Wildehaus (phonetic). "With LSE savings over 30 years, we assume two heating systems over that time."

MR. TSAN: Yes.

MR. SHEWMAKER: "In other words, what's the measure life for an air-source heat pump?"

MR. TSAN: So, yeah, we're assuming the life for an air-source heat pump is 15 years, so that would be two change-ups over that lifetime.

MR. BOZORGCHAMI: Thank you.

MR. SHEWMAKER: Thank you.

Our next question --

MR. PEREZ: Really quickly --

MR. SHEWMAKER: Yeah.

MR. PEREZ: -- it's two costs, right, first-time cost and replacement cost, only two costs, not two

replacements.

Sorry about that, Bach.

MR. TSAN: No, I understand. Thank you for clarifying.

MR. PEREZ: No worries.

MR. SHEWMAKER: Okay, and our next question is from Claire Warshaw. "Does the 2025 Energy Code have heat pump refrigerant requirements?"

MR. TSAN: No, we do not. No, we do not have a requirement. We're going to be following CARB's direction that we do not state GWP values.

MR. SHEWMAKER: Great. Thank you for that.

Our next question is from Snuler (phonetic) Price.

"I'm a little surprised on the poor cost effectiveness for heat pump space heating in Climate Zone 15. Once you buy a large air conditioner to provide cooling in Climate Zone 15, it seems like the incremental cost to purchase a heat pump rather than just an air conditioner would be less than the cost in purchasing a furnace and gas piping.

"Wondering how the analysis has defined the incremental cost for comparison on that result?"

MR. BOZORGCHAMI: Alea, would you like to answer that question?

MS. GERMAN: Sure. Hi again. This is Alea German with Frontier Energy.

And, Snu (phonetic), I'm not sure if you're -- it sounds like you may be referring to the new construction results, but I think we're seeing the same trend in both the new construction and this alteration scenario. And in both cases, you're right that from a first-cost perspective, the estimates show a lower cost for the heat pump installation versus a furnace and a/c. But because of, largely, because of the different lifetimes that are part of the analysis, the 15 years for heat pump and slightly longer, 17 and a half for the furnace and a/c, over that 30-year period, there is an incremental cost for the heat pump case.

And in Climate Zone 15, there is really low heating loads. So when you make that switch, you know, we are seeing savings on the heating side but it's really small. And so it's not enough savings, as we're seeing in the other climate zones, to offset that incremental cost for the heat pump over the lifetime.

MR. SHEWMAKER: Great. Thanks, Alea.

So our next comment is from Gina Rodda. And Gina supports the thermostat comment.

"I hear that from many of which, then they associated it with heat pump and causes issues getting people to

not hate heat pump."

Thank you, Gina.

And then we also have a comment from Jim Vershaw (phonetic). "I see the 78 AFUE is listed. Current DOE minimum is 80 AFUE."

Thank you, Jim.

And our next comment is from Carol Roberts. "Could you please speak to the 0.35 watts per CFM fan efficacy and the reduction from 0.45?"

MR. TSAN: Yes. It is one of the measures used to bring down -- to get the a/c furnace to meet our heat pump baseline.

So I guess, Carol, is there a specific question on the 0.35 watts per CFM? I think that for alterations, the standard would be 0.45, so we're using 0.35 as a measure.

MR. SHEWMAKER: Carol, it looks like you did raise your hand for a brief second. Would you like to unmute?

Payam, can you unmute Carol?

MR. BOZORGCHAMI: Yeah, Carol, go ahead and unmute yourself and state your name and last name and --

MR. ROBERTS: Carol Roberts, R-O-B-E-R-T-S, G.R.E.G. Consulting.

The 0.35 fan efficacy, your expectation here is

that it will test out. I mean, have you looked at the data in the registries with all the fan efficacy data that is captured right now? 0.35 is not. Especially on a change out, I'm not sure that's even reasonable.

MR. BOZORGCHAMI: Okay. So, Alea, could you speak to that?

MS. GERMAN: Sure. Hi. Alea German with Frontier Energy.

Yeah, those are great points, Carol. And so this, these two, these measures with higher airflow and lower fan efficacy are coupled with new duct work. So this is, you know, what would be called an entirely new or complete replacement system, so new, you know, new equipment, new fan, right, and new duct system. So I think that's the only way that these are really feasible for most alterations.

And it is an aggressive target but is achievable if the contractor plays close attention to, you know, the design of the distribution system and the return airflow to the system, and all of those components that contribute to this.

MR. ROBERTS: So currently a new construction, heat pump, brand new, it is a 0.58 fan efficacy, and it has a 0.45 for an a/c furnace fan efficacy. And so you're saying now on a change out that it's going to be -- this is

not replacement or, you know, one part of the system or both parts, you're assuming complete new duct work and equipment and test out at 0.35. I don't know if that's possible.

MS. GERMAN: So this is --

MR. ROBERTS: -- when it's higher than -- the requirement is higher than the current new Code, new construction version.

MS. GERMAN: Yeah. And just to clarify, so this is for the -- a pathway for a new furnace and air conditioner.

So, Bach, do you want to step back to your slide right before this that shows those three paths?

So this voluntary option would be, you know, a heat pump, a heat pump with gas backup, or this option three, which is an air conditioner that, you know, meets all these additional measures that were added to that air conditioner or furnace path to try and achieve an equivalent energy outcome as the heat pump. So maybe that helps give a little bit of context.

Bach, I don't know if you want to add anything.

MR. TSAN: I think you've covered it.

MR. ROBERTS: So what is -- so sorry.

So how are you assuming that at 0.35 is achievable at all if you're replacing an a/c unit with an

existing furnace?

MR. TSAN: So you would need to go in and replace the duct work and associated -- so it's to meet the voluntary pathway, it's a package that includes duct sizing or, you know, new ducts and attic insulation and air sealing. So it would require a whole package, you know, not just simply just a replacement of that particular unit.

MR. BOZORGCHAMI: So I'm going to interject real quick.

So you're saying that all three bullets have to be met for that system to be able to combine?

MR. TSAN: Yes.

MR. BOZORGCHAMI: Okay. Thank you.

MR. ROBERTS: Okay.

MR. BOZORGCHAMI: Yeah, we can have side discussions if you'd like further information on this, so we could reach out to you, or you could reach out to us.

MR. ROBERTS: Okay. Alright. Thanks.

MR. BOZORGCHAMI: Mikey, you have one?

MR. SHEWMAKER: Yeah. And our last online question is from Ken Johnson.

"There was a reference to 400 CFM on slide five, which would be an increase from 350 today for new construction. Would that apply to heat pump space heating or gas furnaces or both?"

MR. TSAN: Well, for this particular slide, it's being applied to the new a/c furnace.

MR. SHEWMAKER: Great. And that's it for our online questions.

MR. BOZORGCHAMI: Thank you, Michael.

So we have one more raised hand from Jay Madden. Go ahead and state your name, affiliation, and please spell your last name.

MR. MADDEN: Am I going through -- coming through?

MR. BOZORGCHAMI: Yes. Yes, perfect. Thank you, Jay.

MR. MADDEN: I apologize. I did not realize I raised my hand. I have no questions or comments. Thank you.

MR. BOZORGCHAMI: Thank you. Thank you. No worries.

So I don't see any more questions and I don't see any more raised hands. I think it's time for maybe a ten-minute break right now. So let's take a ten-minute break and -- actually, let's take a 12-minute break and we'll come back and reconvene at 10:50, if that's possible?

So with that, I'll put the notice up and we'll take a ten-minute break -- or 12-minute break.

(Off the record at 10:38 a.m.)

(On the record at 10:50 a.m.)

MR. BOZORGCHAMI: Welcome back, everyone. Our next presenter is going to be Danny Tam. He's our subject matter and one of our mechanical engineers in the Building Standards Branch. And he will be presenting the multifamily new construction proposal for 2025.

Danny?

MR. TAM: Good morning, everybody. Hi. I'm Danny Tam from the Building Standards Branch and I will be presenting the proposed 2025 heat pump water heater baseline for multifamily buildings.

First, we will review the existing requirements which are located in section 170.2(d). There are different requirements for water heating systems serving single-dwelling units versus central systems. So for your information, in individual dwelling systems each dwelling has its own water heater, while central systems are systems that serve multiple dwelling units.

Diving more into individual dwelling systems, there are two prescriptive options for heat pump water heaters, and one option for gas instantaneous water heater. These requirements also serve as the standard design baseline when the building comply under the performance compliance method.

As Bach mentioned earlier in his presentation, in

the process of developing the 2025 heat pump baseline, there are a number of criteria we have to consider. Like all standards proposals, the proposed changes must save LSE and source energy as compared to a building built to the 2022 Standards. And, you know, all changes must be cost effective and technically feasible. And finally, for the heat pump baseline, we have to preserve a level of flexibility for mixed-fuel systems.

So the main proposed change is to remove the existing instantaneous gas option for individual dwelling units. And the changes only apply to individual-dwelling unit system and not to central systems. And, you know, any other systems, such as gas, can still continue to be used under the performance compliance method.

And this change will also set the heat pump water heater as the LSE target for water heating under performance. We're proposing to leave the source energy target the same as 2022 which has a heat pump space heating as the baseline. Again, this was done to preserve a level of flexibility for builders who are not quite ready to go all-electric.

Oops. Sorry.

Some of the key assumptions for proposals, we assume the water heating equipment to be of federal minimum compliance products for heat pump water heater, that is a

generic UEF 2.0 electric storage water heater, and for gas it is a UEF 0.81 instantaneous gas water heater.

We also assume that the water heater heat pump water heater is located in the interior closet with the exhaust air duct to the corridor. The CASE Team investigated existing multifamily projects that have individual heat pump water heaters. And this configuration was found to be the most common.

All the analysis was done using the research version of 2025 CBECC. It has all the new 2025 LSE values, source energy, and weather files. For the prototypes, we used the standard four prototypes we used for multifamily. There are two low-rise multifamily prototypes, one mixed use mid-rise and one high-rise mixed use.

Here are some early results for energy impact. There is a lot of information so we will not go into too much detail, but these slides will be available after the workshop. What we are seeing is that, as expected, when we switch the water heater from instantaneous gas to heat pump water heater, there is an increase in electricity use and a corresponding decrease in natural gas use. So the first column are the first year electricity and natural gas savings. This results in a reduction in source energy and LSE in all climate zones and for all prototypes.

So this slide is low-rise garden style. Here is

the low-rise loaded corridor, pretty similar. Mid-rise mixed use. And high-rise mix use.

Average therm savings is about 86 therms per drawing unit per year.

Here are some examples of a compliance path if a builder chooses not to use a heat pump water heater. We are still in the very early stage of evaluating other options. We hope to present those in the next workshop.

Just to go over some of the legends, ECM are some additional efficiency package. In this case, we see ECM includes improved windows, U-factor of 0.25 during water heat recovery and compact distribution for the DHW systems. As you can see, you pick one of the packages or a combination of packages. So, for example, in Climate Zone 12, first column represents if the builder has the heat pump space heater and decides to continue to use instantaneous gas. So for Climate Zone 12, to meet the standard, you either do the ECM, the additional battery and PV or solar water heating. We didn't list the solar fraction in these slides, but it ranged from 0.2 to 0.6, I believe.

So this is the low-rise garden style. And low-rise loaded corridor, pretty similar. It's either one or combination of options. Mid-rise mixed use.

Just one note, high-rise multifamily do require

battery storage, so the battery here is in addition to the prescriptive requirement.

High-rise mixed use, currently, we're only seeing options for solar water heating. We're continuing to evaluate other options. Again, we hope to present those options in the next workshop.

So as many of us know, the performance of a heat pump water heater is highly dependent on its location, and as well as the inlet and outlet condition. For this proposal, we're assuming the heat pump water heater is located in a closet and has the exhaust air vented to the corridor. So we're requesting comments on whether these assumptions are appropriate.

One additional note is that we're still working on the incremental cost and cost effectiveness of the measure, and we will present those in the next workshop.

You know, comments, written comment by August 9th at this link here. And you can contact me if you have additional questions or comments.

This concludes my presentation for multifamily heat pump water heater baseline, and I'm going to send it back to Payam.

MR. BOZORGCHAMI: Thank you, Danny.

Just wanted to let people know once more that these presentations will be posted on our docket, we're

hoping tomorrow, and you still have time. You have our contact information, and you have the docket links, so if you have questions, you're more than happy to reach out to us, and we can answer those at a later time if you're not comfortable answering them here in public.

But meanwhile, any questions, any comments to what you just heard from Danny?

We have two questions in the question and answer portal, Mike. Michael, would you like to read those out, or would you like me to?

MR. SHEWMAKER: Sure. Yeah, our first question is from Ray Nelangen.

> "Locations for heat pump water heater and low-rise multifamily has been external with louvered in our all-electric program."

Thank you, Ray, for the comment.

And our next question is from Carol Roberts. "Why would the heat pump water heater ventilation assumption use corridor versus outside?"

MR. TAM: I don't know if the CASE Team is online?

Again, that was found to be the most common configuration. We did evaluate like on a balcony, the heat pump water heater located on a balcony and vented to the outside.

So we're, you know, we are hoping to get some additional comment to see if that is appropriate. And, you know, that's just setting the standard design. The builder can choose to, you know, basically do whatever they want as long as they meet, you know, the standard design budget.

MR. BOZORGCHAMI: So I'm going to jump in here real quick. This is Payam. I know this question came from Carol Roberts.

Do you have a recommendation, Carol? And if you do, if you raise your hand, I could unmute you. Go ahead. Again, please state your name and affiliation.

MR. ROBERTS: Carol Roberts, G.R.E.G Consulting.

Just curious on the colder climate, everyone's going to be heating their water probably longer than in the summer, and that would create an extremely cold corridor if you're venting all of those hot water heaters or heat pump water heaters to the corridor because it's throwing all that cold air in the corridor, then you start to have to heat the corridor to offset that. Is that part of it? Has that been considered or am I missing something here?

MR. TSAN: Yeah, that is model in the prototype. Yeah, I believe the corridors are conditioned, so in the winter, you're correct that it will require some additional heating, so that is reflected in the results.

MR. ROBERTS: Which becomes an owner cost versus

a tenant cost. I just don't know where those, the price, the cost breakdowns come into play here. So, I mean, heating those large corridors in large buildings becomes a big part of, you know, the owner's operations, and you're throwing really cold air in there, so --

MR. TAM: Okay. Yeah. Thank you for your comment. And we'll consider it.

MR. BOZORGCHAMI: That's a good question. That's a good comment, Carol, and I think we'll get back to you on that one. That's good.

Mikey, go ahead.

MR. SHEWMAKER: Yeah, we've got another question from Gina Rodda. "Would there be a performance penalty for moving to the exterior wall and venting to outside?"

MR. TAM: So it all depends. So, again, this only sets the standard. If that configuration performed better, then you will have a performance credit.

MR. BOZORGCHAMI: So you would have to go performance when you do that; right, Danny?

MR. TAM: Yes. It will also depend on how we write the prescriptive requirement. We might allow multiple options for where to locate the water heater, so that's to be determined.

MR. BOZORGCHAMI: Thank you. Thank you. Thank you.

MR. SHEWMAKER: Okay, we've got a few more comments in the chat. A comment from Ray Nelangen.

"There's also a comfort issue with the corridor venting of heat pump water heaters."

Another comment from W Geese. "One other note that thermostats are usually located in corridors, so may not reflect actual home temperatures."

And then there's another comment from Gina Rodda.

"I have yet to have a project in which the heat pump water heater vents to the corridor. They are always to the outside."

MR. TAM: So, yeah, these --

MR. SHEWMAKER: And that is it for the online comments and questions.

MR. TAM: Yeah, these are great comments. So if you guys can write that in writing, we appreciate it.

MR. BOZORGCHAMI: Mikey, are we done with the question and answers? I have a couple of raised hands that I would like to jump to if that's okay with you.

MR. SHEWMAKER: Yeah, that's it for the online questions and comments.

MR. BOZORGCHAMI: Thank you, sir.

With that, Jonny, I'm going to unmute you. Go ahead and state your name affiliation.

MR. KOCHER: Thank you, Jonny Kocher, Rocky

Mountain Institute.

Want to, similar on the single-family new construction side, want to give props to the CEC on moving forward on a strong heat pump baseline for new buildings. I'm really happy to see this moving in this direction. I think it's aligned with where we need to go in order to get -- to hit our heat pump numbers, and really appreciate all the work that you've done and modeling and proving that it's cost effective.

Thank you.

MR. BOZORGCHAMI: Thank you, Jonny.

Next is Ted Tiffany. Go ahead and state your name affiliation, please.

MR. TIFFANY: Yeah. Ted Tiffany, T-I-F-F-A-N-Y, Building Decarbonization Coalition.

Danny, I've got a handful of our design engineers that can help you with these configurations. We've been having this discussion over the last couple of years and we've designed, actually, a lot of different configurations.

The challenge with the corridors normally around the cost of the rated corridors and putting that around the water heater closet gets a little bit more challenging, but we've overcome that in a couple of scenarios. And putting that cool air, it's not quite cold air from the heat pump

water heater specifications, is normally to a tempered corridor with very little space conditioning, rarely if ever cooling added to the corridors and even just minor heating. Most of the time it's just ventilation.

There are configurations we've done with heat pump water heaters on the exterior of the wall systems, venting to the exterior, as Gina noted, and also ducted with the laundry services that are in each unit. So there's a bunch of different configurations of that.

But the dominant or baseline choice would probably have to kind of pull the engineers that are designing these because they've seen it done all three different ways. But I can get you in touch with those folks.

MR. TAM: Fantastic. Thank you.

MR. BOZORGCHAMI: Thank you, Ted.

We just had another question pop up on the Q&A.

MR. SHEWMAKER: Yeah, would you like me to read that aloud, Payam?

MR. BOZORGCHAMI: Please do.

MR. SHEWMAKER: Yes. There's a comment from Louis Garcia. "Corridors are rated and generally prohibit air from adjacent spaces to be dumped into those corridors."

And then there's another comment from Gina Rodda.

"Many building departments require the corridors be conditioned. Bay area is one of the few that don't."

MR. BOZORGCHAMI: Thank you for those comments. They're good. Great. Great.

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

MR. BOZORGCHAMI: Wonderful. Thank you, Mikey.

I do not see any other raised hands or any comments.

I just want to make sure people understand that the sooner that we get the comments, the sooner we get your concerns, the better it is for us. And we could do a proper job of doing a good job of getting the proper language out there.

With that, since I don't see any more raised hands or comments in the questions and answers, thank you, Danny.

I'm going to pass the baton back to Bach Tsan, our Senior Mechanical Engineer, who will be discussing the nonresidential heat pumps for newly-constructed buildings and alterations. I think, first, he's going to be doing the newly-constructed buildings for nonresidentials.

MR. TSAN: Thank you, Payam.

Great job, Danny.

Alright, yeah, so for -- good morning again. I'm Bach Tsan, Senior Mechanical Engineer for the Building

Standards Branch. So thanks for all that were with me this morning and continue to be with me right now.

You know, so very similar to the single-family side, we've been exploring heat pump baselines and have developed a proposed solution for the 2025 Energy Code. This presentation will focus on the heat pump baselines for medium and large offices and large schools. These are the challenging prototypes for the previous Code cycle, but I think we've been able to identify solutions with the use of air-to-water heat pumps.

Alright, just a quick overview of the agenda, looking at, you know, baseline overview, you know, the 2022 prescriptive baselines, just to get it a little set and then figure out where our starting point is. I'll show the 2025 proposals, go over the energy savings methodology, present the tables with the energy impact results, go over just the general cost analysis and present with those tables, and also we have, you know, performance option approaches that we'll be illustrating.

Alright, well, just jumping in to describe the current prescriptive baselines, we have the following.

You know, heat pump baselines for certain spaces are already identified for 2022, so these baselines already encourage heat pump technologies. So for schools, banks, libraries, retail, grocery, you know, these show a heat

pump baseline on dual fuel heat pump there. So these are in various climate zones. Climate Zone 1 and 16, where it's particularly challenging, but this is where we landed for 2022.

Alright, well, this is also for the medium offices, large offices and large schools. These are the descriptions that are the standards designs for these buildings, building prototypes, and the systems.

Alright, so this is pulled from the standards. I just wanted to -- I'll probably just jump to the next slide, mainly because this has a visual to show the different prototypes we used.

In general, this is the diagrammatic representation of the 2022 baseline system. Obviously, the analysis started with the 2022 prescriptive building and it meets all envelope, air quality, and system requirements.

Just a quick description of the large office. It is approximately 500,000 square feet. It has 12 stories with one basement. You know, for this 2022 standard, a large office is being served by a built-up VAV unit with a variable air volume system which delivers air and heating with VAV with reheat coils. So we have a chiller to produce chilled water and a hot water boiler that provides hot water to the reheat coils. Additionally, there's the water cooled chiller, the tower, and a central boiler.

So those are the systems typically used for the large office and large schools and which we use as our baseline -- or use as our standard design for 2022 to do the analysis for 2025.

And for the medium office, it's approximately 54,000 square feet building. It's three stories. Medium office is being served by a package of VAV unit, VAV reheat system, package variable volume DX unit with gas heating, and the hot water reheat terminals.

So then the last one, large schools, as I mentioned, the systems are described for large offices, but this is an approximately 200,100-square-foot building, two stories, built-up VAV, variable air volume systems, chilled water and hot water coils, water cooled chiller, cooling tower, central boiler, same as the large office prototype.

Alright, so these are the same metrics that are being used for single-family as we -- for non-res, but these considerations are to take place. So, you know, we have to show long-term system cost savings when compared to 2022 Energy Code, source energy savings as compared to the 2022 Energy Code. We'll be demonstrating the measure is cost effective for each building type in each California climate zone where applicable, and ensure technology is feasible, but that option exists with mixed-fuel and all-electric to allow for compliance flexibility.

Alright, just to highlight again, we used CBECC. There's two versions, CBECC-Res was what we were referencing last year -- earlier this morning for the single-family, that we're using CBECC, which is the commercial non-res side that it uses. It creates EnergyPlus (phonetic) input data file.

One highlight we wanted to mention was the -- we put -- the software team put together the air-to-water heat pump feature and, you know, thanks to a lot of stakeholders that were helping to study that and get that, turn that on. But it was introduced in CBECC in the 2022 version and allowed for this analysis that we're going to be talking about today.

Yeah, and so just to, you know, overall highlight, you know, we used the -- we added measures to the descriptive minimums, like the air-to-water heat pump, used EnergyPlus versions to do some of the additional modeling. And then the results were consolidated in the graphics you've seen in Excel tables.

So jumping right into it, the proposal for 2025 is, as shown on the screen. This is the system for large offices, and similarly for large schools. This is an air-to-water heat pump. We're proposing that the space heating systems side will require a central air-to-water heat pump with the minimum COP at the rated conditions here at 3.29.

We use a buffer tank in there to minimize the, you know, the cycling so that we're -- this is size that, eight gallons per ton. I think we, for the modeling purposes, we use 10 gallons per ton.

So one component that we used, too, in our analysis was a four-pipe fan coil. So this used the minimum three speeds, you know, plus the off mode. So this four-pipe fan coil and the air-to-water heat pump are the main components of our system.

Again, additionally, we added the dedicated outside air system. It's sized ventilation. It handles most of the ventilation needs. It's set at 0.77 watts per CFM. We use heat recovery ventilation with bypass for cooling and set the bypass lowering limit at 55 degrees.

Alright, and here's a diagrammatic. Here's a diagrammatic representation of this for large schools. We have the air-to-water heat pump components here, air-to-water heat pump, the four-pipe fan coil, dedicated outside air system, heat recovery with bypass, so this is more of the diagrammatic representation of the text that was in there. Air-to-water heat pumps are, although they're not a typical system of choice, air-to-water heat pumps are proven design options, and four-pipe fan coils are an established option for zonal HVAC systems.

The distribution system, an air-to-water heat

pump generates the hot water. We have hot water and chilled water circulated to the individual four-pipe fan coils in each zone. And then, you know, the four-pipe fan coils circulate air within the zone. Ventilation is provided with the DOAS for the heat recovery ventilation. So the characteristics for main savings, as I think mentioned before, minimum of three-speed fan, three-speed fan control on the four-pipe fan coil, and the motor is set at -- or the efficacy is set at 0.35 watts per CFM. This is consistent with Title 24, 2019.

The DOAS provides for -- provides outside air in for ventilation. It's sized for ventilation only, not economizing, decoupled from zonal, which means it does not flow through the four-pipe fan coil. And the fan power is set at 0.77 CFM before the altitude adjustment. And then the heat recovery ventilation, it bypasses for when the appropriate cooling is needed. And then the lower limit bypass which, at 55 degrees, which limits heating energy at the perimeter.

Okay, so I wanted to maybe walk through the air-to-water heat pump sizing and specification. So we spent time and we interviewed several practitioners and engineering firms and kind of gathered these general guidelines for designing a systems.

From the interviews, we saw approximately 50

percent of the sizing, so air-to-water heat pump that is sized for 50 percent of the design load, but this can meet 90 percent of the operating hours. And our set points are at 105. The typical temperatures we're seeing is 100 to 130 reset point, but we -- our model is at 105.

The Delta T at the hydronic hot water distribution, we're looking at is 10 to 15 degree Delta T. Again, eight to ten gallon buffer tank.

We have electric resistance for boilers that are supplemental for this -- for the ten percent times that are not able to meet the load.

So the anticipation is the minimum operation temperature for the air-to-water heat pump is 40 degrees outside air. And, you know, this air-to-water heat pump efficiency is based off of our Title 2, Table 110.2-N.

Okay, so that covers the large office and large schools.

We also are looking at proposing this type of system for a medium office that -- so a medium office that uses central space heating system will require airflow refrigerant flow. We're basing our system design configuration off of VRF systems. Same minimum, three speeds plus off with heat recovery. And then it also includes a dedicated outside air system. Sizer ventilation, same, 0.77 watts with CFM, heat recovery

ventilation and the bypass clinic.

So similarly, this is the diagrammatic version of the medium office here. So the distribution system, as I've said, you know, the out during units exchange heat with the ambient and, you know, circulate refrigerant to the refrigerant zone of the coils for VRF systems. Indoor units can select either hot or cold depending on the zone needs, so it would be -- it would have systems that can do both heating and cooling.

Ventilation for DOAS is HRV. So as I mentioned before, you know, VRF, we're looking at three -- minimum three-speed fans, 0.35 watts with CFM efficacy for the systems.

Alright, we'll stop for questions and answers at the end, but wanted to look at the -- show the first year energy impacts for electricity savings, natural gas, long-term system savings. So this is a little bit different than single-family as we were looking at dollar savings over a 30-year period. This is dollars per square foot over a 30-year period. And then we see a source energy savings here.

So these are the simulation results for significant therm savings. And in some climate zones, we have negative first year savings due to just, you know, the change in system type, but we -- the savings are attributed

to eliminating reheat by using zonal systems. It was key to saving both heating and cooling. You know, the savings you can see from the electricity savings here.

In cooler climate zones, such as 1 and 16, the electricity from heating causes a net increase so that you have some net increase there where you see negatives in the -- in that first year savings column. And then in climate zones where reheat is not a large contributing factor, the baseline, for example in 3 and 5, there's also sometimes a net electric increase from adding the heat pump technology.

So looking at this data, you know, for example, for a 500-square-foot prototype in Climate Zone 3 over 30 years, your range can be between -- sorry, if you look at Climate Zone 5 at 1.33 LSE, you could theoretically see a savings of $665,000, and all the way up to Climate Zone 15 where you're looking at approximately $9 million in savings.

Alright, so this is looking at large schools. We have very similar values, however -- you know, very similar trends and values. But, however, for the heat and reheat is not a large community factor in this baseline for 3 and 15, but there's also sometimes an electric increase in a heat pump technology, same as before. For the schools, there's a difference between this and the office due to the

large outside air and ventilation loads for schools.

And here's a general look at the medium office. So these are the results for the medium office. There's an interplay between the cooling electricity savings because of the reheat versus the additional electricity from the heating side of the technology that kind of attribute to the electric energy use in the Climate Zones 1, 2, 5, 6, 12, and 16.

So with that, here's the graphical representation of long-term system cost over 30 years. So in all climate zones and each of the three prototypes, we see positive savings. Initially for source energy, positive savings throughout for large offices, medium offices, and large schools.

Just quickly jumping into cost, we're looking at the incremental costs for a large office. As you see here, it's a tabular form to kind of show the estimated first cost between the baseline and the proposed, the baseline being your -- you know, the built-up air handler with boilers and chillers. The air-to-water heat pump and four-pipe fan coils are shown on the, I guess, the fifth, starting in the fifth column. We do include the AGIC, which it's avoided gas infrastructure costs, for a large office.

And on the last column, the incremental costs

here, you see negative numbers, mainly due to the fact that we're seeing lower costs for the air-to-water heat pump. And these costs showing negative incremental savings due to the savings systems being slightly less expensive.

And then here's the general bulleted reasoning for that air-to-water heat pump with four-pipe fan coils and DOAS. We see significant savings in air distribution duct work. The DOAS system has a lower first cost than a built-up AHU. Some additional costs for fan coils, but you know, the first -- which is the first cost (indiscernible). But the incremental cost shows like savings over the baseline, and we added the water cost infrastructure costs.

Similarly for the large schools, baseline system over the four-pipe fan coil. We did not add the avoided gas infrastructure charge due to there's going to be appliances and other end uses that would use gas here. But the incremental cost savings is not negative for schools but slightly more.

Alright, so similarly, less distribution duct work. And although they have somewhat higher costs, the less, this is true, the less distribution duct work with the school layout compared to the offices, the reduced cost savings from DOAS due to a much higher ventilation load per square foot, and then gas is included.

Same thing looking at the incremental cost for

the medium offices here. In some climate zones, the cooler climate zones, you have incremental cost savings that are negative. Just to mention, the systems are less expensive. And then in Climate Zones 6 through 11 and 13 through 16, the costs are slightly higher.

Alright, so the VRF system, the cost savings is from a single system for cooling and heating and, also, some avoided duct work. The avoided gas infrastructure cost is included, so about $0.15 per square foot to $0.40, depending on utility and no other gas uses.

So looking at this bottom line with the benefit-to-cost ratio for large offices, except for Climate Zone 1, we see -- since the proposed system is less than the baseline, that we have some infinite benefit to cost ratios, except for Climate Zone 1, although we have a measured cost that's affected much greater than one. And then same with medium office. And then large schools, because of the large ventilation loads and outside air requirements, the benefit-to-cost ratio is greater than one, but it's much lower.

Alright, so we have -- so as we mentioned that we wanted to show some performance options, performance approach options for compliance, so to compare it with our 2025 metrics, we have a packaged air-to-water heat pump, four-pipe fan, DOAS is our baseline. To have systems that

could comply, we would need to use a natural gas boiler. This is your minimum efficiency, I think 80 AFUE or 80 -- sorry, yeah, about 80 AFUE, I think, natural gas boiler with four-pipe fan coils, dedicated air systems, heat recovery ventilation. It would have to add the economizer ventilation and a window measure.

So in theory, you're looking at an 82 percent heat recovery ventilation. R-40 on the roof for some envelope requirements. The U values of about 0.3 in certain climate zones, and 0.35 in Climate Zone 5 and 0.44 in some climate zones to have -- sorry, 0.3 in most climate zones for U values. We would have a shading coefficients of 0.44, just to meet air specs.

For medium office, very similar. We have a VRF and DOAS as a standard baseline. So we have natural gas boilers to provide the heating hot water. We have fan coils with split DX cooling, hot water, hydronic coils with -- plus DOAS. And this is a slightly different system with the fan coil that includes a split DX coil in it. But these systems exist with the heat recovery ventilator and some ventilation economizing measures and some water improvements.

Along with large schools, we have four-pipe, to compare with our four-pipe fan coil similar to the large office, one big component or measure we used here was we're

looking at roof measures and some additional PV. Because it's a office -- or I'm sorry, because it's a large school, you have some additional areas that you can put PV. But there is analysis underway. We're trying to understand what it would take without PV to achieve the comparison with our baseline.

Alright, so that's the current presentation for the newly-constructed buildings. I guess we can take questions and comments.

MR. BOZORGCHAMI: Thank you, Bach.

So I'm going to have Mikey go first because I don't see any raised hands. I take that back. I got one raised hand, and it's from Meg Waltner.

Please state your name and affiliation, please.

MS. WALTNER: Hi, can you hear me?

MR. BOZORGCHAMI: Yes.

MS. WALTNER: Hi. Meg Waltner from Energy 350 on behalf of NRDC. A couple of comments and then a question.

First off, just want to say, you know, thank you for this great work. Seeing you expanding the baselines for nonresidential buildings into these multi-zone systems and other building types, I'm really excited to see you doing work in this area.

You know, I think it's going to take me, personally, a little bit of time to digest the implications

of the specific system types that you all have proposed and, you know, in comparison to the work that's been going on by the CASE Team as well on non-res system types. So I may have further comments on that in the future.

The comment that I wanted to make about that now is just in addition to these baselines, in addition to having sort of the one option that sets the baseline, that it's really important to have multiple prescriptive options for large electric systems in these non-res buildings. And so I'd really encourage you, you know, looking at the work that the CASE Team has done, to include additional prescriptive options, even if they aren't the ones that are used to set the baseline.

And sort of a related point is just emphasizing, again, the importance of the modeling functionality in CBECC com -- or sorry, in CBECC to be able to model all the different configurations of large all-electric systems, heat recovery fillers, using storage and not, just making sure that all of those configurations are, you know, available to the extent possible under the prescriptive path and the performance path as we're moving into this world where we're seeing many more large buildings having all-electric systems, trying to increase those compliance paths.

And then my question is, I'm curious whether you

looked at all at expanding to -- so the current requirements for certain building types are only for single-zone systems. Did you look at expanding these multi-zone baselines to those building types that are already covered by that single-zone heat pump requirement? Like what happens to multi-zone systems in those building types?

MR. TSAN: We haven't started looking at the other building types yet, so we've mainly just focused on large offices, medium offices, large schools. I guess the current building types that do have, I guess single-zone with heat pump options, we're not currently looking to expand multi-zone to those other prototypes.

MS. WALTNER: Okay. Thanks, Bach.

MR. TSAN: At least not for this Code cycle.

MS. WALTNER: Okay.

MR. BOZORGCHAMI: Thank you, Meg. Thank you, Bach.

We have Jonny here. Jonny, go ahead and state your name and affiliation. Thank you.

MR. KOCHER: Thank you. Jonny Kocher here with RMI.

I want to echo the praise that Meg had mentioned. Thank you for looking at multi-zone heat pump requirements. I think it's a great step forward.

I had one question, I believe in the 2022 Code, at least in smaller schools, that the water heating was also acquired to be a heat pump water heating baseline because of higher water use in those building types. Is there any consideration on expanding that to either large schools or other building types?

MR. BOZORGCHAMI: Jonny, so the question is about heat pump water heater? I'm just having a hard time following your question.

MR. KOCHER: Sorry. I think, yeah, I believe in the 2022 Code, correct me if I'm wrong, the service water heating is required to be a heat pump water heater for small schools; is that correct?

MR. BOZORGCHAMI: Yeah.

MR. KOCHER: Is there any discussion about expanding that to other?

MR. BOZORGCHAMI: There has been some discussions, but I'm not sure if we're going to be talking about that today.

MR. KOCHER: Got it. Thank you.

MR. BOZORGCHAMI: Yeah.

So I don't see any more raised hands.

With that, I'm going to pass it off to Michael Shewmaker to review the portal for questions and answers.

MR. SHEWMAKER: Sure. Yeah. Real quick, Payam,

Danny wants to add a little bit.

MR. BOZORGCHAMI: Wonderful.

MR. TAM: Sorry. In regard to the last question, I think for this round, we don't have the bandwidth to expand on the heat pump baseline, water heating baseline for non-res. Unfortunately. We're just kind of running out of time.

MR. SHEWMAKER: So we've got a few questions online. Our first question is from Daniel Arvalo (phonetic), and I apologize if I'm mispronouncing your last name, but Daniel asked, "What are the square foot levels that define a medium office versus a large office and large school?"

MR. TSAN: Yeah. So at least for our prototypes, a large office is upwards of 500,000 square feet. The medium office -- I think the actual number is 490,000, but I can get you -- I'll send you an email with the exact numbers. Medium office, we're looking at 53,600 square feet. And large schools at 210,900 square feet.

MR. SHEWMAKER: Great. Thank you, Bach.

Our next question is from Laura.

MR. BOZORGCHAMI: Mikey? Mikey?

MR. SHEWMAKER: Yes?

MR. BOZORGCHAMI: A quick question to expand on that comment right there that Bach brought up.

The building prototype assumptions are also within our ACM documents in our compliance documents, so -- our ACM reference manual, excuse me, so that information is also there.

But go ahead.

MR. SHEWMAKER: Thank you, Payam.

So our next question is from Laura Petrillo-Groh. "Does the large office prototype include a data center in the basement?"

MR. BOZORGCHAMI: Eric, can you answer that question?

MR. SHADD: Sure. Yeah. Pretty simple answer. No, there's no data center in the basement.

MR. BOZORGCHAMI: Excuse me. Eric, state your name and affiliation. Sorry about that.

MR. SHADD: Oh, I'm sorry. That's my bad. Yeah, this is Eric Shadd with NORESCO, consultant to the CEC.

And there is no data center in the basement of the large office prototype for the CEC prototypes, yeah.

MR. SHEWMAKER: Perfect. Thank you, Eric.

And our next question is from Josh Vasquez. "Would the 2025 proposal eliminate air-to-air heat recovery VRF systems?"

MR. TSAN: I don't believe it would be eliminated. Compliance can still be achieved through, you

know, the performance approach, so not necessarily eliminated. But we can look at the alternative heat pump pathways and we'll review the potential of using this as we move forward. Thank you for the comment.

MR. SHEWMAKER: And our next question is from Karina Luo (phonetic). "Is heat pump mandatory for a food retail facility in 2025 Code?"

MR. TSAN: No, not currently. It's not mandatory for the food retail facility.

MR. PEREZ: Yeah. And just to expand on that really quickly. Javier Perez, Energy Commission.

Yeah, our heat pump requirements are prescriptive requirements and they'll continue to be prescriptive requirements allowing for design flexibility via the performance approach through the 2025 cycle and perhaps beyond.

Thanks.

MR. SHEWMAKER: Thank you, Javier.

And our last online question is from Hilary Weitz (phonetic).

> "For the office prototypes, if the air-to-water heat pump is sized to handle only 90 percent of the load, do the models assume the other 10 percent of the load is served by electric resistance saving in order to claim AGIC savings?"

MR. TSAN: I guess the answer to the first part of the question is, yes, the electric resistance is meant to be the ten percent that handles the -- or handles the ten percent of the load.

I guess I'm not sure I know the answer. Eric Shadd, could you comment on that if the -- if it's used to claim the avoided gas infrastructure costs?

MR. SHADD: Sure. Yeah. Eric Shadd. Sure. Eric Shadd, NORESCO, consultant to CEC.

So I might get a little more specific and say that it's 90 percent of the hours it can handle the load and then the other 10 percent of the hours.

But I think the question here is like, are we using an electric resistance heating so that we can have an all-electric building so that we can claim the AGIC savings? And I would say, yeah, that's a part of the reason that we used an electric resistance boiler versus a natural gas boiler. The AGIC savings were not huge, but yeah, yeah, we wanted to see if we could go all-electric and we were able to do that with that.

So hopefully that answers the question.

MR. BOZORGCHAMI: Thank you, Eric.

We have one anonymous comment that came in and they're asking if the session recording will be posted anywhere for viewing at a later date, and the answer is,

yes. It won't be done by tomorrow but it will be done here in the next week.

And then, again, this session is also being recorded and it's going to be transcribed and that transcript will be available in a few weeks, so thank you.

At this time, I don't see any other raised hand or any questions and answers in the portal.

So with that, Bach, if you're ready, we may just jump into the alteration section of nonresidential.

MR. TSAN: Let me show my screen. Alright. Good afternoon -- good morning. Sorry, I'm in between, I guess, us and lunch with our --

MR. BOZORGCHAMI: Yeah. I'm going to jump in real quick.

Right after this alteration discussion on nonresidential, we're going to take a quick, maybe 45 to an hour, lunch break.

MR. TSAN: Great. Thank you.

So good morning again. So here to talk about the proposal for a heat pump requirement for single zone rooftop air conditioning alterations. So we covered new construction just a few minutes ago. Now we're jumping into alterations. And again, I'm Bach, I'm a Senior Mechanical Engineer, Building Standards Branch.

Alright, quick general brief, similar format,

baseline review. We'll talk about the prescriptive Code as it applies, look at the proposal, savings methodology, impact results, cost analogist, and the last bullet for larger systems, and we'll cover that when we get to that slide.

Alright, so looking at the current Code, which is to show just the exception for a heat pump is not required in an alterations application. The exception is for alterations that does not have to comply with the heat pump requirements in section 140.(4)(a)(2). So the current Code shows -- the proposal is attempting to -- we're attempting to modify this.

So methodology, this is the -- ohm, I'm sorry, I skipped a slide.

So this is the proposed requirement to the, for Title 24, Part 6, the California Energy Commission, we're proposing the Code changes for nonresidential buildings, so we're looking at package units below 65,000 BTUH. So we are prescriptively requiring gas-fired systems, gas-fired rooftop units upon replacement to be a heat pump-based -- to be a heat pump-based in the alteration.

Alright, methodology, similar to new construction, newly-constructed buildings, you know, we have the same (indiscernible) looking at long-term system costs and positive cost-to-benefit ratios. Here, a couple

of steps we looked at, you know, over the 30-year period to calculate the general benefits or long-term cost factors using net present value savings over 30 years, looking at the incremental costs and cost ratios.

Alright, so this is the software used, CBECC 2025 Research Version and EnergyPlus. We are looking at these two prototypes, the small office and medium office prototypes for existing building in the 2000s. These are the current results that we have for these two prototypes. We also are additionally looking at small schools.

Alright, and this is just our main key assumptions, CBECC alterations, you know, lighting at 0.8 watts per square foot with lighting controls in the small offices, envelope at Title 24, 2005. Baseline, the HVAC system, single-zone air conditioning with less than 65,000 BTUH. The SEER level is 14 with an HSPF (phonetic) of 8.2. In Climate Zones 1 to 15, we have electric resistance, and in the Climate Zone 16 it's dual fuel, so furnace for supplemental heating.

Alright, so ventilation, CBECC default, Title 24 at 0.15 CFM per square foot.

So the demand, we have an economizer control with the differential dry bulb. And then for DCV, it's modeled for Title 24 requirements with the larger at the people-based at 15 CFM per person. And then the area based

ventilation at the office is zero, but retail is 0.2, and control to maintain 1,000 PPM in the spaces.

And similarly for retail, looking at 2016 prescriptive area category, electric resistance in Climate Zone 1 through 15 and 16, dual fuel. And the supply of variable speed control is down to 50 percent airflow.

And slide eight here, we're looking at the results for -- from our initial runs, looking at annual savings and negative savings in 1 through 5 and 11 through 16 in electricity, mainly because of this substitution from electric to gas. We have some fairly significant natural gas savings, long-term system cost savings. So in the next graph, we'll see that we have LSE savings for 1 through 15, but 16, there is a challenge there. And then we have annual source savings on the last column.

Alright, so graphical for long-term, the prescriptive requirements is if you're going to -- is to put in the heat pump. So we do, in this graph, we're looking at, for all the climate zones, the heat pump is -- for Climate Zone 1 through 15, the heat pump performs better than the incumbent, which is the a/c rooftop unit with a gas pack. However, in 16, the heat pump performs worse. So we've also -- very similarly for medium retail, we have very similar results with Climate Zone 16, the heat pump not being able to get above the zero line there.

Alright, well, I guess if you're staring at these graphs, you're going to realize that the measures, that you either put in the heat pump, and you can put in any of these other options here. They would be the heat pump, so the gas economizer, gas with DCV, so in theory, there is a gas pathway for these systems.

So overview of the LSE results, the heat pump shows LSE savings with the gas pathway, except for Climate Zone 16, we have the mixed-fuel pathway with the design specified in each of the measures or each of the climate zones. There's an economizer for all unit sizes, even at 54,000 or greater than 54,000. As you know, we -- the threshold is at 54,000 for alterations. Newly-constructed buildings for 2022 is 33,000. Variable-speed fan operation and DCV. You know, the heat pump reported slightly higher here because, you know, based on the federal (phonetic). Heat pump is 14, while the DX cooling is 13.

So LSE doesn't offer much advantage on the heat pump heating versus natural gas, but the heat pump performance degrades in the colder winter days.

And this, we had a memo submitted to the docket by the advocates, the NRDC, Earth Justice, Rocky Mountain Institute, Sierra Club. It was very instrumental in helping us with this analysis. But this quick graph shows that in terms of cost, the gas-fired systems, typically

across the range of between two to five tons, the gas-fired systems are slightly more expensive than the heat pump.

So total incremental costs, you know, we need to continue doing our cost analysis, but we're looking at speaking to some wholesalers and providers for these products, looking at the cost delta between heat pump RTUs and gas DX units between the products and lines, and were looking at, I guess, currently, heat pump RTUs with the electricity shows cost savings versus gas.

But this is subject to the low NOx burner requirement. So in the areas that you see with the dark, I guess, purple, it has an ultra-low NOx requirement, which could add $13.00 to $400 per ton, depending on the two to five ton range.

Alright, so the incremental costs, things we have to take into account, crane lift, but between both the total incremental costs between the a/c freighters (phonetic) and the heat pump. Similarly, you have crane lifts, you have curb adapters, weight requirements. There may be some additional electro-resistant heating required on heat pumps for defrost controls, but these can have impacts on existing buildings. And we'll have to look at how do we address the possible increased load that accounts for electrical resistance.

So this covers units below 65,000. We found that

based on shipments, generally looking at AHRI shipments, most of the systems are from 65,000 and below. So that covers, I believe, at least upwards of greater than 80 percent of the equipment in the market.

Initially, we don't have data currently. We're still exploring the feasibility of systems greater than 65,000 BTUs, so larger than five-ton systems. The same scope, non-res buildings, but we're looking to build voluntary Codes for electrically-efficient driven heat pumps, gas-fired space heating efficiency package. So the methodology is analyzing currently 5 to 20. I think it could be up to 20 tons. You know, we're doing simulations with small office, retail prototypes.

Additional research needed to speak with designers contracts, but this is --currently, we're at a fairly challenging attempt at getting there, looking at larger systems. And we're trying to limit most of the measures to that contractor that related to mainly to the HVAC system, but we'll kind of explore further as we continue.

Yeah, so this, we're looking at the -- these are looking at continued research for heat pump baselines for small schools, but the exploration of, you know, their top units for Part 11. So I probably wasn't clear with the -- the larger systems is for the voluntary Part 11 side, not

mandatory that are scheduled for Part 6.

And that's it for alterations. I will open up for questions and comments.

MR. BOZORGCHAMI: Thank you, Bach.

So with that, anybody want to raise their hands?

If not, I'm going to punt it back to Javier Perez to go over the question and answer portal and start with Mr. Robert Glass.

MR. PEREZ: Alright. Thanks, Payam.

Robert Hassis, who asked, "How do you plan to address emergency replacement in the instance -- in this instance, replace gas-fired with heat pump rooftop?"

MR. BOZORGCHAMI: I apologize, Javier. You're not coming in. You're coming in muffled.

MR. PEREZ: I'll try one more time. How about now?

MR. BOZORGCHAMI: Still muffled. Let me read it real quick. Sorry about that.

Robert Hassis is asking, "How do you plan to address emergency replacement in this instance, replace gas fired with a heat pump rooftop?"

MR. TSAN: Yeah, thanks for the comment -- or the question. We are still in the early stages of kind of looking at all the situations, but we'll have to separately address emergency replacement. So we're thinking through

it but we're -- we need to figure out the -- all the situations in which a replacement -- but I think by -- further research is needed, but I think by the next workshop, we'll look to provide an answer for this.

MR. BOZORGCHAMI: Okay, Javier, do you want to try one more time with Gina Rodda's question?

MR. PEREZ: Can you hear me now?

MR. BOZORGCHAMI: No. I'll take over. No worries.

MR. PEREZ: So sorry.

MR. BOZORGCHAMI: So Gina Rodda asks,

"As we have seen, heat pump equipment used for space heating typically needs to be a larger size than just considering the cooling load. I am assuming this 65,000 BTU trigger is based on existing a/c sizing."

And then another question that she asks is, "Would this apply to packaged and split DX systems?"

MR. TSAN: Okay. Yeah. Thanks.

So hi, Gina, this is Bach, California Energy Commission.

Yes, so the BTU trigger for 65,000, I'm not necessarily sure if it's a trigger, but the -- we're looking at mainly just 65,000 as a kind of that threshold for between smaller, the quote unquote smaller systems versus larger ones. I guess looking at larger systems,

there are additional requirements. They may be slightly -- their cost might be slightly higher. There are a few other concerns we're looking at.

But I don't know if I answered your question properly, but --

MR. BOZORGCHAMI: Bach, Gina has her hand raised, so I'm going to --

MR. TSAN: Okay. Go for it.

MR. BOZORGCHAMI: Go ahead, Gina.

MS. RODDA: Hello. This is Gina Rodda from Gabel Energy, and I thought I wrote that one so nicely, too.

So as we have seen when we are transitioning from gas furnace to heat pump space heating, typically that equipment needs to be sized higher to be able to meet the heating load when typically we are sizing these systems based on the cooling load. So we have to consider, is that 65,000 BTUH threshold for this requirement, is that based on the existing air conditioning size that's being changed out or is it based on what the size will be based on what the system needs to be sized to meet the heating load? And then I have concerns, what's going to happen with existing ducting and so on and so forth.

And then, also, is it different, whether we're talking packaged, which is much easier to do this as long as we consider the duct sizing, versus a split DX system?

Already the industry has a lot of issues when they're trying to apply, say, especially the economizer requirements when we're talking about changing out split DX systems.

MR. TSAN: Yeah, so for the DX, we will look into it. I think we'll have to review its applicability into Part 6.

MR. BOZORGCHAMI: Okay, so very much stay tuned, Gina. We'll have to get an answer back to you on that one. That's a good question.

On the a/c sizing, is Xia on the call from NORESCO? Can he answer that question?

Yeah, Xia and Jon are both on.

MR. BOZORGCHAMI: Or Jon, yeah.

Could one of you guys answer that question, please?

MS. FANG: Okay, maybe I'll take a stab at it. Xia Fang from NORESCO, CEC consultant.

In regards to Gina's question, I think it depends. Some climates, actually many climates in California for commercial buildings, the cooling load actually is much larger than the heating load, except a couple of the kind of Climate Zone 14, Climate Zone 16.

And I would say, when we do this replacement, certainly it's not going to be a true like-for-like

replacement, because you do need to consider the load. But if the load actually -- sorry, but if the equipment size exceeds 65 MBH, then this requirement no longer applies, if that makes sense.

MR. BOZORGCHAMI: I think at the bottom of all the discussion, I think, Gina, we have to respond to you and we'll have a side conversation with you on that, because it's a good question. We need to think about that a little bit more.

MS. FANG: And we haven't really done the analysis on the split DX system yet. That's, yeah, moving forward.

MR. BOZORGCHAMI: That's to be determined still, yeah. Thank you, Xia.

With that, I'm going to move on to Dan Waldenhaus's (phonetic) question.

"On your slide number seven, you're showing the SEER and the EER -- excuse me, SEER and HSPF instead of the SEER2 HSPF, and no mention of the EER."

I guess he just wants to make sure that the intent was SEER and HSPF and not the more modern rating classifications that were --

MR. TSAN: Yeah, I thank you for that. I don't believe the SEER2 and HSPF for rooftop units are in effect yet.

Xia, is that -- could you comment on that?

MS. FANG: As of right now, we are going with the DOE minimum efficiency, and that is looking at SEER and HSPF. We haven't really encountered a SEER2 for these rooftop units yet, for these single-zone rooftop units yet, let me just put it this way.

MR. BOZORGCHAMI: Okay. Thank you. Thank you.

We have another question from Luke Morton. And Luke is asking about the morning's modeling work. "Is there a place where staff can put the prototype models used for the CBECC-Res analysis?"

We will. It will be done at a later time. We will be documenting those and that information will be available for the public to look into, evaluate, and actually do their own analysis if they wish to, so stay tuned. That's going to come here shortly.

Timeline? I don't have a time schedule yet for that one.

Okay, then the next question Robert Glass asks is, "The lead times on large equipment are way out there."

Robert, can I unmute you and have you elaborate a little bit on that, if I can? Oh, there we go. Okay. Go ahead, Robert. State your name and affiliation and --

MR. GLASS: Robert Glass, G-L-A-S-S.

MR. BOZORGCHAMI: Oh, I apologize. I

accidentally muted you.

MR. TSAN: And I think the lead time comment is a comment about just larger systems than 65,000.

MR. GLASS: Can you hear me now?

MR. TSAN: Oh, yes.

MR. BOZORGCHAMI: Yes.

MR. GLASS: Okay. Yeah. No, that was a follow-up to my earlier question about the replacement of gas rooftop units with heat pump rooftop units, is that the larger equipment, the lead times on those things are way out there. So from an emergency replacement standpoint, you don't have the timing to go ahead and get replacements that way, so that's just kind of as a carry-on.

Additionally, as an issue, more so on the commercial side than the residential side, that the lead times on commercial equipment, if you're changing system types, is going to be the lead times can be out there three, four, five, six months from lead times for equipment. So that has to be done on a planning side. So from a replacement standpoint, that's going to be a huge challenge to put that in as a requirement.

MR. TSAN: Alright. Thank you. We'll take that into account. When we speak with the manufacturers and distributors, we'll try to get at our additional survey question of what lead time on equipment is. Appreciate

that.

MR. BOZORGCHAMI: Great. Thank you, Robert.

We have another comment from Luke Morton, and his comment is,

"Emergency replacement, as he believes, is a market issue, not a Code issue. For example, locally, for single-family water heating replacement, some plumbers are using temporary water heaters to put in while permits are being pulled for heat pump alterations. This makes it possible to provide hot water while still getting permits and getting incentives."

Thanks for the comment, Luke.

And we have another comment from Joe Cain. "Across different occupancies, I think emergency replacement of appliances could be addressed with exceptions. Under certain conditions, emergency replacements that include multiple trades, such as pulling additional circuits, could lead to time delays that could be detrimental to occupants during the period of extreme weather conditions."

That's a good point, Joe. Thank you.

Gina Rodda has three or four comments, and she has her hand raised, so I'm going to unmute you, and please state your name and affiliation, and take care of those

comments. Thank you.

MS. RODDA: So sorry, my typing skills were horrible. Gina Rodda, Gabel Energy.

For this type of equipment for commercial is typically three-phase, which is why it's not subject to the new SEER2 HSPF2 requirements, though sometimes I have seen nonresidential buildings use one-phase equipment, in which then it would be subject to those new efficiency requirements. So that should be considered when you are developing, further developing this proposal.

MR. BOZORGCHAMI: Thank you, Gina. We'll take that into consideration. Thank you.

Next we have an anonymous comment that came in, and it says, "SEER2 takes effect on January 1st, 2023."

And then the same attendees provided a website link to that.

Then we have Luke Morton, and I think he's saying, "Robert Hassis' point on nonresidential heat pump lead time is a good one."

And I think I'm looking at Bach right now, and he's shaking his head, and I think we need to look into that, and we'll get back to you guys.

We will be having a second workshop at a later time, at the latter part of August, on the same topic, so we'll probably be able to answer those questions at that

time.

I have a raised hand from Jonny Kocher. I'm going to unmute you and put your station and affiliation, please.

MR. KOCHER: Thank you. Jonny Kocher with RMI.

I just wanted to, I'll make a brief, but yeah, just wanted to say that this is moving in the right direction. Most cost-effective time to be fuel switching is at time of replacement, and really pleased to see the CEC doing all this great research, moving towards it. And glad to see that the threshold is 65,000 BTU per hour.

Thank you.

MR. BOZORGCHAMI: Thank you, Jonny.

Meg, I'm going to unmute you. Go ahead and state your name and affiliation. Thank you.

MS. WALTNER: Meg Waltner, Energy 350 on behalf of NNEC.

Yeah, just to echo what Jonny said, strongly support this and really great to see you all moving forward on it. And I think for nonresidential buildings in particular, you know, as you were discussing with the cooling load dominating, I think it's a much more straightforward case for the units and the sizes that you're looking at and for the building types you're looking at, and just a low-hanging fruit opportunity to install

heat pumps that are needed to reduce emissions throughout California. So thank you for all the work on this and on the proposal.

MR. BOZORGCHAMI: Thank you, Meg.

I don't have any raised hands, and I don't have any questions and answers in the question and answer portal.

So with that, how about if we take a quick lunch break and be back here by 1:15, if that's okay? Let's take about an hour lunch break and we will reconvene at 1:15. So with that, thank you so much.

And then when we come back from lunch, we will be talking about photovoltaics and energy storage, and go into a question and answer session. Thank you. Thank you.

(Off the record at 12:18 p.m.)

(On the record at 1:15 p.m.)

MR. BOZORGCHAMI: So good afternoon, everyone. My name is Payam Bozorgchami. We're back again after lunch. And we're going to be talking about battery and energy storage this afternoon.

Muhammad Faisal -- Muhammad Saeed is going to -- our Senior Electrical Engineer within the Building Standards Branch is going to be talking about PVs and energy storage, so --

MR. SAEED: Good afternoon, everyone. Everyone

can hear me; right? Okay. Good afternoon, everyone. I hope you are doing great. This is Muhammad Faisal Saeed. I'm a Senior Electrical Engineer from Building Standards Branch. Today, we are going to talk about the proposed PV and energy storage changes in the 2025 Energy Code.

Okay, so today, we are going to touch upon the following topics. First one is the 2025 single-family PV requirements proposed changes. Then we will talk about the 2025 low-rise multi-family PV requirements proposed changes. After that, we will talk about nonresidential and high-rise multi-family PV requirements proposed changes. Then we will talk about some of the cost effectiveness updates that we did for all the work.

After that, we will touch upon the (indiscernible) requirements and what changes are we doing there. And there is also some kind of an informational section on energy storage capacity in practice. Then we have some minor updates in energy storage-ready requirements. And, at last, a very minor update in 2025 determinations.

One thing I would like to say, that we are going to stop for question and answers after every topic because there's a lot to cover in this PV plus storage, so we will start question and answer after each and every topic. Thank you.

So the first one is the 2025 single-family PV requirements proposed changes. The first update is about updating the equation for single-family PV requirements. We are going to update the equations based on the weather data and LSE metric. One thing we want to make sure is that the PV sizing requirement will be based on the mixed-fuel building, not the all-electric building. And by mixed-fuel building, we mean gas, space, water, heating, and cooktop slash laundry. Yeah, we don't want to base our requirements on the all-electric building because we don't want to incentivize the all-electric construction.

Okay, not much change, but the second one is, is that we are going to do an upper bound of the PV requirements. In the existing requirement, as you can see, where we had the PV system, we were saying that you can install the maximum PV system that can be installed in the solar access roof area. However, in this one, we are going to make some changes.

We are suggesting something that is quite aligned with nonresidential requirement. There will be a number which we are saying X for now because we are still doing the analysis and we are working on the calculations for now. That number will be multiplied by SERA (phonetic). Just like we have the requirements in the nonresidential, we have SERA times 14. We will have SERA times X, and that

X will be different for different sloped roofs. And the reason we are doing that is most of the time we have the sloped roof on the single-family, but in case we have a flat roof or a low-sloped roof, then we will have a smaller SERA times that number.

Okay, the third update is that we are going to make some changes here. In the performance approach, our standard design was based on the annual load of the mixed-fuel building as determined with the CBECC-Res simulations. In the nonresidential in 2022, we did not do the simulation. Our prescriptive requirements were based strictly on the prescriptive equation. We are going to align in single-family with that. So our standard design will be based on the prescriptive equation, which is described above. And the equations will still assume the mixed-fuel building.

Okay, as far as the self-utilization credit is concerned, it will still be available for 2025. However, we are going to make some adjustments based on the weather conditions and LSE values. For those who don't know, under 2022 Energy Code, self-utilization credit was given once a minimum of 5 kilowatt-hour battery is installed.

Okay, so any questions so far about the single-family proposed changes?

MR. BOZORGCHAMI: So, Muhammad, before we go into

the discussion, one thing that you said earlier was we don't want to incentivize electrification. I think you meant to say --

MR. SAEED: Yeah. Yeah.

MR. BOZORGCHAMI: -- we don't want to disincentivize.

MR. SAEED: Disincentivize, sorry, yeah.

MR. BOZORGCHAMI: Yes.

MR. SAEED: Yes. That's exactly what I meant.

MR. BOZORGCHAMI: Yeah.

So with that, I think we have one question from, in the Q&A, the question and answer portal from Gina Rodda. And we're getting raised hands here.

So let me start with Joe Cain with the raised hands, and we'll go back into the Q&A afterwards.

Go ahead, Joe, state your name and your affiliation.

MR. CAIN: Thank you, Joe Cain, C-A-I-N, Solar Energy Industries Association.

In the third row, if you change the standard design to equal the prescriptive equation, aren't you then giving zero credit to PV? And I guess that's one question.

And then my other question is, the PV system size requirement still assume a mixed-fuel building. I can understand your statement, too, that you don't want to

disincentivize an all-electric building. I do not feel that that disincentivizes an all-electric building. I feel that having the PV system size requirement consistent with the base requirement of heat pump just would be more consistent overall. We know where we're going with this.

And one of the concerns that I have heard from the public is that they see new buildings, new residences with PV on them, and they're asking me, why do I see only two or three PV panels on a new building, which seems undersized?

So I think as we move to all-electric, and we know that there's going to be greater loads but we still have these tiny PV systems on new buildings, we’re sort of heading -- that is not heading in the right direction. I think that making it consistent with the base case would be more appropriate.

So those are my questions.

MR. SAEED: So, thank you for your question.

So your first question was about my third row?

MR. CAIN: Yes.

MR. SAEED: I would like to say that when demonstrating compliance via the performance approach, the proposed design still allows for a lower proposed PV system for compliance where building total LSE is reduced as a result of efficiency design. The standard design will not

change, but efficiency designs are still accounted for. And remember, we have already implemented this approach in nonresidential and high-rise multifamily in 2022.

So basically, if you want to reduce your PV requirements, you can increase your efficiency compliance. And then, yeah, you can put a smaller proposed PV. However, your standard design PV will still remain the same as a prescriptive equation.

MR. CAIN: If I may respond to that real quickly? Joe Cain and SEIA.

I don't think the problem is wanting a smaller PV system than the already small system. I think the problem is trying to get new buildings to have a serviceable PV system that attempts to, you know, satisfy the loads.

So, for instance, I would ask the direct question, if I use a larger PV system, what compliance credit do I get for installing a larger than prescriptive minimum PV system? That's the question that goes with this.

MR. SAEED: So your total compliance will increase. However, without the battery, we do not, basically, decrease or allow you to, basically, use your PV compliance with efficiency measures; right? So this is what you can do.

And one thing I would like to mention here, that

this is the minimum PV requirement. You can always put more PV, as much as allowed by your utility. These are just the minimum standards; right?

And to answer your all-electric question here, and to answer your all-electric question here, even though you are right, that with all-electric, your PV requirements need to go high, however, as you know, with the NEM 3.0, if you are putting a lot of PV on that one, and then you are doing a lot of excessive exports, right, which, in turn will not be so much cost-effective.

However, like I said, that you are allowed to put as much PV as allowed by the utility, as long as it is more than the minimum PV mentioned in the compliance.

MR. CAIN: Okay. I'm sure we'll be talking more about that. Thank you.

MR. SAEED: Sure.

MR. BOZORGCHAMI: Sure.

MR. SAEED: Does someone have to add from the CEC?

MR. BOZORGCHAMI: Thanks, Joe.

So I'm going to -- we've got the next caller,

Misti, I'm going to allow you to speak, and go ahead and state your name and your affiliation, and please spell your last name for the record.

MS. BRUCERI: Misti, you have to unmute. There

you go.

MS. BRUCERI: Hi, Payam. I did not actually request to speak. I apologize. I pushed that accidentally. I apologize.

MR. BOZORGCHAMI: No worries. No worries. You're good. Thank you.

MS. BRUCERI: Sorry about that.

MR. BOZORGCHAMI: Thank you. Thank you.

So I don't see any other raised hands.

With that, I'm going to pass it on to Michael Shewmaker to review any questions in the question and answer portal.

MR. SHEWMAKER: Yeah. Thanks, Payam.

We got one question in the Q&A from Thomas Mertens at PG&E.

> "To what extent is the CEC working with the CPUC to understand whether the proposals put forth in the Green Access Programs proceeding at the CPUC satisfy requirements of the Title 24 Community Solar Alternative Compliance option?"

MR. TSAN: Okay, so we are definitely working with CPUC on the compliance with the Title 24 10-115 for Community Solar Program. However, we are -- and let me get your question again -- we are not aware of any green access programs. I think it is related to Community Solar Program

as well.

So we are working and we are doing the collaboration with CPUC so that the new Green Tariff Program or the new Community Solar Program will comply with our 10-115.

And, also, I think Bill Pennington will reply to that Community Solar question.

MR. PENNINGTON: So sorry. Could you repeat the question? I didn't hear all of it. Sorry. The commenter who asked the question?

MR. SHEWMAKER: Yeah.

MR. PENNINGTON: Go ahead.

MR. SHEWMAKER: So the comment was,

> "To what extent is the CEC working with the CPUC to understand whether the proposals put forth in the Green Access Programs proceeding at the CPUC satisfy requirements of the Title 24 Community Solar Alternative Compliance option?"

MR. PENNINGTON: So, yeah, as Muhammad said, we're having conversations with the CPUC staff and making them aware of all the requirements that we have, and, you know, responding to any questions that they have on that.

MR. BOZORGCHAMI: So for the record, that's Bill Pennington. He's the staff member --

MR. PENNINGTON: I'm sorry.

MR. BOZORGCHAMI: -- with the Energy Commission. Sorry about that. It's alright.

MR. PENNINGTON: I apologize.

MR. BOZORGCHAMI: Thank you, Bill.

So we have another, Mike?

MR. SHEWMAKER: Yeah. Our next question is from Luke Morton. "Can you give a sense of the watts per square foot factor depending on slope? How will those factors vary?"

MR. SAEED: Yes. Okay, so if you are aware of our 2022 nonresidential and high-rise multi-family requirements, those requirements say that, let's say if your roof space is limited and you get a very larger kilowatt DC requirement from the equation, then you have to look at your solar access roof area. In that one, we have the SERA times 14; right? And that SERA times 14 is based on, usually, the flat roof, or I should say technically the low-slope roof. In that low-slope, we assume like ten degree tilt, right, and the shading avoidance.

However, if your roof, like for single-family, like 99 percent of the time maybe, is a sloped roof, then you are putting your panels flat with the surface; right? In that case, as compared to the flat roof, you are covering more area of the solar access roof area, so your SERA times that number, that number will increase.

So, for example, right now we have SERA times 14 because of the flat roof, if you have a sloped roof, it should be -- and we are still working on the number -- it might be around SERA times 17 or 18.

The reason we are going to go -- we are doing those changes, because in the existing requirements, we had what I call the max fit, in which we are saying that just put the maximum PV you can put on the roof. When we say that, we are not kind of controlling the efficiencies as compared to when we are basing it on the solar access roof area times the number. Then we are setting some efficiency requirements in the background for the minimum bound, right, of the PV requirement.

Hope that answers the question.

MR. BOZORGCHAMI: So one second, Muhammad.

Luke Morton just raised his hand, so let me allow him to chime in and have a discussion on this.

MR. SAEED: Okay.

MR. BOZORGCHAMI: Go ahead, Luke.

MR. MORTON: Yes, this is just some --

MR. BOZORGCHAMI: Sorry, Luke. State your name and affiliation.

MR. MORTON: Yes. Luke Morton, M-O-R-T-O-N, with Morton Green Building. I'm also associated with CABEC, California Association of Building Energy Consultants.

Just some food for thought on this proposal is, I'm just wondering, it sounds like it might complicate the SERA analysis. I understand where it's coming from, but I'm wondering if maybe an easier proposal would be just to put limits on that zero calculation with respect to slope? Just because we see a large variety of slopes in some of our projects. You know, we can have, you know, some areas of flat roof. You know, I've seen projects with every 1-12, 2-12, and 3-12, and 4-12, and 6-12, and 8-12, and 12-12, and it just like, it complicates the analysis.

And I'm wondering if it would just be good enough to have some bounds on the watts per square foot from sort of more general categories? Given that most projects are done, it's more important for the (indiscernible) pathway, given that currently, at the moment, if we have a traditional vented attic, then we only have one option for a given attic, one input for the slope.

And so it would definitely add a bit of burden to the modeling effort to essentially model for every one of those slopes to get the SERA to calculate correctly to model 12 different attics, even though it's one single attic. And I don't know how much you're getting out of it, given that, essentially, what you're trying to do is account for the flat, you know, the sort of horizontal aperture of that PV system.

Anyway, maybe I'll leave it at that and leave my comments for later.

MR. BOZORGCHAMI: So, Luke, this is Payam. I'm going to ask if you could submit your comments in writing to us? Because these are some important topics that you brought up. And we need to really sit down and think about that.

MR. MORTON: Sure.

MR. BOZORGCHAMI: Or --

MR. MORTON: Yes. Will do. Thank you.

MR. BOZORGCHAMI: -- or we'll have a side discussion, because you brought up some good concerns.

MR. MORTON: Yeah. Thank you.

MR. BOZORGCHAMI: And thank you.

MR. SHEWMAKER: Okay. And next up, we have a comment from Nick Brown, and he says, "Agree. These four single-family PV proposals clean up some of the issues we've seen at Energy Code Ace."

Thank you, Nick.

MR. SAEED: Thank you, Nick.

MR. SHEWMAKER: And then the next two questions and comments that we have are actually for multifamily, so I don't know if we want to hold on to these until we reach the multifamily portion or if we want to address them now.

MR. BOZORGCHAMI: Ray, do you mind if we hold off

and maybe we can answer some of your questions through the presentation?

MR. SHEWMAKER: Great. Thank you, Ray.

And just received another comment from Joe Cain. He says,

"Regarding installed PV system size, it is becoming apparent that existing homes with PV retrofit might have about 10 or 12 PV panels. New homes in new subdivisions often have only about three to five PV panels installed. The problem is that the minimum prescriptive requirement is so small that home buyers often find themselves in the position of trying to add on to their PV system size to be more appropriate for their demand. The challenge is in trying to retrofit and add on to an almost new PV system with compatible components."

MR. SAEED: Okay. Thank you, Joe, for your question. I'm going to answer this in an engineering, you know, point of view.

Most of the single-family PV have these days, without naming the vendors, have the microinverter solutions. And those microinverter solutions are very easy to add on to the -- right? So I think the cost has significantly reduced ever since I think the microinverter solution has been implemented.

I understand that sometimes with optimizer and without any power electronics, the add-on might be a little bit expensive. But like I said, these are the minimum prescriptive requirements, and you can add as much as possible.

One more thing is that we have the kilowatt hour mentioned in our CBECC, and I think you can also get some of the similar data with EnergyPro as well. And once you do that, you can always find that this is the annual load, and what is your PV coming from the different solar assessment tools, and what is the maximum PV you can put. And you can always consult with a utility, that what is the maximum size I can put. And sometimes these days, utilities are allowing you to put an extra amount of PV because they are forcing the future EV cars (phonetic), as well.

I hope that answers your question.

MR. BOZORGCHAMI: Any more questions or comments regarding the single-family?

MR. SHEWMAKER: Nothing more online.

MR. BOZORGCHAMI: Alrighty. If not, let's move on to the multifamily. We've still got Ray's question, but we'll answer it as we go forward.

MR. SAEED: Okay. Alright.

So now we are on to the low-rise multifamily PV

requirement proposed changes. Okay, so just like in single-family, the first update is about updating the equation for single-family PV requirement. We are going to update the equation based on weather data and LSE metric. Once again, we want to make sure that our PV requirements still assume the mixed-fuel building.

Similarly, with the sloping requirements, we are going to have a SERA times X value, and there will be two X values based on the slope, same reasoning. You have seen low-rise multifamily with flat roof, as well as you must have seen low-rise multifamily with a steep slope. So we will have different requirements of lower bound based on the SERA times X.

And one thing, just for the practical purpose, I would like to mention that most of the time, the SERA times X, or this lower bound, only comes into play when you have a high-rise nonresidential building;, right? And most of the, you know, two or three stories, or maybe less, we don't get into this situation most of the time. So I think that will not be creating (phonetic) the issue. We already have the SERA times 14 in the nonresidential.

Okay, yes, the third one is also similar to the single-family, is that our performance PV sizing will be based on the prescriptive equation. And that equation still assumes the mixed-fuel building.

Okay, fourth one is also the same, the self-utilization credit. Efficiency LSE is straight up still allowed. And we are going to make a few changes in the self-utilization credit based on the underlying weather conditions and LSE values.

Now, the fifth one is a very significant one and I would like to put more time on that one, is a no virtual net-energy metering exception for low-rise multifamily.

Just to give you the background, in 2022, we introduced a non-VNEM exception. And what that exception is, basically, is that if you have a multi-tenant building, whether high-rise multifamily or a nonresidential multi-tenant building, and the utility does not offer the VNEM, then you don't have PV requirements. And as a result, the battery storage requirements.

We were considering to extend those requirements or extend that exception to low-rise multifamily. However, we are exploring a different pathway here. And we are exploring exception for small PV system sizes by dwelling to a unit (phonetic) for non-VNEM projects. So we are still discussing and analyzing some of the thresholds that will be analyzed. And we will also define VNEM here.

I know there will be some questions might be coming from this one, so I want to explain it first, that -- what we are trying to do. So suppose that you have

a non -- that you have a low-rise multifamily project and the utility does not offer VNEM. So what we are going to do is that we are going to apply that prescriptive equation, as you can see on the top, on every small dwelling unit. And we are going to say that right now, as you know, that threshold is 1.8 kilowatts for single-family and the low-rise multifamily, we are going to come up with a number that will be bigger than 1.8, let's say 2.2 for the sake of discussion. And we are going to say that if you get the answer above or equal to 2.2 kilowatt DC, then you are going to install the solar for that particular apartment unit or dwelling unit. If not, if your answer is coming out to be less than that, then that dwelling unit is exempt from PV.

One thing I did not mention here, and I think it will come up in someone's mind, we are not going to have energy storage requirements for low-rise multifamily.

Okay, thank you very much. Any questions?

MR. BOZORGCHAMI: So we have quite a few questions in the question and answer. Should we start with Ray's question, Michael, and have Javier respond, if possible?

MR. SHEWMAKER: Sure. Yeah, so Ray's question is,

"Working with the customer to complete the QUAC

(phonetic) analysis for an affordable multifamily project in the CBECC 2022 software and are running into issues. When SMUD SolarShares is accounted for in the energy models, the QUAC analysis is not accounting for any solar installed on the project. Is there a workaround so that we can account for the SMUD SolarShare PV system in the QAC analysis?"

MR. SAEED: I think we will have our software team get back to you.

MR. BOZORGCHAMI: No, actually, Javier is going to answer.

MR. TSAN: Okay, Javier can answer.

MR. PEREZ: Hey, Ray, thanks for the question. And, you know, this is part of that streamlining of affordable housing programs and the Energy Code and trying to make these things work a little more efficiently.

So appreciate the feedback. I've sent you an email, copied our electrical lead on the QUAC work, so please reply, and we'll work through it. Thanks a lot.

MR. SHEWMAKER: Thank you, Javier.

Next up, we have a question from Luke Morton. "If the SERA multiplier varies by slope, shouldn't it also vary by orientation? Orientation has a significant effect on LSE results, especially with steeper slopes."

MR. SAEED: Oh, okay. Yeah, that's a very good question.

So on the background of the 2022 SERA times 14, we had assumed a ten degree tilt; right? And we always assumed that it is going to be towards the south, 180 degree. However, I think the difference between 10 degree, 5 degree, 25, and 30 degree is not that significant. And we are going to go with a very conservative number here, that, for example, if you even go with a 5 degree, because the lower the tilt, you are going to stack up the PVs against each of them more closely and the more requirements you have. That is why we went with 10 degree, not with 30 degree or more; right?

So as a result, I think our results or the number that we came up with, probably by the next workshop, you can always model with different orientation and tilts to see that, whether these requirements penciled out with your roof requirements.

However, just for the information, in 2022, we assumed the 10 degree tilt and 180 degree orientation.

MR. BOZORGCHAMI: Thank you, Muhammad.

Gina Rodda, I'm going to ask you to raise your hand, and I'm going to unmute you. You have three questions there, or three comments, and I'd like to get a little bit more in-depth information from you. Go ahead,

Gina. Thank you.

MS. RODDA: Hello, this is Gina Rota from Gabel Energy. I didn't think all my comments through to put them all in one thing, so I'm so sorry about that, Payam.

So I thought I heard briefly that there aren't any issues with SERA for low-rise multifamily, which is not true, especially in the urban areas. We have a lot of infill projects. We don't have enough roof area for the mechanical equipment for all this other stuff. And currently, right now, we have to model a fake PV system to show that PV kW, it's just a mess.

So we really do need the SERA times a watts per square foot option, just like you are now going to support for single-family and is already supported for high-rise multifamily. It will really help simplify things and help support those project types.

The cost associated with putting in a PV system per dwelling unit, oh my gosh. And then I'm also concerned about, I have a building that has ten different dwelling unit types. And I have to do this per dwelling unit type, and I only have one or two dwelling units on the first floor and one's on the third floor, and how am I going to make sure that PV system is serving those two dwelling units that are over this exception? Thank you very much for really thinking hard about what that KW exception needs

to be for multifamily.

I have such concerns about the enforceability and designability of this VNEM option that you guys are proposing.

Thank you.

MR. SAEED: Okay, so first comment, Gina, thank you for the endorsement. I will say, yes, that is the reason and the thinking behind the SERA times X watt per square foot. And yeah, once we come up with number, we will be looking forward towards others' comments and your comments as well.

As far as the non-VNEM exception is concerned, we have thought very thorough about it. And that number that we are going to come up, I think it will be mostly for, I'm just making a number here, but mostly it will be around 1,200 square feet or above apartment. And we have done analysis with very, very strict, you know, POUs. And we have seen that once you have a very bigger apartment, the numbers pencil out.

I will make a reference as well. I don't know how much people are paying attention towards our docket BSTD-04 with all the activity going on. We have a particular, you know, exception we are working on right now with Benjamin Apartments. And what we have seen is that once your apartment's size increase, even with -- I agree,

that the costs increase significantly. And I have seen costs ranging from $7.00 to $9.00 per watt. Even with that cost, once your apartment is very big, the cost effectiveness pencil out.

I don't know why I am getting the echo here. Anyways, okay.

And having to apply this for each dwelling unit configuration is going to be difficult.

So usually, you are right, there may be some projects in which the dwelling unit size is not consistent. And in that case, I agree that you will have to do it for different types of sizes. But that's the best workaround we can do. Because the thing is that if we apply that non-VNEM exception to all of the low-rise multifamily, we are going to lose a lot on the solar. And we will not be able to meet our greenhouse gas reduction and all the other goals if we just apply that non-VNEM exception to all the low-rise multifamily.

So we have chosen a central path that we just raised the bar of the cost effectiveness for the dwelling units. But for those apartment units which are still coming out to be cost effective, we don't apply that exception.

Hope that answers your question.

MR. BOZORGCHAMI: Thank you, Muhammad.

We have a question from Jimmy Benjamin. "Are there any proposed changes to PV requirements for existing multifamily buildings?"

MR. SAEED: No. I think you are talking about the PV. Yes. No, we are not going to apply any PV requirements to additional alteration.

MR. SHEWMAKER: Thanks, Muhammad.

Next up, we have a question from Nick Brown. And he's asking, "How much of the state has no VNEM?"

MR. SAEED: Okay, so I will -- I mean, I will have to look at my numbers, but I think around 60 percent of the population is under the IOUs. The numbers may be off a little bit. And the rest of the state has POUs. And most, not all, POUs don't offer VNEM. So we can say that on the, roughly, 30 percent to 40 percent of the population has no VNEM. SMUD does not offer VNEM for retail rate. SMUD does offer for the low-income multifamily. Roseville doesn't have that, Turlock, Lodi. And there may be others in the South as well.

So yeah, we are looking at the 40 percent. And if we apply -- and I understand the background of the question -- and if we apply that non-VNEM exception, we are going to lose around 30 percent to 40 percent of the state. And low-rise multifamily is, you know, is one of the major building prototype out there.

MR. SHEWMAKER: Thanks.

MR. BOZORGCHAMI: Thank you, Muhammad.

MR. SHEWMAKER: Thanks, Muhammad.

And then there is a comment from Nick Brown, saying,

"Perhaps make the PV exception for no VNEM based on square footage of the multifamily units. Currently, the 1.8 kilowatt exception for small single-family homes means a different square footage single-family home by climate zone, very confusing and hard to explain to clients."

MR. SAEED: Yeah, that's one. Yeah, that is a good suggestion. Yeah, we can definitely look into that one in which we don't look at the kilowatt DC, but the square footage. So, yeah, you can submit that suggestion. And we can definitely take a hard look into this one. Thank you.

MR. BOZORGCHAMI: Thank you, everyone.

Thank you, Michael.

I do have one more raised hand for Laura.

Laura, go ahead and state your name and affiliation and --

MS. PETRILLO-GROH: Hi. Tis is Laura Petrillo-Groh with AHRI.

This question really relates to residential

properties. Would you mind if I asked it now if I'm the last person?

MR. SAEED: Sure.

MS. PETRILLO-GROH: Thank you so much. And it also may be premature because we haven't seen proposed language for the heat pump baselines or for the solar changes, but I was wondering if you all had -- there are some requirements that are in the 2022 edition for domestic hot water heating systems, and one of those provisions allows for a solar water heating system with electric backup.

I was wondering if that, you know, if the expanded PV requirements took into account perhaps the roof space that would be allocated to one of these, you know, any of these options that would involve roof space?

MR. BOZORGCHAMI: Sure.

MS. PETRILLO-GROH: And if not -- so sorry. Go ahead, please.

MR. BOZORGCHAMI: No, no, I said, "Sure." I'm just saying, sorry I interrupted, Laura.

MS. PETRILLO-GROH: Oh, okay. So, yeah, that was my question, because I also know that some of the options that were proposed earlier today for mixed-fuel buildings involve battery systems. So I just was trying to get a handle on how, you know, these different measures interact

with each other since I also heard that additional solar requires a battery.

MR. BOZORGCHAMI: Okay. So, Laura, I'm going to have either --

MS. PETRILLO-GROH: Um-hmm.

MR. BOZORGCHAMI: -- I'm going to have either Javier or Danny Tam answer that question.

MR. PEREZ: Thanks, Payam. This is Javier, Energy Commission.

Yeah, I mean, what we were proposing were options, not requirements, so there's different pathways here. This certainly wasn't something that is part of a requirement.

And, Laura, I want to make sure I understand your question, and hopefully that I've answered it. So I'll give you a chance to reply here if you have more questions or want to elaborate a little further.

MS. PETRILLO-GROH: No, it was really having to do with, you know, the roof space that would be involved with a solar water heating system --

MR. PEREZ: Yeah. Um-hmm.

MS. PETRILLO-GROH: -- under 150.1(c)(8), and then those three options underneath it, (A), (B), and (C), those are the three. You know, it's got to meet those requirements, one of those, in the current Code. So if

those options are persisting in the 2025 edition, I'm just interested to understand if that, you know, that roof space that would be needed for the solar water heating system was accounted for in the PV calculations.

MR. TAM: Hi. This is Danny Tam.

So we did not because that's really, you know, a prescriptive alternative. It's not a requirement that people install a solar water heating system, it's just an option.

I would point out that that system probably would require pretty small solar thermal pipes, require one or two panels, so most likely will not become an issue for roof space. But if it is, then they can choose the other, you know, option that's available, or just do performance.

MR. BOZORGCHAMI: So prescriptively, there's multiple paths, Danny, and then if not, then some of them can go performance --

MR. TAM: Correct.

MR. BOZORGCHAMI: -- if I'm understanding what you're saying? Sorry. Okay.

MS. PETRILLO-GROH: Thank you.

MR. BOZORGCHAMI: Thank you. Thank you.

Any other comments or questions? I don't see any more raised hands, so I think we could move on into the nonresidential.

MR. SAEED: Alright. Oh, sorry. Sorry. Okay.

Okay, so we are onto the nonresidential. And this first one is the most important and the major project that we are undertaking right now. And, unfortunately, we don't have the complete details yet. We are going to wait for the next workshop for what changes, if there are some changes we are going to do or not. So if successful, this change is going to be the hallmark of the PV-plus-battery requirements for the 2025 Code cycle.

As you know, the 2022 requirements included PV-plus-energy storage for certain nonresidential buildings and high-rise multi-family. These requirements are based currently on the building type. However, if you look at the list of the buildings, there were certain buildings that are not part of it. I think I can think of maybe gymnasium, you know? This approach is quite like what we have.

So what we are going to do is we are going to explore a new approach, and we are still exploring that, and this approach will be quite like what we have in the lighting, in which every space will have a certain watt per square feet requirements for PV. And similarly, we will have certain requirements for battery as well.

We have, as a result, PV and battery requirements will expand into all nonresidential buildings. And just

like 2022, the PV sizing will still be based on limiting the exports to 20 percent and using battery storage to further limit the exports to 10 percent. So this is one of the major projects which we are working right now.

Okay, just like the second one is that just like we will have different SERA times X for different slopes, we are going to introduce that in the high-rise multifamily. Currently, we just have the SERA times 14, as our assumption was that most of the nonresidential and high-rise multifamily buildings will have low steep or flat roof. However, if there are some high-rise multifamily buildings or nonresidential buildings that don't have the flat roof, we will provide the separate number. Sorry.

Any questions on this one?

MR. BOZORGCHAMI: So we have -- Gina Rodda has one question, one raised hand.

So I'm going to just unmute you, Gina, and go ahead and state your name and affiliation. Thank you.

MS. RODDA: Hello. This is Gina Rodda, Gabel Energy. I'm sure it's going to shock you guys that you have a comment about this.

When we tried to align -- well, we didn't align -- ventilation space types within lighting space types, because these are two different groups that never speak to each other, don't know each other, and we align

and we develop Code, and we assign, okay, what are the requirements for each of these space types? But then when it comes to applying it and enforcing it, in which all of a sudden, is it a bathroom, is it a restroom, you know, it becomes such a challenge. And now you're going to add a third layer associated with PV.

Now, I get it, that trying to determine this at the building level has been a challenge, and we still have outstanding questions with you guys on how we are supposed to be applying this at the building level and what are those definitions. I just have concerns about the complexity of this and how it layers and maybe even conflicts with how we name spaces for other parts of the Code.

Thank you.

MR. SAEED: So, yeah, Gina, thank you for your comment and, like I said, that we are still working on it. And we don't know whether we are going to move forward with this approach or not but we are analyzing quite heavily and we have spent a lot of time on this approach. And once that approach will be finalized, hopefully by next workshop, then we will see how does that look like.

But, yeah, you are right that it will be -- it will have some challenges. However, the intended effects are quite great. Right now, there are some few

nonresidential buildings in the new construction that don't satisfy any of those building types that we have. Once we have this approach, then we are going to -- we are not going to spare any nonresidential buildings out there; right? So that is one major, you know, good thing that can come out of it.

But, yeah, you are right. We are analyzing some of the problems internally, and we will see how does that play out.

MR. BOZORGCHAMI: Eric Shadd, do you want to add more to that?

MR. SHADD: Yeah, I would like to add to that. Eric, Shadd, NORESCO, consultant to CEC.

So Gina, yeah, I've been talking -- I've had meetings with Sally and with that team, and we are trying to align exactly with the lighting space types. So it would be the same space types that are used for lighting. It would be the same space types that are used for the PV requirement, PV and battery requirement.

And then I saw another comment up here that was about hospitals. Yeah, we're talking about that right now. And there may be an exception for hospitals.

MR. BOZORGCHAMI: Eric, but the work on hospital is still iffy; right? We're still working on it, and we're trying to figure out if we got the bandwidth to tackle

that; am I mistaken there?

MR. SHADD: That's, not for PV. Not for PV, Payam.

MR. BOZORGCHAMI: Okay.

MR. SHADD: But what's in discussion is whether it makes sense to do it for hospitals or not. And so, yeah, we're all talking about it.

MR. BOZORGCHAMI: Yeah.

And I think what Eric, everyone, what Eric was alluding to was the comment in the question and answer portal from Ina Dolosava (phonetic). I'm sorry about that.

"Would PV requirements will be extended to hospitals? How do you see space type versus building types for medical offices?"

And I think Eric was trying to allude to that question also. Thank you.

I'm going to jump back over here to Ted Tiffany. I'm going to unmute you and go ahead and just state your name and affiliation, please.

MR. TIFFANY: Yeah. Thanks, Payam. Ted Tiffany, T-I-F-F-A-N-Y, Building Decarbonization Coalition.

In wholehearted agreement with Gina, you know, obviously.

But just want to throw one more thing to consider in there is old shell and worn shell that don't have space

defined, as well as a defined building. And then split submittals. If you're going to have a split submittal with a lighting designer submitting separate from mechanical zoning and envelope, those are going to tell you two very different things in terms of the space counts. And even having two different energy consultants model that building the way they break out space types and what they classify space is going to be a nightmare for you on this.

So I'd consider those two things in this consideration, breaking it down by space type.

MR. BOZORGCHAMI: Thank you, Ted.

MR. SAEED: Yeah, thank you, Ted. And definitely --

MR. BOZORGCHAMI: We'll take it into consideration.

MR. SAEED: Okay. Yeah. Yeah.

MR. BOZORGCHAMI: We're going to take that all into consideration and review and see what we can do.

I noticed, Gina, you had your hand raised. I'm going to unmute you and go ahead and maybe -- oh, sorry. Maybe, if you raise your hand, I'll unmute you again.

Ray? Oh, here we go.

MR. SHEWMAKER: Yeah, so there's a question from Ray in the chat. "Any changes regarding SERA exempted excluded roof areas?"

MR. SAEED: Ray, can you elaborate this one? I don't know if you are talking about that executive director approval for SERA exclusion based on some other Building Codes or not. Can you just speak to your question, maybe, you know, because what kind of SERA? Yes, yes, exactly.

So, yeah, we have occupied roof decks already. On top of that, I think we have the regulatory advisory either published or will be published soon, in which we are saying that if there is a state code, state building code, then the SERA gets reduced automatically. However, if there is a local building code that conflicts with SERA, then that local building will have to apply to CEC. And we are going to see how that building code reduces the SERA, and it has to go through the executive director approval.

Does that answer your question? Thank you.

MR. BOZORGCHAMI: Thank you, Ray.

Thank you, Muhammad.

Gina, let's try one more time. Go ahead. I apologize for that.

MS. RODDA: Gina Rodda, Gabel Energy. So I want to build a little bit on what Ted said. And, Ted, I think about tenant improvement spaces. Thank you for bringing that up. But when we do lighting, we don't always have a space type that aligns with the space types we see in the lighting category tables. So we take the one that most

closely represents what's happening in the area and the intent, and we make our best guess.

Now, if we have to make that best guess thinking lighting, but then we might be going, oh, but how does that affect PV, and if PV becomes the precedent of why you're going to call it one space type over another and how that affects lighting, so just tread carefully, please.

And I'd be happy to help support what you guys are doing and make sure that it's enforceable.

MR. BOZORGCHAMI: Thank you, Gina. That's good information, so we'll look into it.

MR. SHEWMAKER: And, Payam, it looks like we have another raised hand here.

MR. CAIN: Thank you. Joe Cain with SEIA.

I do think this is a very interesting discussion and valuable discussion on modifying the calculation by space type. And I think that, you know, one thing that we've seen, of course, California started a PV requirement. I work on the IECC, which is just introducing a commercial and nonresidential PV requirement, and that is modeled after ASHRAE 90.1. So we have other things happening in other parts of the nation outside of California.

Those things are very simplified. ASHRAE started with a tiny 0.25 watts per square foot of three largest floors. Someone who works on ASHRAE might correct me if

I'm misstating, but I believe that's changed from 0.25 to 0.5 watts per square foot of three largest floors. That is still a very, very small system as part of the prescription minimum. The IECC, I believe it was a proposal from the Department of Energy as developed by Pacific Northwest National Laboratory. I think it took a similar approach but bumped it up to 0.75. I think we can do better.

And I think that this minimum PV system sized by space type, I hear Gina's concerns, I understand that it is more complex. California has not hesitated before to be a leader and show that thought leadership.

And I think that in terms of breaking it down by space type, I think we have to remember that even though, yes, we do that for lighting, we do that for other purposes, that we are now beyond the regulated loads when you're talking about demands for electricity that, you know, could be supplied by PV. So now there could be some space that has a concentrated plug load or some other load that is not part of the traditional regulated loads that some of our energy consultants think about on a daily basis.

So I think it's worth exploring. I'm glad to hear that you're exploring it. I think it's worth development. And I think it's worth considering with an open mind from multiple stakeholder perspectives. So I'm

glad. Thank you for doing this. And we don't know if it's going to stick, but I think it's worth exploring. Thank you very much for doing it.

Thank you.

MR. SHEWMAKER: Thank you, Joe.

Looks like we have another raised hand from Carol Roberts. Sorry, Carol, give me one second. There we go. You should be able to unmute now.

MR. ROBERTS: There we go. Apologies, I'm just dialing in late.

I do have a question on VNEM. And I don't know if there was an answer to how much of the state does not have VNEM. Was there anything, was there a comment on that, or is it something to get back to?

MR. SAEED: I'm sorry, Carol, is your question how much of the state does not have VNEM?

MR. ROBERTS: Yeah, so apologies. I didn't get in here right after lunch and I've missed the part I really wanted to hear.

MR. SAEED: Oh, okay.

MR. ROBERTS: So there's a question in the chat, it says, "How much of the -- do we know how much of the state does not have VNEM?" Was there an answer given to that question?

MR. SAEED: No, I just gave rough --

MR. ROBERTS: Oh.

MR. SAEED: -- figures, that almost 60 percent of the population is under IOU that have -- by CPUC have to have VNEM and there are -- and the rest are POUs, and some of -- and very few of those have VNEM. So, I mean, the guesswork is, around 35 percent to 40 percent of the state population, you can say, might not have the VNEM.

So the point I was making, that if we extend the non-VNEM exception to low-rise multifamily, then it will be a huge loss of PV.

MR. ROBERTS: So I have a comment to that last statement that I want to double-check with you.

MR. SAEED: Okay.

MR. ROBERTS: Regarding VNEM and availability, I have gone round and round with Los Angeles. They have a pilot VNEM program. And there's no way to understand whether or not that qualifies as VNEM because you have to qualify under their pilot.

So my first answer would be, no, it would not be considered VNEM is available because it's not available to all project types or multifamily projects.

MR. SAEED: Um-hmm.

MR. ROBERTS: Have you had any back and forth with other folks trying to understand whether, you know, --

MR. BOZORGCHAMI: So on this --

MR. ROBERTS: -- LADBS? Yeah?

MR. BOZORGCHAMI: So this is Payam.

I think on this one, we're going to have to do some research and look at some more details. And I think we're going to have to communicate with you a little bit more, if that's possible, offline --

MR. ROBERTS: Um-hmm.

MR. BOZORGCHAMI: -- to get a better feel. I don't think we have the right answer right now if we needed an answer.

MR. ROBERTS: Okay.

MR. BOZORGCHAMI: Yeah.

MR. ROBERTS: And then in the areas where ballparking narrowed it down to about 35 percent to 40 percent of the state that is not in a VNEM territory, I mean, are we clear on what those jurisdictions are? That's L.A., Anaheim, I think it's even Long Beach, I mean, it's Riverside. I mean, these are not small areas.

MR. SAEED: I am more familiar with my area. So SMUD does not have VNEM for regular multifamily projects. They have VNEM for qualified low-income projects.

MR. ROBERTS: Right.

MR. SAEED: Roseville is also not small, not big, but it's a very growing area. They don't have VNEM. Turlock and Lodi in the valley also don't have VNEM. And I

think majority, I think the majority of the POUs don't have VNEM. I think the only VNEM kind of a program that I know from a POU is the Silicon Valley Power that I have recently known that they have something similar to VNEM.

MR. ROBERTS: IID has put one out there --

MR. SAEED: Okay.

MR. ROBERTS: -- down here. I love that you all are in Northern California but, you know, Southern California has a whole lot of large jurisdictions that are not --

MR. BOZORGCHAMI: Yeah.

MR. ROBERTS: -- do not have VNEM.

MR. SAEED: Correct.

MR. BOZORGCHAMI: Yeah, that's fair. And I think we might need to get a list from you, if possible --

MR. SAEED: Yeah.

MR. BOZORGCHAMI: -- for Southern California and get familiar with this a little bit more further.

MR. ROBERTS: I mean, nothing in L.A. --

MR. BOZORGCHAMI: Sure.

MR. ROBERTS: -- has VNEM. I mean, that's a huge area --

MR. SAEED: Yeah.

MR. ROBERTS: -- that is not putting solar on --

MR. SAEED: Um-hmm.

MR. BOZORGCHAMI: Okay.

MR. ROBERTS: -- which is kind of good for some. You know, some see it's good, and some see it as bad. But --

MR. SAEED: Um-hmm.

MR. BOZORGCHAMI: Sure. Sure. Okay.

MR. ROBERTS: -- yeah, it's pretty widespread. Okay.

MR. BOZORGCHAMI: Thank you. Thank you.

I don't see any more raised hands or any comments in the question and answer portal, so I think we can move on.

MR. SAEED: Alright. So as far as the PV and battery storage is concerned, we are not going to go into the numbers, the tables here. However, I'm going to basically talk about what are the difference in the cost effectiveness assumption that we are assuming for our analysis that we are working on so far.

So in the previous cost effectiveness -- and let me put find my laser here. Okay, so in the previous cost effectiveness assumption, we were using a different accounting method, the TDV values, time-dependent valuation. We have just introduced the 2025 LSE, so these are the first major changes that we are using LSEs to study the cost effectiveness.

One thing that happened is that our export compensation before were based on NEM 2.0, which was the retail rate minus net surplus charges. However, if you look at our 2019 and 2022 PV reports, or PV-plus-battery reports for 2022, we had mentioned that we had studied what will be the effect if the exports are compensated at avoided costs.

So as a result, in 2025, now NEM 3.0 is a reality on net billing tariff, I should say. We are going to compensate our exports based on the avoided costs determined based on LSEs. So these are not the actual bills, but these are the avoided costs based on LSEs. So LSEs have different components, and some of the components, like retail rate and emission abatements, we kind of basically subtract from the whole LSE values, and then we get the export compensation based on the avoided costs.

The other big factor is that now we are assuming 30 percent tax credit. For 2019 PV requirements, we had zero percent tax credit. However, for 2022, we were assuming ten percent tax credit for PV as well as for battery storage. But now, after President Biden signed the IRA, we are going to assume 30 percent LSEs.

And I think there might be some questions, so I will clarify that it is -- this 30 percent ITC will only go into the first cost. The maintenance and replacement will

not have that tax credit as the existing tax credit is going to sunshine in 2032, if I'm not mistaken.

Similarly, we have updated our cost data sources. In 2019, it was 2016 annual data, and we are going to use 2022 annual data. So I don't have any table and numbers, but just some major assumptions right there.

MR. BOZORGCHAMI: Thank you, Muhammad.

We have one question in the question and answer portal, Michael?

MR. SHEWMAKER: Yeah, we've got a question from Luke Morton.

> "Has ACC/LSE calculations been posted? I think many would like to review those in detail to help with alignment of compliance and on-bill cost effectiveness."

MR. SHEWMAKER: Javier, would you like to answer?

MR. BOZORGCHAMI: So I believe in the 2025 portal on our website, there is a version of the 2025 CBECC software that has LSE and that is available for download. And it's not the final version, but it's a version that can be utilized at currently.

That was the only question in question and answer.

Anybody wants to raise their hand and ask any further questions?

MR. PEREZ: Really, really quickly, Payam, I wanted to expand on that. Give me one second. Yeah. So our software is actually currently being updated to reflect some of the recent updates to the 2025 research version software.

So, Luke, you know, we're working feverishly to try and get that software ready ASAP. You know, we got a version from our contractors, I believe yesterday, and we're still kicking the tires, trying to make sure that all the runs are performing as expected, so stay tuned. I think probably in the next week, I don't think we'll get it done by tomorrow, but certainly in the next week or two, we'll have software available for you to simulate with adjusted values, so stay tuned. Thanks for the question, Luke.

MR. BOZORGCHAMI: Thank you, Javier.

We have one raised hand from Carlos Roberts. Go ahead and state your name and affiliation, please.

MR. ROBERTS: Hi. Carol Roberts, G.R.E.G Consulting.

MR. BOZORGCHAMI: Oh, I'm sorry. I'm sorry.

MR. ROBERTS: That's okay. Again, a question regarding your federal tax credit at 30 percent, is there something that has -- do you have to prove that 100 percent of projects have access to this tax credit and are getting

30 percent? What is, you know, what is your guidelines around using that as a credit in your analysis yet? Is it available to 100 percent of the projects?

MR. BOZORGCHAMI: And is Bill Pennington on? Can you answer that question, Bill?

MR. PENNINGTON: You can't see me, can you? Can you hear me now?

MR. PEREZ: Yes, Bill.

MR. PENNINGTON: I'm not sure why I can't get my camera to go.

So, yeah, our understanding is that the vast majority of projects are eligible. And so if you have any comment to the contrary about that, you know, maybe we could get that offline from you.

There also would be potential to address this through a 10-109(k) process, which allows us to look at, you know, cost effectiveness for individual projects.

If there's some systematic difference that we should be taking into account, it'd be good to get information from you about that.

MR. ROBERTS: I'm just curious on, number one, on the process.

Number two, as an energy consulting firm our tax credit work is really 45L, which is a completely different item. And we rely on the installing contractors and

designers in the solar, battery, and PV industry to manage and let everyone know, number one, that this 30 percent is available to them, their tax credits, but it does not seem like -- I'm concerned that something that not everyone knows about, perhaps, or not everyone is eligible for. Thirty percent is a large number for you to use in your cost effective calc. And if only half the building population has it available, I think we should understand that before we use the whole amount there.

MR. SAEED: Yeah.

MR. BOZORGCHAMI: Go ahead.

MR. SAEED: Yeah, thank you, Carol, for your comments. Yeah, definitely, if you have some information that certain buildings are not eligible for a tax credit, and if you have some strong evidence, then yeah, definitely, we will consider that once you give that to us and we can update our cost effectiveness accordingly.

MR. ROBERTS: Do you have any evidence of the fact that all buildings are eligible?

MR. SAEED: So, yeah, I mean --

MR. ROBERTS: Can you put this number out there? Yeah.

MR. SAEED: Yeah. So in 2022, when we did our analysis and we included the ten percent tax credit for PV and battery, I think we had mentioned there that all

buildings qualify for that. There might be some issues with the nonprofit, you know, that are not eligible. However, there are some other ways in which IRA has some guidelines that how can you basically qualify and get those tax credits.

MR. ROBERTS: Are you speaking to the PV battery tax credits?

MR. SAEED: Yes.

MR. ROBERTS: Because I know nonprofits struggle also with the 45L. So again, you've taken out, what, 30 percent, 40 percent of the building stock that's permitting and building today by not -- you know, that can't take advantage of this. That's where I feel there's probably a large hole. If you're using this number to create a ruling around what this software is going to do and if it's affordable or not --

MR. SAEED: Yeah. Yeah.

MR. ROBERTS: -- I think it maybe needs to be adjusted a little.

MR. SAEED: Yeah. Yeah, I would definitely agree that if 30 percent is not available to a whole group of buildings, then we should consider it. So, yeah, I mean --

MR. ROBERTS: Yeah.

MR. SAEED: -- if you have any kind of information on this one, send us properly and we will

definitely look into it.

MR. ROBERTS: Okay. Thanks.

MR. BOZORGCHAMI: Thank you, Carol. And I apologize. I get my new glasses next week. Apologize.

MR. ROBERTS: That's okay.

MR. SHEWMAKER: Payam, do you want to continue with the question and answer?

MR. BOZORGCHAMI: Yeah.

Bronte, you have your hand raised. Go ahead and state your name and affiliation, please.

MS. PAYNE: Hi, Bronte Payne with SunPower. It's B-R-O-N-T-E, and then P-A-Y-N-E.

I just want to respond to Carol's question on the IRA. There's not a restriction on the types of buildings that can take the solar investment tax credit for battery and storage.

And then one thing that was very helpful is that in the IRA, they actually expanded who's able to access it through things like direct pay and eligibility, which will make it easier for things like nonprofits who have struggled in the past to access it.

MR. SAEED: Thank you, Bronte, for the comment.

MR. BOZORGCHAMI: Thank you, Bronte.

And, Carol, I unmuted you so you could respond.

MR. ROBERTS: Sorry. Thanks, Bronte. I'd like

to reach out to you to see how we can spread the word, because I don't think that's happening at the solar design and contract level, so great.

MR. BOZORGCHAMI: Okay. Thank you.

Mike, I have no more raised hands at this time.

MR. SHEWMAKER: Okay. We've got a question online from Joe Cain.

"Could you please review LSE as compared to TDV and whether there will be any impact specific to PV in the new metric?"

MR. SAEED: Yes. Javier, do you want to take this one first? And then I will add to it.

MR. PEREZ: Yeah, I mean, the underlying math is the same, you know, it's just we're converting energy to dollars, and long-term system costs dollars. So, I mean, you know, we had an analysis last year that kind of spanned over six months that included updates to weather files, you know, ensuring that our weather data, underlying weather data that simulates buildings in different climate zones is, you know, as current as we can be.

We then simulated the electric -- or the grid, whether it's gas or electricity, and then put that long-term goals, whether they're Renewable Portfolio Standard goals or, you know, a number of different state goals that we had that affect the grid in multiple ways and then

generated new multipliers.

So I mean, to answer your question, you know, the value of energy, depending on the time and depending on the day of the year, you know, yeah, it does shift as a result of new weather, and then different forecasts for the utility systems.

Now as far as impacts for PV in the new metric, yeah, I mean, if your energy consumption changes, then your generation will change accordingly; right? So I think Muhammad might have a slide on some other requirements.

But all that is to say, you know, that there's still a lot of work to be done, Joe. You know, this is a really, really complicated requirement. And we appreciate your questions and hope to have more thorough answers as we continue through this pre-rulemaking workshops for the next month and a half.

MR. SAEED: Yeah. I would just like to add one thing, that we are doing the export compensation in the LSE, as well, so, yeah.

MR. PEREZ: Yeah. And the last thing I'd add is that, you know, we have slides on the TDV and LSE changes docketed, presented in October of 2022. And they're on the same docket that any material is for this workshop and any subsequent workshops during this pre-rulemaking phase, so you can see some summaries there. And again, like Will

Vicent said earlier, you know, we'll have a report posted in the coming months that further clarifies the changes in LSE for the 2025 cycle.

Thanks. Thanks for the question.

MR. SHEWMAKER: Thank you, Javier.

And then we had a couple of comments from Ted Tiffany. I think he was chiming in to the conversation that Carol and Bronte were having. Ted states

> "Not for-profits, and cities/governments that don't have tax liabilities. They are traditionally going through PPAs."

And then we've got two questions from Anonymous. "30 to 40 percent of buildings owned by nonprofits?"

That was a question.

And then your other question was,

> "Shared savings programs where a private company owns the solar and leases it to the nonprofit entity, does this address the tax credit issue for nonprofits?"

MR. BOZORGCHAMI: So I'm going to stick my neck out here, this is Payam, and say that 30 to 40 percent of buildings owned by nonprofits, I don't know if that's true or not, and I don't know if we have data on that.

So if the person that's the anonymous attendee could provide that information to us, that'd be great.

So with that, I think, I don't see any more

raised hands or any more questions and answer.

MR. SAEED: Alright. So now, next we have the JA12 requirements. And before showing the slide, I would like to mention that this is still a work in progress, and we might change these requirements as we talk more with the public.

Before going over this slide, I want to let everyone know that we have been coordinating extensively with the energy storage industry for quite some time, especially to put more stringency around the control requirements.

So the first one minor change is the addition of the UL 1741, Supplement B. Right now our requirements have Supplement A and we are adding Supplement B. And these requirements are coming from after the recommendation coming from our Renewable Division.

The other change is just the clarification. Existing requirements have usable capacity for more than five kilowatt hour. However, we have found out that certain manufacturers have products available for less than five kilowatt hour. So we are going to allow smaller products as long as their combination adds up to more than five kilowatt hour.

The third change is work in progress. It is still ongoing and we are still in the analysis and research

phase. The existing requirements, as you can see, were similar for all energy storage types. And there were two times annual reset ten days before the TOU schedule. And we hadn't defined load shifting capacity very clearly.

Going forward, we are going to split our control strategies into two. One, we will have the single-family requirements in which we will basically try to see how can we limit the battery reserve level by doing an automatic reset after every 72 hours. This 30 percent maximum level of the reserve, this is -- we are still in talks with the energy storage manufacturers and we are going to update our method as we move along; right? And we are going to do the load shifting capacity clearly defined.

So before, what we were thinking is that we are going to allow the customer to decrease or increase their reserve level. However, we are not going to. What we will do is that if the customer has a reserve level in excess of 30 percent for more than 72 hours, we will put it back. We are still in talks with energy storage manufacturers and we are going to work on how to do the percentage or the absolute value of kilowatt hour that can be regulated.

The nonresidential and multifamily battery storage requirements are still a work in progress. And I will be honest that it is very complicated than the single-family. And we are going to do a lot of working in the

coming months on how to shape these requirements. We don't have anything to say about the nonresidential and multi-family requirements so far.

Any questions?

We have one from James Frey (phonetic) in the question and answer. I'll read it real quick. "Do you mean the UL 9540 A?"

MR. SAEED: I don't think so. I think it is 1741, Supplement B. I mean, if anyone can check quickly whether we have supplement A with 1741 from the Standards and correct me? But I think it is 1741.

MR. BOZORGCHAMI: So, James, we're going to have to get back to you on that one to confirm.

MR. SAEED: Yeah.

MR. BOZORGCHAMI: And we have one raised hand from Bronte.

Go ahead, Bronte, state your name and affiliation, please.

MS. PAYNE: Bronte Payne, SunPower.

I don't think this will be news to the CEC staff because you've heard me say this before, but wanted to share here. I think we're supportive of the direction that the JA12 requirements are going in with the 72-hour reset period. But we think it's really important that the battery credit be maintained at the level it is currently

for the next Code. And we think it will be appropriate given how customers are going to be using their batteries to cycle a lot under NEM 3.0.

So we're, you know, looking forward to continue working with the CEC on this proposal and maintaining a compliance credit so that there's a big incentive to continue to add batteries.

MR. BOZORGCHAMI: Thank you, Bronte.

MR. SAEED: Thank you.

MR. BOZORGCHAMI: We've got one -- we have two comments and a question in the question and answer box.

MR. SHEWMAKER: Yeah, we have --

MR. BOZORGCHAMI: Michael, would you be able to read those questions and answers?

MR. SHEWMAKER: Yeah, sure, Payam.

So we've got a comment, again, from James Frey, I think following up from his earlier comment. He says, "UL 954 A is a much safer version of the Standard."

And then there's a follow-up to that by Joe Cain, who said, "UL 954 A is a test protocol. UL 9540 is the primary standard for energy storage systems."

So thank you, James. Thank you, Joe.

MR. TAM: This is Danny Tam. I just want to add, UL 9540 is already required in the JA12.

MR. BOZORGCHAMI: It's the supplement that we

have to double-check; right, Danny?

MR. TAM: It's a separate UL, not the 9540. There's a new supplement. But the one that was in the chat, we already required, not the A. We should still check on it, but, yeah.

MR. BOZORGCHAMI: Thank you, Danny.

MR. SHEWMAKER: Thank you, Danny.

And we've got a question from Carol Roberts.

"Who at the state level tracks the number of affordable apartment units permitted annually and total number of apartment units permitted annually? My assumptions are skewed by my client base and building locations."

MR. BOZORGCHAMI: I'm going to say this is a discussion that we may have to have with HCD. They do a lot of work on the affordable housing, so that's where we start with. The HCD stand for Housing and Community Development.

MR. SHEWMAKER: Thank you, Payam.

And last comment is from Joe Cain. He's saying, "Plus one for comments by Bronte Payne of SunPower. Compliance credit for PV plus ESS is very important to moving forward."

Thank you, Joe.

And that is it in the online Q&A.

MR. BOZORGCHAMI: Thank you, Mikey.

We have Andy Schwartz. Go ahead. I'll unmute you and go ahead and state your name and affiliation, please.

MR. SCHWARTZ: Hey, good afternoon. Can you hear me okay?

MR. BOZORGCHAMI: Perfect.

MR. SCHWARTZ: Yeah, Andyrew Schwartz with Tesla. Yeah, I want to echo the comments of Bronte.

First, I really appreciate the CEC's engagement with the storage industry as you consider changes to the JA12 requirements. I think, you know, we certainly appreciate the, you know, balance the CEC is trying to strike here between ensuring that these systems are cycling and providing GHG benefits while also preserving customers flexibility to use these systems in the way that they deem necessary, in particular preserving their ability to use them for resiliency.

Similar, I think, also to what Bronte and a few others maybe have said, you know, I guess I am curious where the CEC is going to land on the issue of the credit impacts of the changes to other requirements, and just would urge the CEC to consider how the new realities under the net benefits tariff where customers will be strongly encouraged to cycle their systems out of their own economic

self-interest.

And then also recognizing that the data that you may have collected thus far, you know, on the amount of reserve capacity customers are sitting on is not in the context of these requirements. And so, you know, if you now have a control framework in place that's constantly reminding customers or really reverting their systems back to, you know, to a more acceptable level of backup reserve, I think it maybe changes the -- I would hope it would change the CEC's perspective on how much of a credit reduction needs to occur.

So, yeah, but I don't know, are we going to get into kind of the credit impacts today?

MR. SAEED: Yes. Yes.

MR. SCHWARTZ: Okay.

MR. BOZORGCHAMI: That’s in a couple of slides coming up here shortly, Andy.

MR. SCHWARTZ: Great. Awesome. Thank you.

MR. BOZORGCHAMI: Thank you for your comment. And we'll get with you and Bronte here shortly after and discuss this further.

MR. SAEED: Okay. Sorry. Okay.

So this slide is informational only. We want to share some research with the public here. And the reason that we started a forum and talks with energy storage

industry was to solve one particular issue that resurfaced. And the issue was that the battery storage for single-family is not being used 100 percent for load shifting. Rather, a significant portion of the battery storage is used as a reserve so the customer can use that during the PSPS and other unknown emergencies.

Now if you look at the graph, you will see, so these are the percentage of the customers and these are the cumulative backup reserve. What cumulative backup reserve means, for example, let's say 70 percent means that 70 percent or less of the reserve level; right? So this one is being added up continuously. It is accumulative.

So what we are seeing here is that almost more than 50 percent or 30 percent of the customers here are setting their reserve level almost less than 30 percent here. Now these, I think the industry will agree that this is the existing or a little bit older reality than NEM 3.0, but we still have to get the data on the new reality of NEM 3.0 in which we can make sure that the customers are setting their reserve level quite low here. As a result, we are going to make some changes in over some of the calculations here.

So sorry.

As a result of the research shown of the previous slide, we are considering making some assumptions here. We

are well aware that net billing tariff is going to change the way customers cycle their batteries. However, we need to see the evidence. Unfortunately, the net billing tariff is quite new and we don't have the data yet. However, as the time passes and we get the strong evidence that the customers are cycling their batteries aggressively under net billing tariff, we will revise our assumption. But for now, these assumptions look like that.

We are going to assume that 60 percent of the said capacity or the apparent capacity will be used for cycling and 40 percent in general will be used in reserve. So if someone does the self-utilization credit using ten kilowatt-hour battery storage, it will be modelled internally at six kilowatt-hour as being available for load shifting.

So these are some of the assumptions that we have used and I know we will have some questions on this one. No?

MR. BOZORGCHAMI: Okay. Any raised hands? Oh, we got one. Here we go.

Go ahead, Bronte. State your name and affiliation.

MS. PAYNE: Bronte Payne with SunPower.

I mean, I think similar to my last comment, but just to put our finer point on it, if you go back to that

graph, like Muhammad said, these are customers that are under an old net metering regime. So most of these people who are getting storage probably got it for the resiliency benefits as opposed to for the economic benefits of, you know, pairing it with their solar, like they will be under an NEM 3.0.

So, to Muhammad's point, we definitely think people are going to be cycling their batteries and have less of a reserve under an NEM 3.0. And, you know, we're excited to start seeing that data come in. And I think because of that, you know, we definitely feel like the 60 percent is too low for their credit level.

MR. SAEED: Thank you, Bronte, for your comment. Yes, and I think we have talked with industry before that, yeah, we have -- the time is not over yet and we have still six, seven months until we make the final, you know, assumption. So as soon as we get the fresh data out of net billing tariff, we will, you know, modify our requirements.

And like I said, the performance requirement, this 60 percent cycling and 40 percent cycling is not going to go into the regs. This is the software CBECC change, which we can do quite later as well. So as soon as we get the data that, hey, the batteries customer have the new construction, single-family homes are cycling their batteries quite aggressively, then we will modify our offer

assumptions. But without any data assumption, we cannot just base our numbers on the anecdotal evidence.

MR. BOZORGCHAMI: Thank you.

Andy, I'm going to unmute you. Go ahead and state your name and affiliation, please.

MR. SCHWARTZ: Yeah. Hey, Andrewy Schwartz with Tesla again.

Yeah, so at the risk of repeating myself, you know, the data that you're basing the diminution of the credit on, you know, to Bronte's point is based on kind of, you know, for systems that were deployed under a very different regime.

And then second, I guess it sort of assumes that the control scheme that you're proposing to establish where, you know, after 72 hours, customers would have their systems reverted back to a low level of backup reserve, and while they maintain the ability to set a backup to a higher level, I mean, it seems to assume that that will have no impact on customers behavior, which strikes me as a little odd as well.

So I guess just more food for thought as you think about how the credit will be impacted by this new approach.

MR. SAEED: Yeah. Thank you, Andrew. Yeah, definitely you are right that it will have some impact on

that one. But like I said that I think as we have talked with industry, that we're not going to put any hard cap on that one. So there may, I mean, there may be some customers who again, after 72 hours, increase their reserve level data.

So that's why we really want -- instead of, you know, looking at the anecdotal data, we have to look at the hard evidence coming from the vendors. And as soon as we get that in the next coming months, we will definitely update with this approach.

MR. SAEED: Thank you, Andy.

MR. BOZORGCHAMI: Thank you, Andy. Thank you, Muhammad.

Carol, I'm going to unmute you. Go ahead and state your name affiliation, please. Thank you.

MR. ROBERTS: Carol Roberts, G.R.E.G. Consulting.

I have a question, whether it's single-family or multifamily. I know multifamily 25 is still TBD. Is it possible that there could be a credit in the software for folks that implement the additional, you know, legwork it takes to have mode shaving capacity?

And the reason I'm asking is if just left to the energy modeling person and maybe the solar person that won the low bid, right, they're not putting a lot of thought into it. They're just saying, I needed a 10K battery to

meet Code and it was easier than more PV or whatever. They're not having a deeper conversation with clients saying, this is what it means. I mean, we like to think that people are planning this really well for their home or their multifamily apartment building, but in practice, they're really not. They're looking at a number, how do I meet code, how do I get out of this, what can I do?

And if there was a way to get some kind of a credit for doing a good job in sizing a battery or in the load shaving software that's required, because a lot of times these will go, you know, grid first and no one has the conversation about, well, what if I want it not to go grid first, what if I only want it to discharge from four to 9:00 p.m., would that be something that we might be able to see in software at least?

MR. BOZORGCHAMI: That's an interesting concept. I'm going to ask if you could --

MR. TAM: So --

MR. BOZORGCHAMI: Go ahead, Danny.

MR. TAM: Yeah, this is Danny.

So currently, JA12 does not allow battery discharge to the grid. It's supposed to first serve the building. So that's, you know, that's the basic assumption already.

MR. BOZORGCHAMI: Yeah. But, Carol, can you

submit your comment in writing to us? I think this is something --

MR. ROBERTS: Yes.

MR. BOZORGCHAMI: -- we need to look into a little bit more in depth.

MR. ROBERTS: I'm curious how it serves the building first, because when it's brought up in the field, it's all about where they place, you know, where it goes --

MR. BOZORGCHAMI: Sure.

MR. ROBERTS: -- before the bus or after the bus and all of that. I mean, and those aren't things that just happen naturally in the sales of the system to a homeowner --

MR. BOZORGCHAMI: Yeah.

MR. ROBERTS: -- or someone else.

MR. BOZORGCHAMI: Yeah, I think staff needs to think about this one a little bit. Yeah. Yeah, write to us answer submit written comments.

MR. ROBERTS: Okay.

MR. BOZORGCHAMI: And I hope, you know, maybe the manufacturer --

MR. ROBERTS: Yeah.

MR. BOZORGCHAMI: -- can help us. So when the manufacturer is certified to us as JA12 qualified, they're sort of finding the battery is supposed to meet the load of

the site first.

MR. ROBERTS: Okay, but we --

MR. BOZORGCHAMI: But, yeah, we'll look into it.

MR. ROBERTS: Yeah.

MR. BOZORGCHAMI: If you can write to us?

MR. ROBERTS: Alright. Thanks.

MR. BOZORGCHAMI: Thank you, Danny.

Thank you, Carol.

Bronte, I'm going to unmute you. Go ahead and state your name and affiliation.

MS. PAYNE: Bronte Payne, SunPower.

I was just going to, in response to Carol's question, I think for a single-family where batteries are behind the meter along with your PV, so it's simpler. I think some of the questions that you're bringing up are really related to some of the design in multifamily. And I think a really good thing to explore.

MR. BOZORGCHAMI: Thank you, Bronte.

We're going to hold off on the rest of the questions and answers right now until we get through the rest of the slides. I don't know how much more you have, Muhammad, but we got three more slides and it's -- or four more slides, and then we'll go through those real quick.

MR. SAEED: Alright. So 2025 energy storage-ready requirements, even though it looks like a minor

change, it's not. In 2002, we introduced energy storage-ready requirements for newly-constructed single-family, including the ADAs. However, we have gotten some pushbacks when it comes to applying these requirements for ADUs. As a result, we are introducing some exceptions for these requirement.

First, the practical implication is that if you have a new ADU and you have to install the new service because the energy storage requirement need you to have the 225 ampere bus per capacity and that will cause you to upgrade the service, you will not be required to do energy storage-ready requirements.

Second is if the building is not required to have the PV, you will be exempt from the battery storage-ready requirement.

We are going to go to the next slide and then we will ask the question at the end.

Community solar. The major, you know, proposal is in the building opt-out, we introduced in 2022 the building opt-out in which we allowed the individual buildings to opt-out, but not the dwelling units. In 2024, we are going to change or modify the language such that the multifamily dwelling units can opt-out, as well, in addition to the building. So if an apartment is a owned apartment, right, if someone owns an apartment out of 100,

the apartment owner can install the onsite PV without having to convince all the building to opt-out and install the solar.

So, I mean, there has to be a lot of practical conditions that have to be met between the owner and the association of the apartment -- building. But if they are satisfied, we are not in the hurdle and we are not stopping them to opt-out.

Location, located on a distributed system of the load-serving entity, we introduced this in 2022, we are going to clarify the distribution system requirements as having the interconnection voltage less than or equal to 100 kV.

And the third one is a very minor one in which we did not mention to include the public comment period in the executive director approval of revised application. We are going to clarify that a public comment period will be required.

So I will hurry up to the next one. I think this is the last one.

Yeah, so 2025 determination, here's another update we are proposing here. For those who don't know what cost-effectiveness determination, we have a regulation in Part 1, 10-109(k) in which we allow the CEC to determine that PV system requirement do not apply with cost-

effectiveness threshold where public agency rules cause cost-effectiveness analysis not to hold for that project. For example, if the tariff rates are so small that the PV does not make sense, or if there are first cost in hand, like a non-VNEM solution, you know, sometimes then the builder or a utility can apply for 10-109(k).

And we are making it a very small and minor here. Previously, if you were granted exception in the previous Code cycle, you had to apply and go through the whole process, which included the business meeting. We are proposing that if you were granted exception in the last Code cycle, in the next Code cycle, you will only have to go through the executive director approval. And we are following the similar strategy for Community Solar Revised application.

That's it for me, and thank you very much. I think now we will -- you can ask questions.

MR. SHEWMAKER: Thank you, Muhammad.

We've got Gina Rodda. She's got her hand raised.

Gina, go ahead and unmute yourself, state your name and affiliation.

MS. RODDA: This is Gina Rodda from Gabel Energy.

If we could go back to the slide about the ESS exceptions? I am loving that you guys are considering exceptions associated with ADUs. And I love that no PV is

required for the building, hence no ESS is required, and it's a choice. Perfect. It's easy to enforce. I'm not so sure about the existing service from the utility is underground, et cetera.

I'm just not sure how easy that can be enforced at the plan check level and what's going to be needed to support that when they go in for plan check. And if we leave it for when the building inspector is out there, it's too late to integrate it if it really isn't underground.

So that's just my concern. Thank you.

MR. PEREZ: Alright. Thanks Gina for the comment. Surprise, I'm under Payam's screen right now, he had to take off for a phone call, so I'll be playing Payam for the rest of the evening.

Yeah, there are serious complications in these systems and requiring these systems, and then in the challenges that exist where existing services are creating problems; right?

So I think we 100 percent agree with you that there are difficult enforceability components of this. And suffice to say, we're eager to engage with you, Gina, and we're eager to try and find a middle ground here that is appropriate for all parties.

So thanks for the constant feedback, Gina. And again, look forward to collaborating with you.

Looks like we've got Luke Morton on the line. I'm going to unmute you. And like Payam says, name and affiliation, and then go forward with your question, Luke.

MR. MORTON: Yeah, This is Luke Morton, Morton Green Building Services.

And just to kind of follow on with Gina's comment, this one comes up a lot in, I think, for my work and the work among my colleagues. I think the important approach for this is to add flexibility, is to somehow get the storage requirement, implement fitness, but really capture virtually all the plausible, and then this is specific to ADUs. The cases where that readiness will be useful in the future.

Currently as documented or codified, it's arguable that that readiness is pretty useless and I think that in many cases is not going to be useful because it is not correlated or not correlated with the service connection.

And so maybe we can help in the background with submitting real project types, real projects and saying, hey, how can we -- what is the best way to incorporate energy storage readiness into this project versus that project and considering all the factors on the ground?

MR. PEREZ: Yeah, that's the whole point of this, Luke, is to tell you what we're thinking about and then to

hear you out and maybe come to a collaborative conclusion. So, yeah, where you have situations that present unique or serious or real challenges, you know, we're all ears. You know, we have to do this every three years, so we've got a window to do this, right, and that window is open. And, you know, we're glad you're engaging. So when you can formulate those situations and give us some more detail, happy, happy to engage and make sure that we can all come to a reasonable agreement. Yeah, thanks, Luke.

Looks like Joe Cain is next up and I will pass the mic to you. Go ahead, Joe Cain.

MR. CAIN: Thank you. Joe Cain, Solar Energy Industries Association. So a couple of comments or questions.

On your prior slide regarding community solar and the 2025 for multifamily buildings, I want to -- for the 2025, what's stated right here on the screen, I understand the sensitivities around opt-outs and that that is a question that has come up, but I'm thinking about the case that you have in here that you have one -- even if you have individually owned units and you have one tenant or one owner of one unit that wants to opt out, the probability of that owner getting permission from the overall building management to install a PV system as a replacement for community solar to me is approximately equal to zero. I

just, I can't see that one.

So in other words, what I'm saying is that if you have an opt-out from one unit as you have on the screen, to me, it seems like in cases out of 10, you will not have a replacement for that opt-out. So I think, and particularly in the condominium or any type of thing, one owner does not own it or have control over the building. So I think that that piece of what you have there is not realistic, not practical.

MR. PEREZ: Yeah.

MR. CAIN: And then, so that's one question, so maybe I should pause there.

MR. SAEED: Yes. I will make a comment on that one. Yes, Joe, I think it's a good comment. You are right that it may -- it will be a very minor, you know, incident in which a dwelling unit owner is going to apply. But we just want to make sure that if that happens, even if it is one out of hundred or maybe one out of thousand, our standards are not -- aren't stopping them to do so; right?

And I will say that we here want to align our requirement with single-family, that if a single-family can opt out, then, yeah, the dwelling unit should be able to opt out as well. Whether they are able to or not, that is between them and the practical reality they are facing. But our standards are not creating any hurdles for them.

MR. CAIN: Well, thank you for the response, Muhammad. But I think that perhaps if this is something that you're on track to do, I think you would need to recognize that one opt out, out of a building with 100 dwelling units, is very different from one opt out out of a multifamily building with four dwelling units. So in one case, it may be a minor impact, in another case, it could be a major impact.

So that's why I think this really needs further study before I could support that.

And then the second point is just a question, and that is, do you have a date or when you're going to release the CBEC research to the public on these issues?

MR. PEREZ: This is Javier again.

No. We're kicking the tires in the software and hope to have that done next week. We fully expect it to be done next week. Like I said, we got a version of it yesterday and want to make some minor tweaks, make sure that everything works appropriately. So the intent, Joe, is next week, you know, unless unforeseen challenges exist. But, you know, this is the beginning of this long kind of pre-rulemaking and then rulemaking journey. You know, we expect kind of adoption in June of 2024 next year, so we've got a little breathing room, Joe, but certainly appreciate your --

MR. CAIN: Yeah.

MR. PEREZ: -- desire to get into it.

And, you know, we are over time, Joe, you know, your other question or your other concern about the variability between number of dwelling units, whether it's 4 or 100, certainly would appreciate more detail in writing. And you know, we'd like to continue to engage. You know, I think Muhammad's point is that we want to make sure that we aren't creating a situation where we're disallowing the situation to exist in the event that it is possible.

So thanks again for the engagement and I look forward to continuing collaborations.

MR. CAIN: Okay, just really quickly. I know that you said that you were wishing to have comments by August 9th, so the release of the CBECC research would be very helpful. Thank you.

MR. PEREZ: Yeah, 100 percent agree. You know, we expect to have another workshop here on the same topic by the end of next month, so stay tuned on the notice for that. And, yeah, thanks again.

MR. CAIN: Thank you.

And, Michael, I think we've got a couple of comments, and then I think we've got to wrap up here because we're over. I love the engagement, don't get me

wrong, but --

MR. SHEWMAKER: Yeah, we've got two questions in the chat.

First is from Nick Brown.

"Could we clarify in 2025 if and how smart electric panels meet the requirements for the four circuit critical load sub-panel that is part of the ESS ready language?"

MR. PEREZ: And, Danny, I think you're, hopefully you're available to answer this one.

Is Danny Tam available?

MR. SHEWMAKER: Yeah, one second.

MR. TAM: So the comment is, how can it? My understanding, that the smart panel can already meet that requirement. There's split into two parts. You can do a sub-panel or you have the smart panels that does it, you know, to segregate the circuit internally, but we can chat offline.

MR. SHEWMAKER: Thank you, Danny.

And our other question is from Luke Morton. Luke is asking,

"Should energy consultants, including myself, submit projects directly to Muhammad or how should we send projects over to serve as examples for single-family and single-family ADUs? Submitting to the docket is a

little tricky with privacy concerns and a lot of work and anonymize projects."

MR. SAEED: Yes, definitely. I mean, I am available, and my email is muhammad.saeed.energy.ca.gov and you can submit me to meet that directly and I can engage with my team and we'll respond back to you.

MR. SHEWMAKER: And that's all we had online.

MR. PEREZ: Okay. Alright, now I'm going to work on Payam's computer to share my screen, so stand by. Almost there. Okay, so it looks like you can see my screen now. So, let's wrap up here.

Alright, so like we've said a few times during this workshop, you know, comments are expected by August 9th, 5:00 p.m. You know, we hope to get that software up and running over the next week here.

Certainly, you're going to appreciate all of the engagement. You know, I don't think anybody expected us to go beyond 3:00 p.m. and now here we are. You know, I think the whole point of this is to hear you, is to make sure that we're developing a Code that we can all collaborate on and that we can achieve reasonable and meaningful goals but also come to a consensus or as much of a consensus as we can. So, as much as you'd like, you know, I think submit comments, you know, continue to engage. I hope that we can get to a consensus here as we move forward.

Our next workshop is scheduled for August 10th, Thursday, August 10th, 9:00 a.m. to 3:00 p.m. It's two weeks from now. Topics to be covered are non-res HVAC system requirements, nonresidential HVAC control requirements, refrigeration systems, and then controlled environmental horticulture.

If you'd like to see our drafts or the draft case reports, which are Code and Standards Enhancement Team reports, they can be viewed at the link at the bottom of this slide, and final reports will be posted very, very soon for these measures, and then subsequent measures will follow as this goes on.

So, again, I do want to take another second to say thank you so much. You know, I think we're trying to get on the same page and trying to develop consensus and get to a great place with this next Code, so hope to work with you all again soon. Thanks. Have a great evening.

(The workshop adjourned at 3:09 p.m.)

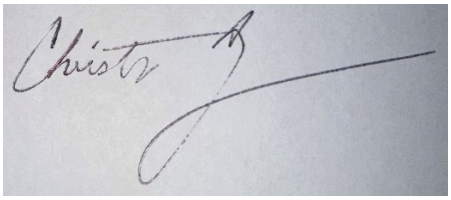
REPORTER'S CERTIFICATE

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

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

IN WITNESS WHEREOF,

I have hereunto set my hand this 22nd day of August, 2023.



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Chris Caplan
Electronic Reporter
CER**1971

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

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

IN WITNESS WHEREOF, I have hereunto set my hand this 22nd day of August, 2023.

Myra Severtson
Certified Transcriber
AAERT No. CET**D-852