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CALIFORNIA ENERGY COMMISSION

STAFF WORKSHOP

In the Matter of:	) Docket No.
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	)
	) STAFF WORKSHOP RE:
2019 Building Energy Efficiency Standards	) RE: 2019 Zero Net Energy Residential Standards

STAFF WORKSHOP ON
2019 ZERO NET ENERGY RESIDENTIAL STANDARDS

CALIFORNIA ENERGY COMMISSION

THE WARREN-ALQUIST STATE ENERGY BUILDING

FIRST FLOOR, ROSENFELD HEARING ROOM

1516 NINTH STREET

SACRAMENTO, CALIFORNIA

THURSDAY, APRIL 20, 2017

9:00 A.M.

Reported By: Kent Odell

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I N D E X

P R O C E E D I N G S

April 20, 2017 9:05 a.m.

MR. BOZORGCHAMI: My name is Payam Borzogchami. I'm the Project Manager for the 2019 Building Energy Efficiency Standards. After many years leading the Energy Standard development, Mazi Shirakh is now taking a role as a Technical Lead for the Zero Net Energy Adviser to the 2019 Standards Office Staff, especially me.

We're going to give you guys some housekeeping information. So in case of an emergency we're going to leave the building and convene at the park kitty corner from us. The restrooms are out the door to your left. And the snack shop, if you guys get hungry, it's on the second floor. Help yourselves. If possible, please keep your cell phones muted and when you come up to the podium please announce yourself and the associations you are with. This is being recorded.

Today's basic background is we're going to go through some standard historical information regarding the California Energy Commission. And then after that Mazi Shirakh's going to present the energy design rating for residential buildings for both efficiency and efficiency in PV. And then after him, Christopher Meyer is going to propose the modeling of PV ordinance for local jurisdictions.

I'm not sure how we're going to do this at this time. If there's not a lot of questions being answered we might just go right through with a quick break between Mazi's presentation and Christopher's presentation. But we have planned an hour lunch, but we may be done sooner than that.

So with that the history of how the Energy Commission started, due to the energy dilemmas of the '70s the Warren-Alquist Act was signed and developed under Ronald Reagan's era in 1974. And Governor Brown, his first term, when he came into the office in 1975 he funded and started the whole concept of the California Energy Commission. And these are other responsibilities of the Energy Commission. We're not just Energy Efficiency. There are other divisions of what we do here at the Energy Commission.

Our policy drivers for the Building Standards, our key areas, our goal is to hit the ZNE definition for newly-constructed residential buildings by 2020 and 2030 for nonresidential buildings. We have some other environmental plans and strategies that environmental plans and strategies that have been bestowed upon us. I'm going to wait until ...

So two main policy drivers that drive the energy efficiency is pursuant energy and cost savings at a

statutory mandate by the Warren Alquist Act. And greenhouse gas reduction is required by statute and supported by very strong policy commitments. If you see our Loading Order, energy efficiency is the primary goal here at the Commission. And we do renewable generations and cleanest conventional source.

The standards are updated every three years, or triennially, with the help of our utility partners and consultants. I would like to give a special thanks to our utility partners who helped out on the 2019 proposals. And those would be Pacific Gas and Electric, Southern California Edison, San Diego Gas and Electric, Sacramento Municipal Utility District, Los Angeles Department of Water and Power.

Prior to these pre-rule makings, the Codes and Standards team, funded by the utilities, had two sets of case-sponsored workshops prior to having these meetings here at the Commission. All measures were presented to the public and the comments were taken by the public for those case reports.

As you can see the focus of California is a little bit different than other parts of the country. If you look at the ASHRAE Climate Zone Map, California is either Climate Zone 4 or Climate Zone 3. The majority of California is under Climate Zone 3. Here in California,

we're a little bit different. If you go from the hottest part of the country to drive about an hour you get up to the mountains and you can go skiing. You can't do that in other parts. So what we did was, California was divided into 16 climatic zones, based on the heating degree days and cooling degree days. And then a set of standards are developed and is based for that climate zone.

One of the requirements that we have is any proposals that we do has to go through a vigorous Life Cycle Cost Methodology based on the Time Dependent Valuation. The TDV, as we call it, is values of gas and electric changes depending on the season and the time of the day.

This is one of Mazi Shirakh's favorite slides. And it shows what the Energy Commission and what our partners have done is actually helping meet this goal of reducing energy consumptions here in California. As you can see from the 1970s to 2019 how it's different. You will probably see this slide on and on again in other presentations today.

Our 2019 Standards process, so this is our tentative standard update schedule. Right now, we're in the April month and we're just starting our pre-rulemakings here at the Commission. We've got a long ways to go. We've got a lot of things to do in a short amount of time.

We're going into -- for adoption of the 2019 Standards in the March 2018 timeline, plus or minus a couple of months here and there. But really, we don't have much time to veer off of that schedule. We're supposed to go through adoptions, get the manuals, get the computer compliance programs all ready a year in advance of the effective date.

So as of now, we're starting our pre-rulemakings here at the Energy Commission. And as you can see, this is our first one, it's going to be based on PV and ZNE. It's going to be a high-level discussion. We recently have got the computer program to help evaluate this.

We're hoping that we have more in-depth discussion in the May 23rd timeline. We're scheduled to have our workshop on residential envelope measures on June 1st. And all the water heating measures, the indoor air quality measures, lavatory measures, warehouse topics and residential HVAC measures we will start on June 6th. June 20th is dedicated to non-residential HVAC systems. June 22nd is the non-residential lighting measures. And we have a new building type that we'll be looking into for 2019 Standards and those are the hospitals. And we're going to be looking at demand response clean up and ATTCP requirements.

We also scheduled July 13th as a workshop here, but this we're holding as a place holder if we run out of

time, because as you can see there's a lot of topics we have to discuss in one day. And if we can't we kept July 13th open, that we can have more discussions on that day if we need it.

Currently, in process, we've updated the TDV values to reflect the current natural gas and electric costs. We've updated life cycle costs analysis assumptions based on TDV and other parameters. And that's what actually Mazi is using to do his evaluation on the EDR methodology that we're working on right now.

A couple of key websites that you might be interested in, you could find all of the proposed measures by the case team -- the 2019 Title 24 Utility-Sponsored Stakeholders -- the website will have all of our measures and the documentations available. We will have eventually all the case measures posted on our website too. As we get them we will post them. And you can find them under our website of the Building Energy Efficiency Programs. And if you have any comments or concerns, we're not going to be able to get to today, you can use the third website to provide any feedback to us.

These are the key staff that's working here at the Energy Commission to develop the 2019 Standards. Again, Mazi Shirakh is our ZNE Technical Lead and Adviser to the 2019 Building Standards. Myself. Larry Froess, who

is our Senior Mechanical Engineer, who's going to be leading the ACM development, alternative calculation methods, the computer programs. One of our supervisors, Peter Strait, who's at the podium in the back behind me. He's the Supervisor of the Building Standards Development staff. Todd Ferris is the Supervisor for our software tool development. He's working hand-in-hand with Larry on these measures. And if you don't like any of those, you guys can still always complain to Christopher Meyers, who's our Manager of the Building Standards Office.

So with that, any questions?

MR. RAYMER: I'm Bob Raymer, with California Building Industry Association. On the slide that was going over, about the 10 or 12 important dates, I noticed -- well I think I noticed, I've been running on very little sleep over the last week -- have you decided to move or at least tentatively move adoption date from May of 2018 to March of 2018? Yeah, March 1st. I just noticed you've kind of moved it up two months. Was there a reason for that? Or it doesn't seem like there's going to be time for 15-day language if you do it between.

MR. BOZORGCHAMI: Well, like I said this is tentative. We're going to be going back and forth on those a little bit.

MR. RAYMER: Okay. No problem.

MR. BOZORGCHAMI: I'm just giving you worst case scenario right now.

MR. STRAIT: Yeah. This is a case where in theory, if we were to start the 45-day process on December 1st, we would be able to adopt by March 1st. We're assuming however that there might be 15-day language that would adjust those dates.

MR. BOZORGCHAMI: I think after every presentation, there will be a question-and-answer period. And okay with that I'm going to transfer it to Mazi and Mazi's going to do his presentation.

MR. SHIRAKH: Good morning. I'm going to run this from here. My name is Mazi Shirakh. I'm the ZNE Lead for these brand-new standards, so we're going to be describing what our vision and strategy is for the 2019 Standards and beyond when it comes to the Zero Net Energy Goal.

But before I start, I want to recognize the contribution of my colleagues, Christopher Meyer and Bill Pennington, through this document. I also wanted to recognize E3's contribution. Three of them are represented here and also Wilcox and his software team, with Ken and Scott who have been a tremendous help.

There's a lot of slides here and a lot of information, this is going to take a while. So if you have

specific questions about a slide, or the information I'm presenting, feel free to raise your hand and ask that question. But if you have general comments like you hate this proposal or you love it or you want to high-five us, save that for the Q&A at the end. But do ask your questions about specific items here. And again I've got the E3 here and they can also help me answer some of the questions regarding to the main rules and cost effectiveness and so forth.

The presentation has four areas. The first one is the ZNE Strategy, what it is and how we arrived there, so we're going to be discussing that.

And then the cost effectiveness, why we think our strategy is cost effective considering all the limitations and rules and NEM rules and TDV and all that. So we'll touch upon those topics.

And then there's a section here that deals with the strategies for the Reach Codes, local ordinances, how you can use the software that we're developing, the CBECC-Res, to actually help you with the Reach Codes and whatever target they're trying to get.

And then I have a few screen shots on the CBECC-Res tool that shows how the software's going to work, and hopefully within the next few weeks we can release the Beta version of this for public trial.

A little bit of background, the ZNE goal was set about ten years ago. At the time it was a simple vision. You take a building, you make it really efficient, you improve the envelope, you improve the electrical system, lighting. And then you add a certain amount of PV, photovoltaics to net out the annual energy, not just electrical, energy consumption of that dwelling or house on an annual basis. So that's basically what most people understood and that's what's repeated in this language here from 2015 IEPR. But as it turns out the world is always more complicated than people had envisioned ten years ago. And this is definitely a case of the world being more nuanced than was envisioned.

And I have listed three factors here, there's probably more. One of them is the 50 percent RPS goal. That the utilities in the state will have to have 50 percent of their generation resources, electrical resources, come from renewables. That has a big impact on how ZNE and PV is perceived.

Coupled with that is installation of PVs on residential and our buildings throughout the state. So the net result is that there will be more solar resources on the utility scale and more solar resources at the building. The value of kilowatt hours of those PVs generated in the middle of the day will actually get depressed. And it's

not to say these things are bad or good, it just means we have to think about it and come up with strategies that will deal with it.

On top of that we have Net Energy Metering rules, NEM, that was introduced a while back ago. It was amended in 2016, and it will probably be likely amended again in 2019. And NEM really governs whatever we're doing here related to PVs. So we have to be very mindful of NEM and sometimes NEM helps, sometimes it hurts. But you know it also points to new directions that we have to consider of it.

The other problem we have is this notion that is perpetuated by NEM actually, and perhaps by the end some other definitions for ZNE, like source energy and so forth. That it assumes somehow the Grid is this big vast storage where you can overproduce at one time of the day, like right now, and then use it later in the day even if the sun's not around anymore.

Worse yet, you can also assume that you can over-generate in one season, like in summer, and then use that in the winter. In reality, as is mentioned here the batteries have not included the storage. The Grid has very little capability to store electricity, so that's another thing we have to keep in mind. And this leads to the so-called duck curve issues that's actually becoming an

increasing problem even here in California, even today. And I'll have some slides to show that the ISO is very concerned about that.

So the net result is that we've got to think about those things and come up with a strategy that moves us towards the ZNE goals, but it also works from the homeowner's prospective that is it cost effective, that we're not wasting their money. The standards require that whatever measure we put in a building has to be cost effective from the homeowner's perspective. But it also has to bring value to the Grid and the environment. So we're trying to hit all these goals at the same time and it's like a juggling act.

And these measures are called globally, in the name of grid harmonization or grid integration strategies, and here's a definition of it. That the Grid harmonization strategies are strategies that enable the homeowner or the building owner to maximize self-utilization, which means to the extent possible use as much as possible the kilowatt hours that are generated at the site and minimize uneconomic exports back to the Grid.

And there's some examples here like battery storage, demand response and perhaps for non-residential buildings the EV integration is going to be an important factor. So these are some of the goals that we're trying

to hit at the same time.

Our approach remains the same. We're going to be looking at building envelope and energy efficiency first. So we already introduced the new concepts in 2016 Standards, like high-performance attics and walls and QII. So we're going to improve upon those to the extent possible as allowed by life cycle costing.

Then we're going to be looking at an appropriately sized PV that will remain cost effective, even under adverse NEM scenarios. And I'll describe some of the scenarios.

And third, we're going to be looking at grid harmonization strategies that bring this whole thing together. Most of these grid harmonization strategies will not be a prescriptive or mandatory requirement as part of the 2019 Standards, but we will be providing incentives, compliance incentives, so the builders can take advantage of them. And these grid harmonization strategies become very important in Reach Codes where you're actually trying to get to a score of zero.

I mentioned that there's a problem with perhaps too much solar resources in the middle of the day and this is actually happening in California already. And there's a recent news article here that says California's getting so much power from solar that wholesale electric prices are

turning negative. And this article was April 10th, 2017.

The interesting thing was that this was presented as if it's something good. And I actually posted this on my Facebook page without any commentary to see what kind of reaction I get. I got one thumbs up, two thumbs up, three thumbs up. Everybody loved it, but in reality we know this is a problem, because if the prices are turning negative then we're not bringing value to that investment that's producing those kilowatt hours. So this is where grid harmonization comes in.

This is a graph from a recent ISO report that they prepared for the CPUC that most of you are probably familiar with. This is the infamous "duck curve." And the problem here is that as the belly of the duck gets fatter, it means our problems are getting worse, which is we have more problem with over-generation.

Interestingly, ISO in this table here, they're recommending a set of measures to mitigate this duck curve. Unfortunately, what they're recommending here lines up pretty well with what we're going to be describing today, such as energy efficiency first and increased storage, demand response, easy integrations and so forth.

This is another ISO graph that shows curtailment is happening in California today. We used to think that this would be more of a problem a few years from now, but

it is actually, as you can see, there is curtailment every single month today and it varies by month. As you can see, in shorter months, in the spring and fall, you've got a bigger problem than summer, but even in August and July we are curtailing.

Cost effectiveness, so we're mandated by the Warren-Alquist Act to consider cost effectiveness for all measures, whether it is energy efficiency or renewable resources. So that's what we're doing. Again, the problem with renewable resources is that we have NEM rules to worry about. And we're currently operating under NEM2, but it is possible in the future that NEM2 will be revised in 2019, by the CPUC. And where it's going to go we don't know, but we're making an assumption here that the exports may not get a very generous, or as generous of a compensation, as they do today. And I'll show that in a minute.

In our cost effectiveness, we assumed there is no federal ITC, because those credits will sunshine in a few years. So we're not considering those.

What we found through our analysis is that PV size that is sized to displace the annual kilowatt hour of the dwelling is cost effective in all 16 climate zones, even under adverse NEM rules. So that is going to be our proposal for the 2019 Standards. But prescriptively are the builders will have to install a PV size that is just

large enough to displace the annual kilowatt hours of the electricity. And I'm just talking about the electrical portion, so the natural gas is not part of it.

So prescriptively we have a way of calculating this. And it's going be done using this equation here, the PVs is the PV size, the WSF is the watts per square foot of PV size -- that's for a dwelling of 1,200 square feet or less -- times CFA is the conditioned floor area, times area adjustments. So this is a multiple progression equation basically.

This first parameter here was the watts per square foot for a 1,200 square foot. But if your home is bigger than that 2,000/2,500 there will be a table you can look up this area adjustment factor. And then there's also a climate zone adjustment factor, because the thing about PV size is when you talk about insulation, you just specify the U-factor. It doesn't really change much with the size of the house or it doesn't change much between climate zones, but the PV is very susceptible. The size actually changes. That's where we have to come up with kind of a nasty equation like this.

And if you don't like that, then you can go to or use our performance software, CBECC-Res. Now within CBECC-Res we're using a new tool, it's called Energy Design Rating, to actually achieve the goals that we have. So I'm

going to describe the EDR tool and this is a tool that's developed to basically compare the performance of the dwelling that you're proposing to some referenced building. And with a switch to the RESNET's 2006 ICC compliant home and so that's our reference building. And at a score of 100 -- and again this is 2006, that's what 11 years old -- so square of 100 means that your building is performing exactly the same as that 2006 IECC home, which is not very good any more.

With the 2016 Standards our average EDR is in about the high 40s, low 50s, for energy efficiency only. With the 2019 Standards we're probably going to be in the low-40 area for the EDR score.

And then we're going to have, as I mentioned, an amount of PV that's enough to displace the kilowatt hour. And that tends to push then the final EDR in the 20-to-30 range, which means we're going to be about 20 or 25 points short of meeting the full ZNE, which basically leaves room for the Reach Codes to bridge that gap for this time around.

I mean, the question or the obvious point here is that we're proposing for 2019 not to go to full ZNE, but stop about 20 points short. Is it good or bad? No, it's a matter if you want to see the glass 80 percent full or 20 percent empty. But when we look at the NEM rules and

everything else that governs the cost effectiveness and the Grid impact we really think that is the best strategy. And so that's how we are going to be proceeding.

The EDR -- go ahead, please. You can go to the podium.

MR. CHANGUS: Thanks, going back just one slide, Jonathan Changus, with the Northern California Power Agency. With cost effectiveness, I'm just curious without assuming some of the IOU avoid of constant rates versus someone that represents small publicly owned utilities that have we'll just call them different rates, I'm just curious if that was modeled or considered? Or if it was just kind of the IOU went in.

And secondly was there also a comparison to the cost effectiveness or cost comparison of individually-sited on rooftops versus more of a community solar or grid alternative as well? Whereas something might be cost effective, but it could still have some preferable alternatives to get us to a broader objective?

MR. SHIRAKH: I'm going to answer your second question first. I'm not talking about community solar here, although that's very important. That's going to come up in a subsequent workshop. There's all different ways of doing community solar. We've identified about seven or eight different strategies, but we're not quite done with

it yet, but you'll be presented. What we do know is that community scale solar is going to be more cost effective, because it is larger, in economies of scale. But what we've found so far is that almost every community solar strategy that we've looked at has some issues. There's one or two promising ones, but again I don't want to get into that much, because that is a separate topic we'll be addressing.

On the question of cost effectiveness we're using NEM rules and NEM rules, by definition they're basically impacting the IOUs.

So EDR target, you know, we talked about the Energy Design Rating is going to have three components. And there's going to be an EDR based on the energy efficiency features of the building. So the builder will have to meet the energy efficiency EDR with energy efficiency measures in that building. And then there's going to be an EDR contribution from the photovoltaics.

And then we'll combine the two together in a final EDR, a target EDR. So I'll have a slide that will show exactly how that works, but what's an important point here is that the energy efficiency EDR can only be met with energy efficiency features. Which means that the PV tradeoff that we offered at this round of standards, 2016, which was proposed as a temporary thing -- it's going to go

away. And you can no longer, at least the proposal is that you can no longer trade away efficiency features with PVs.

In a little bit more detail, these are some of the measures we're recommending for the 2019 Standards. We'll be having workshops on these as Payam mentioned. We introduced high-performance attics in the 2016 Standards. We're proposing to improve the high-performance attics in the cooling climate zone, going from R13 under the Batt insulation to R19. We also introduced the concept of high performance walls. We're also proposing to improve the U-factor from .05 on down to .043 to .046, you know, that's to be determined.

And the good thing about this thing is when you make the envelope more efficient, then you don't have to have such a large PV. And as I'm going to show you in some climate zones to get to full ZNE it's going to be a challenge as how much space you have on the roof and orientation and all that. So by making the shell and the building systems more efficient, you reduce that size.

We're going to be improving the window U-factors and SHGC a little bit and currently is proposed that the QII, Quality Insulation Installation, becomes a prescriptive measure. And again we'll establish an EDR target for these efficiency features that has to be met with energy efficiency only.

And then we'll calculate an EDR for the PV. And again, it's the PV size that's required to displace the annual kilowatt hours in each climate zone. And then we'll calculate the EDR contribution of that PV and then we'll combine this with the EDR from energy efficiency and we get a total EDR target.

Why we are using EDR is because we think that brings a lot of benefits and flexibility. With this approach, we're going to be basically defining the performance level of the dwelling in an EDR target term. But we're not telling the builders how to get there. We have a set of prescriptive measures that basically is the baseline for that, but the builders can use any means at their disposal, any product. Different buildings have different preferences, you know, some tend to like high-performance walls or attics, so don't. Some like better furnaces, the better air conditioning systems. They can do it however they want.

And we tried to support you with 2016 and it was fairly successful. And I'm hearing -- and Bob's nodding -- I'm seeing that.

And then it also again, another benefit of EDR is it's really a good match for the Reach Codes, because again we're going to be stopping in Part 6 and we have a total EDR target of about 25 or something like that in most

climate zones. And then the Reach Codes can specify a lower EDR, you know, like maybe 10 or 15 or maybe all the way to 0.

And again the other benefit of the EDR target is that even though we're prevented from requiring appliances that are higher than the federal minimum efficiency requirement, because they're preempted, the builders are not preempted from using those. So they can actually use better appliances to meet these EDR targets.

And it also allows things like demand response, demand flexibility, battery storage, thermal storage and all these techniques to get sufficient EDR credit toward a zero net goal.

So this is a screenshot from the CBECC software. And this shows how this EDR target is going to work. The EDR of standard design -- in this is a 2,700 square foot prototype in Climate Zone 12. This is the larger of the two prototypes we used in the standards calculations. The reason I'm using 2,700 is because this is larger. It's actually the more challenging. It's two stories, there's more limited space on the roof for PV, so if you can solve the problem for the 2,700, we have automatically solved it for the 2,100. So all the screen shots and everything I'm showing here are based on the 2,700 prototype.

So the standard design of the EDR is 43.7. So

the proposed EDR should be equal or less and in this case, the proposed EDR is slightly less than the standard design. So for energy efficiency features that are modeled here, we're good.

Then you have an EDR, a minimum required PV size that translates into an EDR of 18.6. And so the PV that you installed in that home, for Part 6 has to be equal to this amount or a little bit -- actually more. So in this case, the amount of PV that I've installed in this home is slightly larger, which basically complies. And then when you look at the total EDR, the target was 25.1 and the proposed is 24.3. So this house actually complies.

But the key here is that this number hast to be smaller than this number or equal. But this number has to be greater or equal to that number. And then you'll get a final EDR.

And this number zero here. That's kind of important, because what that means is again this PV system, in this house, is generating almost 5,000 kilowatts in that year. Which is exactly equal to the amount of kilowatt hours that the house is using, which is also 5,000. So the net is zero.

MR. CAIN: In your preliminary studies, can you tell me kind of a range of what PV systems -- oh sorry.

UNIDENTIFIED SPEAKER: Make sure to identify

yourself.

MR. SHIRAKH: Yeah, please identify and state your question.

MR. CAIN: Joe Cain, Solar Energy Industries Association, just a question at this point. In your preliminary studies can you tell me what range of installed capacities you're seeing on the PV system? And part two, I'm assuming you're going to install a larger system, but you're calculating the portion that you can use in the calculations?

MR. SHIRAKH: I have two slides that will answer those questions exactly. It's coming up.

So again, this EDR size is based on the assumption that you're generating 5,000 kilowatt hours that displaces the site kilowatt hours.

Electrification is what happens when we go to all-electric homes. And the first thing is that what we're proposing is that for mixed-fuel homes we're going to require a PV size that is just large enough to displace the annual kilowatt hour of that mixed-fuel home, which let's say in Climate Zone 12 is about 3 kilowatts. When we go to all-electric homes, you can imagine the kilowatt hours that that house uses is much larger.

But the prescriptive requirement is going to remain the same. That it's going to be actually not based

on the kilowatt hours that the all-electric home uses. It's going to be based on the kilowatt hours that a mixed-fuel home of the same size and the features, except with a gas furnace and gas water heater, would use. So in other words that three kilowatt hours that we calculated for the mixed-fuel home, that's going to be also for the prescriptive requirement for the all-electric home.

Why are we doing this? Because we could potentially go a lot higher, but by requiring a larger PV system on an electric home you actually disadvantage those homes. We can potentially go to a PV size that's about two, two-and-a-half size of a mixed-fuel home, which means an additional $12,000 to $15,000 cost in PV systems. And we thought that would become actually a disincentive to all-electric homes. And by putting it on an equal footings, then we will remain neutral.

And if people want to put more PVs, they can. We're not preventing them from doing it. But the minimum they have to put is going to be the same between both the mixed-fuel homes and the all-electric homes. And we actually ran this by all-electric advocates and once they understood why we're doing it, they're supporting it.

The only thing about all-electric homes is that this table here -- I don't know if you guys can see it on the screens are not -- we used to have large, big

projection screens that everybody could read. But we managed to update them to something that nobody can read now. (Laughter.) But I can tell you what's going on here is this column, this is the all 16 climate zone. Here is the kilowatt hours of summer that that 2,700 square foot home is using in every climate zone.

Now if we go to an all-electric home, which means we have a space heating heat pump and space heating pump for water heating, then what we see in 15 out of our 16 climate zones, the amount of kilowatt hours that are used in the winter are actually significantly larger than in the summer.

Take our Climate Zone 12, Sacramento, which is no paradise in summer and it gets pretty hot here. But that house is using about 550 kilowatt hours in the summer. In the winter months that's more than 2,000, it's four times as big. So again, this is another thing we need to consider in that there's a lot of benefits in full electrification is why we want to go there. But we have to think about the consequences or unintended consequences.

And we all know what the duck curve looks like in the spring and the summer. What we want to make sure is that we don't replace that with a Christmas turkey, because what could actually end up happening, you can have a winter demand that's greater than the summer. And that's actually

depicted in this graph that I have here. The red lines represents the all-electric home. And the blue are the mixed-fuel homes. The graph with the sun on it, that's the solar generation. These are months of the year, January being here and December here. And as you can see, effectively in the winter months the solar production is low and it goes up to a maximum around June or July and then starts dropping down. The problem is the load is the exact opposite, almost mirror image.

So when you put the two of them together, you have a situation. This goes back to my first statement, a grid is not a storage. Maybe when you're way under-generating in the winter months, at some point around March, the two kind of cross each other. And then you're way over-generating in the summer, but the load actually goes down. In the mixed-fuel homes you have the same situation, but it's not quite as bad.

So this is another way of saying we need grid harmonization strategies. Otherwise, we're going to have unintended consequences here.

So this is the slide that I was going just promising that has the different sizes for different climate zones for different strategies. Calling for what we have here -- first of all these are the EDRs for the energy efficiency only -- for these building without any

renewable resources. So if you just model those buildings with the 2019 energy efficiency features, out of about 16 climate zones -- but I think I've got 11 of them here -- and as you can see, without any generation we're in 48, 40, it hovers most of them in the 40s.

We said that the requirement is going to be a PV system that displaces annual kilowatt hours, which turns out to be this size in different climate zones. Most of them are fairly reasonable sizes. And our solar ready zone is about 250 square feet. To get a decent PV system, you should be able to install a four-and-a-half kilowatt system within that 250 solar ready zone. So there's only one climate zone there the sticks out, which is Climate Zone 15. That's the low desert, Palm Springs.

But for the rest of it we actually have a fairly reasonable size. And then if you add the contribution of this PV system to the efficiency, then you end up with a final EDR that looks like this, that Climate Zone 12 is about 25 and some of the milder climate zones, you're in the teens. The challenge is going to be climate zones 1 and 16 really, because of the load, especially in the all-electric scenario.

So this is our prescriptive requirement. But I guess there are other columns here that shows what happens if like in a result of a Reach Code here and then people

want to go all the way to zero. What size PV do you need to go all the way to zero? So if you wanted to go all the way to zero with a dumb PV system that basically you put it up on the roof and walk away, and just large enough to generate enough kilowatt hours to get you all the way to zero, this is what you'll end up -- which is significantly larger than the scenario that I just described.

Go ahead please.

MR. SMITHWOOD: Brandon Smithwood with the Solar Energy Industries Association. Can we go back to the turkey graph, as I think you described it? Oh, I think we overshot it. Perfect.

MR. SHIRAKH: Oh, this one?

MR. SMITHWOOD: Yeah. So what assumptions are you making about cycling your heating, because presumably we're going to have a really tight envelope home? It's my assumption, looking at this, is we're assuming we're meeting the heating need as the ambient temperature is driving the heating need instantaneously. Like time of use rates for cooling in the summer, when we've shown people can cycle their cooling to shift load, are we presuming that people are going to cycle their heating, or are we not?

MR. SHIRAKH: So I'm using CBECC software and I'm basically modeling this to minimally comply with the code.

Both the proposed and standard budget are exactly the same, s all the cycling and the scheduling that you're talking about directly comes from the IACM. And so I'm not changing any of that, but that's the software that we're using, we have been using. So if you have issues with some of the schedules, questions, I would be happy to talk to you, but for this analysis, I didn't change anything when I went into CBECC. I just modeled it to minimally comply. And then we looked at the therms and the kilowatt hours on a monthly basis for both the all-electric and mixed-fuel homes.

So going back to this story, then if you have a standalone PV system that's basically going to go through an EDR of zero, these are the sizes that we end up with. The problem with that is that it violates NEM. It's way too large and it's not really good for grid harmonization, because you have these PV systems that are uncontrolled and they just doing this.

Now what happens if you want to add some demand response and demand flexibility measures, so we added for this column six, either a battery storage system with some basic controls and see how the batter can improve the size. Now, what battery does is if you can imagine, we talked how the value of how electricity gets depressed in the middle of the day, like right now perhaps? So that has low TDV

value.

The storage can instead of sending that back to the Grid, it can store it, and if this was June or July where it's going to be hot in the afternoon and we go and turn on our air, then when you go and do that instead of drawing power from the Grid, you can draw it from the battery. So what storage does, it can turns that low value kilowatt hours into high value kilowatt hours. And that's the magic of TDV.

And by doing that, then you can actually decrease the size of your PV and get the same value out of it. In other words, you can have a very large PC system, or you can have a smaller PV system and storage and they can return the same TDV value to you. So if you do that then you can see the PV size. Let's just look at one climate zone here. It goes from 7 kilowatts to 5.8 where it becomes more reasonable.

Now the batteries can actually be controlled two ways. One of them is basically what we call the basic controls. And this would be a control where it's very simple. You have generation and you have house load. When generation is bigger than load, the extra is going to go into the batteries. So you've got this other bucket here. Generation is high, load is lower, like right now, the excess is going to go into this other bucket that's

storage.

And then as the day goes on, the sun's going down, so generation goes down, but the load goes up. We all go home, turn on our TVs and air conditioning and all that, then when the load becomes bigger than generation, then you start drawing from the battery instead of from the Grid. So that's the basic strategy.

There is a second strategy, that's called a smart strategy. It actually puts the battery under the control of the utility. And it becomes much more sophisticated, because the utilities can actually predict where the very high demand hours are based on the forecast and working with the ISO and this and that, the weather forecast and all that. They can really identify those extremely high value TDVs and only discharge the batteries during those hours. So if you can do that, then it really increases the value of those kilowatt hours that were stored during the day and used at the optimum hours.

So if you do that, then the size actually goes down considerably from 5.8 to about 3.8. A significant improvement, and still, you can get to a score of zero.

The problem with this scenario is that the utilities have to actually provide this program and they have to support it. Currently, they're looking at it. They're piloting it. But no utility that I know of is

supporting it, but hey we've got two or three more years until 2020, right?

So now let's say we want to really put the pedal to the metal and have this smart battery and all of that. And also put in a better furnace, a condensing furnace, and a condensing water heater and the size actually goes down to 3.5. So these strategies here, they're all doable, they're cost effective, they're reasonable. But this one here definitely is not, so we're trying to avoid this scenario.

In the ratio here, as you can see, this is like column six to column four or column six is that the PV site is zero EDR with basic battery control. And as you can see, even with that basic control in some climate zones, we're about twice the size that we need here. But once we add these demand response strategies, then we get into more reasonable ranges. So these are the choices that the municipalities have, builders have to build to Zero Net Energy.

This one is for all-electric homes. So it's kind of similar to the other one, but it's on steroids now. Because you're talking about all-electric homes, so all the numbers are just bigger. I'm not going to spend too much time on it, but it's the same thing. These are the prescriptive requirements and these are the PV requirements

for different scenarios that I just described. And the conclusions are about the same for both all-electric and mixed-fuel homes. We'll post this to our website so you can actually have it and look at it and ask any questions.

So now we're getting to -- go ahead, sir.

MR. SMITHWOOD: Sorry, I have a lot of questions here. Brandon Smithwood, with SEIA again. So can you explain to me why the presumption is that the utility needs to dispatch the battery?

Like we've, in PG&E's current rate case, we've put forward a cost based time of use rate that would achieve the same objective. And the utility doesn't have to control that battery.

MR. SHIRAKH: Again, they don't have to. But what we think can happen is if they do control, because they can forecast like a day ahead, an hour ahead. And if there's like a severe weather or something going on, they can actually forecast when those hours are and only discharge the batteries during those hours.

I know Zack is itching to respond too.

MR. MING: Yeah, this is Zach Ming with E3. I think one of the main differences between the time of use dispatch versus the TDV or utility dispatch is sort or the peak periods that we're looking at are much more concentrated and rare than the sort of daily time of use

schedule. So, for example, with the time of use schedule how a customer might dispatch their battery is any time from 3:00 pm to 10:00 pm. Whereas the utility might say, "Well, what we're really focused on is specifically from 5:00 to 6:00 on this day or on a different day from 6:00 to 7:00.

And on the flip side of that is on a day where there really isn't any constraints on the Grid, a customer might still have a time of use economic signal to operate their battery in a certain way, but the utility actually doesn't need them to operate the battery in that way, because there're aren't constraints on the Grid. And so on a day like that, they would be incurring sorts of round trip battery losses for minimal benefit to the Grid.

MR. SMITHWOOD: So are these distribution level constraints or are these generation?

MR. MING: So the values that we look at in TDV have both -- there's several different components of value. The first is just the change in energy price. The second is generation capacity, which looks at essentially the entire CAISO system and the constraints on generation. And the third is differentiated by climate zone, looking at local T&D constraints.

MR. SMITHWOOD: Okay. And we have tool called Critical Peak Pricing that gets at these event days. But

anyhow (indiscernible) --

MR. MING: (Overlapping)

MR. SMITHWOOD: -- but I appreciate the clarification.

MR. MING: And critical peak pricing would be much closer to the utility dispatch.

MR. SMITHWOOD: Right. Thank you.

MR. SHIRAKH: And Zach, you may want to sit there, because now we're getting into the -- I'm done with the easy stuff. We're not getting into the --

MR. MING: Should I just stand up there? (Laughter.)

MR. SHIRAKH: You might want to go sit up there.

So life cycle costing, this first part is for the prescriptive requirement. So we work with E3 very closely and we find that the PV system that is sized to displace the kilowatt hour in a mixed-fuel home is very cost effective, even under adverse scenarios. And I'll show you why. And this scenario is cost effective even if the NEM2 rules are changed to compensate hourly exports at avoided costs, instead of NEM-adjusted retail. And with no federal ITC.

So E3 has provided a lot of slides to us and I'm not representing all of them here. These will be posted on our website as part of -- in a report. What I have here is

basically what I call is E3's greatest hits.

So what this graph does -- again I apologize, it's very hard to see there on the screen -- this is the PV sizes that are needed for different scenarios. This is the all-electric home. This is the mixed-fuel home. And in the all-electric home there are two lines. I call them blue and gold.

The blue line represents a PV size that displaces the annual kilowatt hour. It's the one that I've been repeating. The goal is the line that displaces the annual kilowatt on a TDV basis, so that's the TDV sizing. This is basically the source of our site energy, right? Displacing the kilowatt hours on site energy basis. And, as you can see, in every scenario, the TDV size is always bigger than just displacing the annual kilowatt hour.

And so that is why we are recommending the blue line and not the gold, because under the gold, you end up with over-generation, over-sizing in all 16 climate zones.

In the all-electric home, we have one additional line, which is the red line. And that would be the size of PV that you need to displace in the mixed-fuel home both natural gas and electricity. So if you wanted to oversize the PV to displace not only electricity and natural gas, that's where you end up with these huge lines. And you can see they're significantly larger than either the blue and

the gold in every single climate zone. And so that's where cost effectiveness and grid harmonization and all that becomes really a problem. So again, we are going to stick with the blue lines for the rest of this analysis.

Now, we'll look at the cost of the PV -- George?

MR. NESBITT: George Nesbitt, HERS Rater. I thought you said that the PV sizing for an all-electric home was essentially the same size as it would be for mixed-fuel home?

MR. SHIRAKH: Yes.

MR. NESBITT: Yet you're now showing us a chart that would appear to --

MR. SHIRAKH: But this is what it would have been if -- this is like "what if" scenarios. We're not drawing conclusions from these slides here. We have to kind of look at this and everything else that comes, but these graphs are showing what happens if you were displacing the annual kilowatt hours.

And again, what this tells you is that in Climate Zone 1 if you were displacing annual kilowatt hours, you need a seven kilowatt system. But in a mixed-fuel home, you only need three, so we're going to settle on this. That's how we're using the information.

MR. NESBITT: So your left chart is you were trying to offset 100 percent of electricity in an all-

electric home, site energy versus TDV. Whereas the chart on the right is what you're proposing is essentially that everything is sized on a mixed-fuel home. And then what you're showing on the right is what your solar electricity offset would be annual. Your TDV electric site -- your site TDV -- so all-electric TDV and then --

MR. SHIRAKH: Let me explain that, I think (indiscernible) --

MR. NESBITT: (Indiscernible) Your biggest one is the one you were offsetting TDV for both all fuel and electricity?

MR. SHIRAKH: Yes.

MR. NESBITT: Okay.

MR. SHIRAKH: So these are all scenarios that would be if somebody wanted that, but again we're showing all of that. What we're saying we're going to stick with the blue lines here for both mixed-fuel and all-electric. It just shows you what happened, why we picked this, and what was the implication if somebody wanted to do something different.

MR. NESBITT: Okay.

MR. SHIRAKH: So another factor we have to consider when we are talking about cost effectiveness is the first cost of the PV system, the installed cost. You have three possible cost scenarios. One is $3.55 per watt,

which is basically today's cost. The mid-cost is about $3 a watt. And the optimistic case is about $2.60 per watt. For the rest of this analysis, we're going to assume that by 2020 and beyond the installed cost of the PV system to the builder is going to be around this mid-cost of $3.

So here's where NEM comes in. The rule of the land currently is NEM2. And NEM2 says the blue line here are self-utilized kilowatt hours from the PV array. So that's how much of that kilowatt hour you're using onsite and not exporting. And the blue lines are compensated at retail rate.

NEM2 also says that hourly exports, every hour you're going to have mismatch between load and generation. And you're sending electrons back to the Grid, just like my PV system is doing right down here. I'm not using it. It's going back. So NEM2 says the compensation for those hourly exports is along this line, which is the NEM-adjusted retail rate. It's less than retail, but it's more than avoided costs.

It is possible that in 2019, that CPUC may actually gravitate towards this is what I would call NEM3. And they may keep the behind-the-meter at the same retail rate, but they may decide the compensate the hourly exports instead of a NEM-adjusted retail compensated and avoided costs. So we have to look at this scenario too and see how

that would impact the cost effectiveness of the PV.

This one is if the CPUC is really in a bad mood and they decide we're going to compensate everything at avoided cost. We don't think they're going to go here, but we did the analysis just to see where we might end up if they did. We think in the future we're going to be someplace between these two scenarios.

So we put everything that I just talked about together in one graph. Oops, I went all the way to the beginning -- there.

(Pause to adjust slides.)

MR. SHIRAKH: So for our analysis, we're going to assume this is where our future is going to go. It's what I call for now NEM3. That your exports are compensated at avoided cost. Of course, you have annual net surplus, that that's going to be compensated at net surplus compensation, which is only three cents.

So for our analysis, we're going to consider this and the cost that is in the middle. And those are represented by these squares here. And so the mid cost for PV and avoided costs are these red squares. And these red squares, as you can see, in all 16 climate zones, this is the line of break even. So all of these -- for all 16 climate zones were significantly above this line, which means even under adverse NEM rules and with mid costs for

PV systems, we're still cost effective in all 16 climate zones throughout the state.

MR. NESBITT: George Nesbitt, HERS Rater. So when you're saying the systems are cost effective are you actually using real utility rates to determine this, or are you still using TDV?

MR. SHIRAKH: It's all TDV based.

MR. NESBITT: So but TDV doesn't include things like minimum transportation charges, so what happens when you overproduce in a given month you get hit with a certain minimum fee. So even when we started in 2001 nobody sized PV systems to produce 100 percent of your site electricity use, because you'd already reached your maximum cost effectiveness before that point, with a utility rate schedule that didn't have minimum fees. So it seems like that needs to be taken into account, because without storage, most of these systems and probably some of them will be oversized, based on people's actual use, let alone predicted. They're going to be hit with minimum charges, which I think are now at what like $10 a month? My electric bill is 15.

MR. SHIRAKH: Yeah. So the short answer is that -- well, do you want me to respond to this or do you want be --

MR. STONE: I want to make a clarification.

MR. SHIRAKH: I don't want to open it up for general --

MR. STONE: I'll make it really short. I think George is wrong. I've taken a look at the tariffs that are being proposed and there is a minimum charge, but it has no effect. I mean it's not affected by how much you use. There's a minimum charge and that's the floor, but it has nothing to do with whether you over-generate or not.

MR. SHIRAKH: Yeah. And that was Nehemiah Stone.

Yeah, and then TDV is not perfect, but in our view it actually represent the actual cost of generating electricity. And it's fairly representative of the actual cost to the homeowner. And most NEM customers are going to be on time of use rates and then they generally line up with the TDV rates. And again we can improve it. We can debate it. But it's the currency that we have that we use.

So the point here is that the strategy that we've defined is fairly cost effective and even if the rates change it'll still be cost effective. And the point is that these sizes are cost effective. But in one of these climate zones, let's say 12, if you start over-sizing the PV system then the extra generation is not going to be compensated at retail or even avoided cost. So this dot becomes closer and closer to this line. And when it touches that line, then you're at the breakeven point,

which means that is the size that is breaking even. If you go beyond that size, then the homeowner is actually losing on their investments.

Go ahead.

MR. CHANGUS: Sorry, not to beat the horse here a little bit, Jonathan Changus, with the Northern California Power Agency. But with regards to TDV as kind of default, I understand kind of best available data and how that might be appropriate for IOUs. But I think -- and we'll explore this a bit more in our comments of things we've said previously -- I'm not sure that it works for a number of the public power communities. And that creates some challenges unless we've built in some flexibility or some other bits into the standards, so we'd love to talk with you more offline about how TDV does or does not work for 25 percent of the state.

MR. SHIRAKH: Yeah. That's a valid comment.

MR. CHANGUS: And just for the other 25 percent of the state as far as retail sales.

MR. SHIRAKH: Okay. Now we're getting into analysis for different strategies for the Reach Codes. And so up to this point we said we're going to have a PV system that displaces the electrical load on mixed-fuel homes. And that'll get you, if you combine that with energy efficiency features, you'll end up with an EDR of about 25.

But many municipalities, communities, they actually want to go lower than that. They want to go to 15, 10, 5, maybe even 0. So that means that we have to allow PV systems that are somewhat bigger than we just described. And then we have to couple those with other strategies, like demand response, demand flexibility, storage, pre-cooling and all that to get to zero.

The questions becomes how much can you oversize that PV system and still be cost effective and grid harmonized? So that's what these next few slides are for.

We had, E3, they looked at four different scenarios. One is the electric in a PV size -- that is a PV that is sized to displace the electric kilowatt hours, which is what we've been talking all along. But what is the PV size that brings the maximum net benefits to the homeowner? We have a PV size for option one, the kilowatt hours, but is that really the optimum benefit for the homeowner? So what would that be, so that's one scenario we looked at.

And the third one is the electric TDV is the PV size that's required to displace the electric on a TDV basis, instead of annual kilowatt hours. And we already saw that graph, but what's also important here is this graph, which is zero net benefit. And again as I mentioned, you can increase the size of that PV system

progressively. And that dot that I show is going to get closer and closer to the breakeven point. At some point, that dot's going to hit that line and you're at your breakeven point, beyond which you're not in a cost effective realm anymore. So we asked them to look at all 16 climate zones for this building and tell us where the breakeven point may lie.

And again I apologize if you can't read this on this graph, but what -- and I can't read it on the screen. (Laughter.)

So what we found was looking at Climate Zone 1 here, actually all climate zones, the PV size to kilowatt hours and the PV size for maximum benefit, they're always the same. So this is going to support our previous strategy that PV that is sized to displace the kilowatt hours -- I'm sounding like a broken record here -- that actually brings the maximum benefits. And that's why that became the prescriptive requirement in all climate zones.

What is interesting here is the green bar is the PV size to zero net benefit. That's the breakeven point. How much you can oversize the PV before you hit that breakeven point. And that's represented by the green lines here. So what we also did here, we calculated the ratio between just the breakeven point, the green line, and the blue line, which is the optimum point. And basically what

this tells you is that you could potentially over-size this system significantly and still be in a cost effective realm, albeit not as cost effective as before, because you're getting closer and closer to that line.

So this was for the 2,700 square foot home and NEM2 meet cost PV. And I must mention that the convention here is that everything that you see in blue is E3's. What you see in red is my notes, so I can understand what E3 was telling me.

So this is NEM2 for self-use and exports, Net Surplus Compensation for net surplus. Basically that's the scenario.

Now, we talk about how the NEM rules might change. And I showed those three bars and the CPUC might go to a NEM3. This is basically the NEM3 scenario that if the annual exports now get compensated at avoided cost. So there's going to be less compensation for the electricity that you're sending back to the Grid. And as you might expect the breakeven point becomes significantly lower. This is an important graph, because we're going to be using this scenario for allowing possible over-sizing for the Reach Codes. Because it's a more conservative approach that is avoided cost for exports and that's where we may land in the future.

So if you look at these factors here, if they

kind of settle around a factor of 1.6. Actually, what I did was I looked at these based on housing starts in each climate zone, I did a weighted average and the number that I got is about 1.6. So keep that in mind as we look at other slides.

So this is another scenario where retail is for self-use, but net surplus compensation is for export scenarios. So this is like the third scenario that we talked about. Actually, it's not the third scenario. It's basically behind-the-meter, you're still getting retail. But for anything that goes back to the Grid whether it's the annual surplus or the hourly exports, you only get basically wholesale rates, three cents. And as you can see, then the numbers get further depressed.

So basically what these things are telling you is that it matters a lot what happens to NEM rules in the future. And that's the point of this slide. So these graphs, they showed you what the PV system would do by itself. What sizes you need by itself, and how they impact into the cost effectiveness scenarios. But what if we couple the PV system with battery storage now? What would happen to these graphs if we added storage?

(Brief off mic colloquy.)

MR. SHIRAKH: So for these, we assume a battery storage system that's about 14 kilowatt hours. It's a five

kilowatt charge-discharge rate in a 90 percent round trip efficiency and $500 per kilowatt hour installed cost.

Now, we looked at two scenarios. Actually more than that, I have two scenarios here. This is the one I called the Santa Option. You know, what if somebody gave you this battery storage system, if Santa gave you free power at no cost to you? And if it doesn't cost you anything, what would that do to the breakeven and the cost effectiveness of the PV system.

And as you can see, expectedly, if you couple that free storage system with the PV system, then because those TDVs become much higher values these bars are actually going through the roof. So this is an indication that battery storage actually does improve the performance of the batteries.

So this next system, it actually includes the cost of the battery. So this one is without the cost and this one is with the cost. And as you can see, these numbers become significantly lower, but still pretty high. That if you couple storage with a PV system, you are still with these breakeven points that are quite high. And the blue lines here are basically the breakeven points. And that's the PV size to zero net benefit. And then the green bars are the PV size to zero net benefits and the green are the breakeven points.

So looking at all the strategies what we are proposing for the Reach Codes, again going back to this slide, is to perhaps allow an over-sizing of about 1.6, a factor of 1.6, if their storage is going with a PV system.

So again, all of this only pertains to Reach Codes. It has nothing to do with Part 6. But if there's a municipality, who they want to go to an EDR that's lower, then we're giving them this option then if they add battery storage then they can over-size the PV system. And we're limiting it to a factor to make sure that that system will remain cost effective under all scenarios. So that's where this is going.

So we're almost to the end. Go ahead, will you?

MS. DIFRANCO: Hi, Rachel DiFranco with the City of Fremont. So I appreciate that all of this analysis is done looking at the building energy usage only. But I do want to bring up a point about electric vehicle charging.

In the City of Fremont we have pretty high electric vehicle ownership levels already, already over 5,000 EVs. And when I did kind of a back of the envelope calculation, using the California Air Resources Board factor of 8.5 kilowatt hours per day for EV charging, it looks like about 3.5 percent of our current residential energy consumption at the end of 2016, is attributable to EV charging.

So assuming that moving forward, those numbers are going to increase exponentially as they have been. Over-sizing of a PV system by this factor really is not going to put us in the red. It really would accommodate for EV charging and still there would probably be grid energy usage.

MR. SHIRAKH: I can respond and Christopher will also have a response.

That's actually what you said is an excellent point. And it's another reason why we allow Reach Codes to oversize, because we think we may be concerned about what you just talked about. And we know that as people live in their homes the loads tend to go up. You buy another TV, a fish tank, a Jacuzzi and EV.

So that's another reason we think in the Reach Codes -- and in the minimum code, Part 6, we cannot assume that. We're not limiting people from putting larger systems, we're just saying we're going to give you credit for so much. But yes, in the Reach Codes definitely the place where your municipality could decide that some over sizing is warranted.

Christopher, did you want to respond before I go to the gentleman?

MR. MEYER: Yeah, just Christopher Meyer, I'm with the Building Standards Office. One of the things that

we're also looking at with EVs is just the coincident of load and generation. As you can imagine even on weekends, when your system is generating, if people are using their car to get to work or to do fun things on weekends, there is not a lot of time when your electric vehicle is parked at your house charging while your PV system is going. So if you wanted to actually charge an electric vehicle at a residence, we run into a thing where we don't want to try to find a mathematical or an accounting solution that has no engineering value.

So if you didn't have a large battery system that you were having to round trip losses in your home battery, and then using that home battery to charge your EV, the general assumption would be that your residentially-owned EVs are going to be charged by grid power. Which in that evening time may have a lower renewable percentage than it would if you could charge that EV during the middle of the day.

So and that's the kind of stuff we're trying to do where instead of looking at things over the entire year, and looking at the numbers and equaling everything out, what's the hour-by-hour? What's the actual realistic use? And then we can start identifying are there demand response, are the load following, are there other strategies instead of saying, "Okay. It doesn't work."

Are there strategies we can do to address that lack of coincidence that get towards solving the problem without creating grid harmony issues? So does that --

MR. SHIRAKH: And EVs are a great match in non-residential applications. For residential, it makes a bit challenging. Again, we're not trying to align it with the output of an array as Christopher is saying in order to work. Is there EV charging at that hour or not? So it's something to think about.

Go ahead, sir.

MR. CAIN: Joe Cain, with Solar Energy Industries Association. So you've talked about sizing assumptions for Reach Codes and for Part 6, and I understand we could kind of expand in the Reach Codes, but in the Part 6, could you help us understand the assumptions in the sizing calculations for lighting, for plug loads, for my kids playing Mine Craft and charging their tablets. What sort of assumptions do you have in there for what's covered?

MR. SHIRAKH: I can show you some of the screenshots that I have that has the plug loads in there. Again, we're using all the assumptions that are in the CBECC-Res for 2019 or '16.

And recently, with the help of the IOUs, we revisited the plug load assumptions. So we think we have fairly good data, but I am using what's in CBECC-Res. And

I can show you the relative values in a couple of slides.

So getting to the last part of this, thank goodness, and so I just have a few screenshots that showed you that the CBECC software is capable of doing. They're really improving the software. And it's going to be, I think, a good tool for both Part 6, and it's really going to make it easy for Part 11 compliance. And our goal is basically to allow people to go into the building and design it with the features that they want and then specify an EDR target, whatever that is, 0, 5, 10.

The software will calculate the amount of PV that you need based on that EDR target and the other features. And whether or not you can actually achieve EDR target without exceeding the PV size. It will basically give you a message if you are outside that range that you cannot get to this target EDR with the PV size that you have without violating the NEM rules. So you have to back in there and do some adjustments.

So the software can be used to size PV for Part 6 compliance, or lower target EDRs for Reach Codes, you can do that. Assess the impact of the battery storage or lowering EDR, the impact of pre-cooling and other DR strategies for lowering EDR, and heat pump-water heater DR strategies and its impact on EDR, among other things. These are not the entire list.

So this is the input screen from CBECC. You have all these choices here, there's a project analysis. So there's a tab. It's called EDR/PV. And under this tab, what you can do is you have two choices for your PV selection. This one is a detailed tab. The other choice is a simplified tab. And the simplified tab, you can use if you have only one PV array pointing in one direction and it's generally toward south. Then you can use the simplified direction. It will assume that you're close to about 170 degrees from true north.

If you selected detailed choice, you can have different arrays at different sizes and pointed in different directions. And this is actually fairly common and my own PV site is pointing three different directions. So I would have to use the detailed and actually specify the size and orientation for each. But if you have a simple installation, you can choose the simplified.

But what's important is up here. You have a check box that says "perform energy design rating." So this is a new feature. You check that and the software will actually calculate an energy design rating for your home, based on your energy efficiency features and the PV that you've specified here. What's also cool is that now, we have a check box that's a specified target energy design rating.

And here I put the number 0. So this is again for a Reach Code that they want to go to an EDR of 0. What it does, it will show in one of the result screens that you specify some PV system here that's going to take you to some EDR target. But this will tell you how much PV system you need to get all the way to 0. So you don't have to do iterations.

Before we had this, if I wanted to get to a target EDR, I had to manually put in different sizes and try to eyeball it until I hit that target. Now the software will do that. You just check this box, you put your EDR target that you wish and the software will calculate the PV size that you need to get to that. When I did that, it could really reduce the amount of time I was doing for analysis by about two-thirds.

Then you've got another tab for batteries. You specify the battery capacity is 14 kilowatt hours, is what we're assuming. Remember when I said for batteries you have two controls: one is basic, one is the advanced. So here's where this choice is. This one is the default choice. If you wanted to put the more advanced -- then you know I can't do it here because this is a screen shot -- you click on this and select the advanced.

This is the range of efficiency, about 10 percent. And this is the charge/discharge rate, about 5

kilowatts.

This is the tab on the building where you can actually select pre-cooling strategy. Pre-cooling actually can give you significant compliance credit, but again this is one of those things that the house needs to be in communication with the utility. And the idea here is that if you have a hot day in August, that you can actually pre-cool your house around noon when there's plenty of sun. It's mild. You can run your air conditioning system, bring it down to around 72 or 73.

And because these homes are so darned efficient in the envelope -- you know, you've got high-performance attics, high-performance walls, you've got great windows, blah-blah -- the chances are the house is going to coast through the day, the hottest part of the day, without using the air conditioning system. So that's what this pre-cooling strategy is giving you. But again it's one of those things that requires a program with the utility.

So this is the results summary that can be used to demonstrate compliance with Part 6. And I think somebody just asked me, "What about the plug loads?" So what you have up here are kilowatt hours and therms for regulated loads. That's the loads that we typically regulate through Title 24. So that's space heating, space cooling, indoor air quality, and water heating.

What you have down here, well this first one is PV output, so forget that for a second. You have inside lighting, appliances and cooking, and plug loads and exterior lighting. So these numbers together represent what we call unregulated loads, because Title 24 doesn't directly -- or prescriptively, we don't regulate them.

Some of these are regulated by Title 24, like inside lighting you have mandatory requirements. You have to put LEDs and blah-blah, but it's not part of the tradeoff. It's a fixed number. And these numbers like appliances and plug loads, which is totally outside of our control -- what is interesting here when you look at these kilowatts versus these kilowatts guess what's dominating? It's the plug loads. And we've done such a good job. You know, Payam showed you that graph -- sorry?

(Off mic colloquy.)

MR. SHIRAKH: You know you have that declining EUI for a home in time. What we've done is we've really squeezed the heck out of the regulated loads. So what's left is basically the plug loads that from here on out, we need to consider. Again, you know, we've looked at these assumptions we think they're pretty good.

So this one is the results screen that can be used for Part 11. And again I showed these boxes before, but what's interesting here is the target design rating

achieved, final rating, a design rating of I put 0. This is bringing it up to 0.1, which is close enough. And then it's telling you, you need a PV size of 5.8 kilowatts to get to the EDR target of 0.

So you did put in some amount of PVs in there that did give you some results, but if you wanted to know how much PV you needed to get to EDR target of 0, this will tell you. This way you don't have to go back and keep putting in different numbers to hit that EDR target.

So we just got the software, this updated version, a few days ago. We're testing it. We found some issues we're fixing and I'm hoping that in the next few weeks we can have a Beta version of it released for the public. And please when you use it, use it with a grain of salt, because these numbers could still change even if you find something in it.

Voila, I'm done. Any questions?

MR. CHANGUS: Jonathan Changus again with the Northern California Power Agency. And I guess I'm coming from a world where I spend more of my time in the SB 350 implementation. And I spend a long time at Air Resources Board about transportation electrification.

And there's a lot of times where codes and standards comes up quite frequently as one of our key strategies to addressing two primary issues that no one has

a clear idea what it means. And that's fuel substitution, transitioning from natural gas to electric in end uses, as well as fuel switching in the transportation sector to lower carbon and more electric vehicles.

And Zero Net Energy obviously, as you noted, has a history that dates back before all those conversations in 2006. And so I'm just curious, and we don't have to discuss it today, but going forward in addition to ZNE the transportation electrification questions I strongly agree with. Like how that's supposed to occur? How's that getting built in?

Because yesterday, Tuesday, I had a huge conversation in here in this building where CEC leadership made it very clear that's something they have very aggressive targets and standards for. And a lot of that charging is going to occur at home if we're successful in getting there. And they're pushing us, as utilities, to get there, and we want to get there as well. So I'm not quite sure if we've figured that all out and it's not easy math by any means. But there's a lot of moving pieces that goes beyond just trying to offset the load today at homes.

And that's where I really appreciate the cup is 80 percent full. And the Reach Code process, I think as we dive more into that, that's going to provide some of the flexibility. But I think there needs to be a larger

conversation beyond just is this cost effective on an individual building basis, to how are we addressing the fuel substitution and fuel switching goals that the state and this organization, the Energy Commission, of why they're embracing or are pushing in a lot of other venues. And I don't know if I understand today if we really hit that nexus. Like I said, it's a difficult question, multiple agencies, multiple stakeholders.

But I think we need to go a bit further on that and love to talk to whomever I need to at the CEC about how do we coordinate to make sure what we're doing at NCPA in our membership, as small publicly owned utilities, complement and support the broader aperture, because it is going to take a collaborative effort. It's always what are we going to do on fuel substitution? I go no, no, no. What are we, as the state and the utilities going to do? And as well as well as a variety of other stakeholders.

So I don't know if there was a question in there as much as a comment and hope to continue that dialogue.

MR. SHIRAKH: Yeah, we understand. And I have response and maybe others can also chime in, Bill or Christopher.

But our strategy here is to actually be fuel neutral, that provides a path in both Part 6 and Part 11 that's neutral between the two and address that in some

future standard in another cycle. But for this round we're basically going in a path that basically allows both mixed-fuel homes and all-electric homes for both Part 6 and Part 11.

And I understand the transportation. We've thought about it a little bit, but it's a challenge, because we cannot predict what homes are going to have electric vehicles and not. And how do we credit? We know all homes are going to have a dishwasher. But some homes will have EVs, some don't and when they're going to charge it? So it's a complicated stuff, so we thought for this round, we will not include it into the Part 6 basically. And kind of leave it up to the Reach Codes. They can decide if they want to --

MR. CHANGUS: I completely agree. Jonathan Changus, again with Northern California Power Agency, I think the challenge is that while there's elements within the Energy Commission that recognize all those challenges and are going in one course there's a very different message coming from other elements.

And I think that's where it gets tricky. Because if you, as the CEC recognize the challenges and are going to pursue that in your own policies and practices, but then look to utilities and say, "Now, here's all the stuff that while it's too difficult for us we'd really like you to do

instead," I mean that's where we want to be supportive. But we see some of those same challenges and it seems like we get mixed messages at times, so again that's kind of tangential for today on (indiscernible) --

MR. SHIRAKH: Well, here comes the big guns. Bill is coming.

UNIDENTIFIED SPEAKER: Get out of the way, he's here. (Laughter.)

MR. PENNINGTON: Bill Pennington, Energy Commission. So we have a scope question here, is what you're bringing up.

What this program is about is controlling the energy efficiency of buildings. And you're talking about bringing into consideration other loads that are not part of buildings. And so we have, for the life of this program, been talking about how to best manage the energy performance of buildings with all of the features of buildings that come in buildings. And so that's what this Zero Net Energy is targeting. That's what the EDR is about, is about that scope. We don't include other potentially significant loads that a customer might have in the Building Standards, in any performance way.

For example, swimming pools, we don't have swimming pool pumps built into the performance calculations. And let that trade off against whether you

have good windows and good insulation and so forth.

So with EVs, we come along with the same dilemma, problem. EVs are outside the scope of the building. And so you have a choice, potentially you could include the load of EVs in the performance approach. That might be a future idea. And then you might think about how you reduce that or how you fuel switch that or whatever. And you might have a calculus that would take into account your options related to that.

And you might even allow, with that bigger scope of the energy that you include, in those measures you might even allow tradeoff between what you do for EVs and what you do for windows and water heating and so forth or PV meeting of those loads. But you kind of have to consider both the load and the remedies in a change to the standard.

And particularly now when we have a low market penetration, relatively low market penetration, for EVs. That seems like a lot of guesswork about what would those loads be and how would you do it? It's probably not appropriate for us to do for the 2019 Building Standards. Maybe it's a future problem what we need to figure out what to do about. So anyway, that's my take.

MR. SHIRAKH: Bill, do you want to sit up there for now?

MR. STONE: Nehemiah Stone of Stone Energy

Associates. I don't want to go into everything I have on this topic right now, but I'd like to present it later.

But I've taken a look at one of the costs that is not included in the cost effective analysis and it relates to the topic what we were just discussing. And that's the cost of gas infrastructure. And there's a number of sources of the data, including a study that EPRI did for SMUD, including studies that were done for Palo Alto, etcetera. And the cost, there's a number of elements to it. One is bringing the gas down the street. Another one is bringing it from the main to the house. And the other one is the gas infrastructure inside the building itself, single family or multi-family.

And when you take a look at those costs, the net in incremental cost, counting the fact that heat pumps are more expensive, the net cost ranges between $2,000 and $3,000 per door, for multi-family. And between $3,000 and $6,000 per door for single family. Between 2 and 3 for multi-family and between 3 and 6 for single family.

If those costs were included in the cost effective analysis, when you're looking at a package for the prescriptive I'm pretty convinced that we would end up with the basic package being an all-electric. So I would like to present that data at some point. I realize this is probably too long of a thing to do right now, but.

MR. SHIRAKH: Yeah, we already talked about this at the retreat in Shannon. (phonetic)

MR. STONE: Yes. Yes.

MR. SHIRAKH: The point is if yeah really that cost saving is there, which it could very well be, to me that's a powerful incentive for the builders to actually build all-electric, because they will save $4,000 to $5,000 per home. So that to me is a good thing and the builders, if they're aware of it, that's what they'll do.

MR. STONE: Well, I understand it makes sense as a voluntary thing. But when you're setting standards, you should be counting all the costs. I mean, what you were saying earlier was that when you looked at cost effectiveness, you're counting all those costs.

Well, you're actually not, because you have to have electricity to the building. You can't run your lights on natural gas, so you have to have electricity. The cost to bring electricity to the building and the cost of the panel, etcetera, that's an embedded cost that you don't need to count. But the cost of bringing gas to the building and piping through the building, that is not an embedded cost. That's a choice that you make. And if you choose not to do that, you can save, depending upon where you are etcetera, you save anywhere between $2,000 and $6,000.

One of your Commissioners made a presentation, quoting KB Homes, saying the reason they're going all-electric with some of their new sub divisions is because they found that it's cheaper by $4,500 per home.

MR. SHIRAKH: Okay. Thank you. Well, send us that study. Thanks.

MR. DELFORGE: Pierre Delforge from NRDC. I would like to thank staff for all these presentations, a lot of the detail of information is extremely helpful. We'll be taking time to go through it and reply in our comments in writing.

I wanted to just offer a few general comments. This is obviously an important co-revision given the state's climate and energy policies and the impact of the building code, particularly on SB 350, SB 32 and even in longer terms, because buildings built today will last 50 years or more on our long-term climate goals.

From our perspective, energy efficiency remains the most important and cheapest way to achieve these goals. And we really appreciate the Commission's approach to sunset the PV credit, which was meant as an on-ramp for high-performance attics, walls, QII and I forget the last one. But I think it's critical as time now to move to make sure that these efficiency measures stand alone and that the PV requirement stands alone as well.

And efficiency remains critical to minimize building energy use, even when the sun is not shining. But people still need to cool their home in late summer evenings or heat their home in the winter mornings.

Generally, we support the transition to the EDR metric and the two-tier approach that does not compromise energy efficiency. The mandatory PV requirements and Commissions's looking at EDR credits for grid harmonization strategies, this is really important to help integrate renewables and mitigate consumer electric bills.

The one point which I'd like to mention, is also the fact that while the code aims to save energy, climate remains one of the overarching policy priorities in the state. And we really appreciate the Commission's approach to try and be fuel neutral and not to create additional barriers with the size of the PV system. But there remains some barriers to re-level the playing field between electric and gas and mixed-fuel homes. Particularly on water heating, which does not have currently an electric baseline in the code. And I understand why it's not there. But it remains a barrier to being able to do an all-electric home or just water heating, electric water heating in the home.

It's important to ensure that builders can comply with the code, whether they use electric water heating or

gas water heating. All of the same efficiency, they should be able to achieve the same code compliance and this is not the case today. In 2016, with the PV credit, you can pretty much get there, but in 2019, without the PV credit it's going to be a challenge. So I encourage the Commission to find a way to ensure that there's a real level playing field in terms of particularly water heating technologies are the ones that have the most disadvantage today.

The other one is the one that Nehemiah just mentioned in terms of full cost accounting. To make sure that when we look at the cost of running an all-electric versus mixed-fuel home, which TDV is, it's basically a consumer cost metric. Let's look at the full cost of doing that including the cost of bringing gas to the home.

My last point is around Reach Codes. I really appreciate the Commission's effort to help and encourage cities to lead towards Zero Net Energy, with model Reach Codes. The one thing I want to mention is some cities may choose not necessarily to go towards Zero Net Energy per se, but just to -- or in addition to trying to reduce carbon as much as possible. And that's going to require not to necessarily just to zero out EDR, but to look at strategies to reduce carbon including electrification not gas loads.

So with that said, I look forward to working with the Commission and stakeholders on this important proceeding. Thank you.

MR. SHIRAKH: Thank you, Pierre. I appreciate it.

Bob, did you want to?

MR. RAYMER: First off, just administratively speaking, how long do we have to get written comments in to you? Because we could stay here for a couple of days and then cover these, all these moving parts here kind of make your head explode.

MR. SHIRAKH: We appreciate two weeks from today, but --

MR. RAYMER: Two weeks. And like a lot of the other proceedings that are going on, I'm assuming that once somebody submits a comment, it'll appear and automatically notify the people that are on the notification list that the comment's been submitted? I really want to be able to read what some of the other groups are saying --

MR. SHIRAKH: We have a docket and all the comments will go into the docket. So if it's submitted to the docket you will get a copy.

MR. RAYMER: With regards to the Reach Codes, it seems very clear that battery and PV are going to be the key approach there. And with regards to comments that

Jonathan was bringing up, I'll just to start to say at the 30,000 foot level we're seeing local jurisdictions, air quality districts, local planning and land use management teams from jurisdictions that group together and look at SB 375 issues that are out there for local project approval. That more and more what's minimum code standard is not of interest to them.

They're looking at rather significant issues of how do we just make sure that your new project, this 10-20,000 unit projected project is simply not going to impact the Grid? And that we're going to see rather significant reductions of air quality and greenhouse gas reduction or massive, that goes way beyond the scale of the minimum requirements of Part 6.

And one of the things that we're kind of running into is while the air quality district may work with the builder and come up with a nice plan, we've had a lot of push back recently from utilities who weren't really part of that decision-making process. And who are a little bit skeptical and actually opposing some of the projected designs. And once again, that gets to the over-sizing of the system.

But to me, if you're able to do a good job with the battery plus PV component here, as we do the Part 11 stuff, that will be a big help. It would be nice if the

IOUs were here every day and working and playing well with everybody else and we were playing well with them. But the fact is when you're doing a project, they could come in at the last minute and basically say, "We're not going to hook up the house, because you've oversized it by two or three kilowatts."

And we want to make that that doesn't happen. That's the kind of thing that really costs the builder money, having to go back and try to renegotiate why everything's ready to go. And we want to try to prevent that.

A last comment, and like I said we could go on here for hours and hours giving the moving parts here, but with regards to gas we understand where the state wants to go. And they want to see an all-electrification down the road. A huge problem we're having is the consumers are giving a huge pushback on this. In that the vast majority of them, right now, would be aghast at the thought of buying a house without a number of gas components that they've grown to love and live with for decades.

And so this is going to take a huge consumer behavior choice modification as opposed to just some changes and regulations. Because we've got to be able to market these things.

So lastly, we'll look forward to seeing the

comments of others. A lot of good points have been made today. So we'll get our written comments in.

MR. SHIRAKH: Thank you, Bob.

George?

MR. NESBITT: George Nesbitt, HERS Rater. Every building that exports electricity to the Grid is part of the problem. The duck curve is a problem. It's a growing problem and it's going to drive a lot of things. Without an equivalent increase in electricity use in the middle of the day, or storage, we're screwed. It's just quite that simple.

The question is what is our goal? We've got goals of 50 percent electricity generated by eligible renewable, because we have non-eligible too. So if we have a Grid that's already about percent, we're going for 50 percent. Why does a building need to generate 100 percent of its electricity with renewables?

Now, TDV does include renewables, but the thing is TDV is a cost. And it includes a lot of things, but it ultimately comes down to a cost thing as opposed to actually looking at the source of the energy. In the middle of the day, I think what we're probably hitting 75 percent of our electricity is renewable? So without consuming more energy in the middle of the day, we've got a problem.

Also, our goals are really about carbon reduction. So we're not calculating carbon in CBECC currently, are we? We should be. We have been in the HERS software forever.

A couple of other things I just want to hit on. Since the software is a rating system, and it is the HERS rating system, and it does include those things that are not part of Part 6. We ultimately need more ability to model and accurately model, as well as get credit for being bad or good, whether it's lighting or other appliances.

And I just want to make a comment about solar ready. So we're really going to have to require that buildings are ready to add storage or electric vehicles, because it's cheaper to do it now than it is later.

MR. SHIRAKH: Thank you, George.

Any other comments in the room, whoever gets fastest to the podium.

MR. BLUNK: Yeah. Hi, I'm Scott Blunk, and I work for the TRC Energy Services. And I help PG&E implement their New Homes Program for multi-family and single family.

And just a couple of comments, the appliances and plug loads are a driving force moving forward. And what's being looked at in terms of home energy management systems that can do the same thing as some sort of demand response?

I mean that's kind of going to be going into the code, we talked a ton about batteries and PV, but I think this is part of the future moving forward.

Also I guess cost effectiveness, I understand the prescriptive path is being used in calculating cost effectiveness, but running these new construction programs what we find is builders aren't building prescriptively. I think everyone in here knows that. They're using the federal preemptions to go well beyond on those three: water heating, space heating and space cooling. So ultimately, what's being built or what we see in the program and not across the board, but in a lot of cases, we find negative electric savings according to code and positive gas savings.

So they're meeting code, but they're doing it with negative electric and over-savings in gas. And again, this kind of goes against the whole. I think a lot of us want to see an all-electric future because it's less carbon, but the way the code is being manipulated or used to the advantage of the builders, they're actually using more electricity than code allows prescriptively, anyway.

MR. PENNINGTON: Scott, can I ask you. Do you know what's driving that? What do you see as driving the negative electricity compliance margin?

MR. BLUNK: Yeah. That's a great question. I

mean a lot of it is the federal preemption, right? So largely there's gas water heating and space heating. So those two, you can easily bump up the efficiency of those two appliances to achieve compliance. The other one is the space cooling, which is usually electricity. But so orientation has a big impact on it, but also it's two of those three in the federal preemption. They just max out the efficiency on two of those three and don't do walls and windows and attics.

MR. PENNINGTON: So they're not doing high-efficiency air conditioners?

MR. BLUNK: They are, but it's not as beneficial as the two gas appliances they're doing. And I can show you data on it. We've got lots of examples.

MR. SHIRAKH: Why is that a problem? At least they're -- we know they're worried about reduction in carbon and they're using condensing furnace and water heaters to reduce natural gas then I imagine that's a good thing.

MR. BLUNK: And it is a good thing, right. But we're not building according to the prescriptive code, which I think the code assumes. So ultimately they're using more electricity than what were predicting in the software, or what we want to predict in the software.

And then my last comment is just I think we all

struggle with the term ZNE. It's hard to talk to consumers about what a ZNE home is. It was hard under ZNE TDV and now we're going to ZNE, kilowatt hours and like --

MR. SHIRAKH: We shouldn't be using the word ZNE, yeah.

MR. BLUNK: We shouldn't be using the word ZNE, right. Thanks.

MR. RAYMER: Could I ask a question?

MR. SHIRAKH: Sure.

MR. RAYMER: Bob Raymer, CBIA. Given your discussion of the regulated load and the unregulated load and the massive -- I would say now disparity, given the 35 years of dealing with a regulated load -- how do you necessarily know that it's not what we would say an undocumented increase in the plug load? You know five or six teenagers in the home, using a whole of stuff at a particular time, as opposed to the gas usage that's creating this disparity. I mean there's any number of things that could account for that increased electricity usage that could be impacting here. And so unless you basically have the house discreetly monitored, we may not know where that's coming from.

MR. PENNINGTON: He's talking about compliance margins, not actual.

MR. RAYMER: Okay.

MR. SMITHWOOD: Brandon Smithwood, with SEIA again. There were a few comments earlier that kind of hit on the -- from Mr. Pennington and the gentleman from NCPA, in particular -- about the building code is efficiency focus, but we're really working in the context of our climate goals. And I'm looking at the proposed code and I'm seeing a tight envelope gas home with an undersized PV system.

And if you look at what we know from things like E3's Pathways Report or studies out of LNBL, Lawrence Berkeley, we know that we need to move to a fully electrified future in the timeframe that these buildings that are going to built under this code, are standing. And in that the same timeframe that the cost effectiveness evaluation is looking at. You know we need to do that incrementally from Lawrence Berkeley. We know we need to have electrification on the margin be 100 percent by the mid-2020s.

And it seems that we're making this move, because of assumptions about issues that I would argue in the timeframe that these buildings are going to stand are really transient. So the first is questions about different rate designs and tariffs, so we've talked a lot about what's the future of the NEM tariff. Different assumptions about rates that batteries would be -- the cost

effectiveness of your battery is really going to assume a lot of what your rate designs are. These are relative near-term issues.

And one which was a big one, the duck curve, I want to touch on that for a bit. Because I think we're kind of conflating ZNE with the deck curve in a way that I don't think actually matches reality and could lead to some unintended consequences.

So I think first, like where we are right now. This is supposed to be a huge over-gen year. Our snow pack is at 160, otherwise at its peak 164 percent of average. What we've seen thus far this spring, as of April 15th, was a maximum of 1.8 gigawatts of curtailment at any one time from solar. We have 18 gigawatts on the system. At most of that generation we've curtailed 10 percent and I think that's been on four days. Most days, it's several percentage points of the potential solar generation getting curtailed.

It was referenced to August curtailment. We have to remember there's system curtailment and then there are transmission constraints that can cause a random curtailment. We don't have duck curve issues in August. We have duck curve issues in a handful of spring months.

Now if we kept moving towards our climate goals, because we know we have to be 60 percent renewable by 2030

RPS, plus everything we have to do to meet SB 32 goals, we're going to keep putting more on the system. But we're also going to have to do other things that will integrate those renewables. We have to do all the electrification, the regionalization. Right now, when we're curtailing, we have all these thermal generators, some of which aren't dispatched by CAISO running. It's the reason why the renewables are getting curtailed. It's because the thermal generators are running, some of them not responding to the market.

So part of the duck curve can be electrifying all these loads, part of resolving the duck curve. But we're really conflating two issues here by saying that the decision on ZNE should be driven in significant part by considerations of the duck curve.

So anyhow, a lot more to discuss, we will have extensive written comments I'm sure. But thank you for all your work on this and for hearing me out.

MR. SHIRAKH: Thank you.

Noah?

MR. HOROWITZ: Good morning, Noah Horowitz with NRDC. I want to re-echo the comments from my colleague, Pierre Delforge, and add another one -- that we support the shift to the EDR-based system. We think it's an elegant way to move forward. You have one square where you have to

meet it with just the efficiency. And you're eliminating the tradeoff to make sure the building is efficient throughout the whole day and we think that makes a lot of sense and we're very supportive of that. Then there's the second score one needs to achieve, as I understand it, with the PV being installed.

So one question that we didn't talk about, and maybe we talk about this after lunch, I'm not sure, is what if the site is not deemed suitable for the installation of PV onsite? Do you need to make it up elsewhere with the within the community or other measures in the home? And also, what would be the definition if a site is deemed unsuitable for installation of onsite PV? Let's make sure early in the process there's a definition that's shared. And that needs to be airtight, otherwise that could become a huge loophole that's gamed. Thank you.

MR. SHIRAKH: So what they haven't shown here, which is not quite ready, is the prescriptive language for the PV and with all the exceptions that we're thinking about. So we're going to deal with some of the scenarios you suggested through that language and the exceptions. That, you know, for instance if you're building where there are redwood trees all around and it's shaded, I mean it can't require PVs, right?

So we're thinking about some other scenarios

where you cannot have a standard language that's impossible to meet in some situations. So we have to find and either create exceptions for them or some of variations that you just mentioned through community solar or things like that.

MR. HOROWITZ: Will you be able to cover that in the May 23rd meeting?

MR. SHIRAKH: Yeah, I'm hoping, yeah. The question was if that language would be available at the May 23rd meeting and the answer is yes.

MR. BLUNK: Hi. Just one more comment, Scott Blunk here.

But just by and large, I want to say that the statewide IOUs, through the residential new construction teams that we work with support this change going toward the EDR and all of the 2019 codes and we've wrapped them into our new construction programs. And I guess I should clarify, I don't speak for all of the IOUs, but they all have kind of agreed to adopt this methodology in our new construction program, and we're supporting it. So any communication moving forward, we'd love to work with you and help move the code in that direction. So thanks.

MR. SHIRAKH: Thank you, Scott.

Questions? We want online questions, too.

MR. ZIMMERLY: Yeah, Brian Zimmerly with Tesla, just a quick question about the PV plus battery. I'm

wondering about how we might get questions answered about how you assume the control of the battery that was operated? Obviously, that asset is really dynamic and we want to understand or make sure that the full value is being benefited as it's shown here.

MR. SHIRAKH: Right, we have -- Zach, can you answer that?

MR. MING: Yeah, so just briefly, the TDV is essentially an hourly price, is one way to think about it, and so there's 8760 (phonetic) different hourly prices that the model has. And the battery is more or less being dispatched to arbitrage those prices, where it's charging during the cheapest hours and discharging during the most expensive hours. And then obviously there are constraints such as the maximum capacity of the battery, round trip efficiency losses, and such.

So that's broadly how the battery is being dispatched. There is some logic where we can show you specifically some of the more detailed algorithm for how it does that, but it's pretty simply just arbitraging some of those hourly values.

MR. ZIMMERLY: Okay. Yeah, and that makes sense. And I think part of my question is do we assume that the PV array is serving onsite loads first and then charging battery, or vice versa? Because that would sort of impact

how much battery utilization you would have and how much benefit you could realize in those sort of peak PV periods.

MR. MING: Right. So how they are, depending on the rate structure that's assumed, the battery does have some different rules that it has to follow. One of the rules that the battery always follows is that it cannot charge from the Grid directly. It can only charge from the PV output.

MR. ZIMMERLY: Right.

MR. MING: As far as the hourly values that it's seeing, that it's using in its sort of optimized dispatch decision, that's dependent upon the rate structure. So in some rate structures exports are less valuable or more valuable. And so it can change its decision about whether to export to the Grid or save that energy to offset its own load later in the day. And those depend on the three rate structures that we looked at.

MR. ZIMMERLY: Got it. Excellent. Thank you.

And just one follow-up, I wanted to comment on I think it's the slide with the various columns about the sort of optimized battery use in sort of a utility dispatch scenario. And one thing I just wanted to comment on there is that I understand that an optimal utility optimized dispatch of the battery would significantly improve the benefit and potentially reduce the size of the required

array size. But it's worth commenting that the fact of the profile of the Grid, we might consider sort of incentivizing a larger PV array to maximize the benefit of that storage to create stranded value in the battery itself.

So for example, if you have some of those PV array sizes were as low as in the ones and two kilowatt hour range. You may be actually stranding some of the value of the --

MR. SHIRAKH: The PV size is we're talking about is much larger than that. It's basically, for mixed-fuel homes we're talking this range, three to four, that's the mixed-fuel. And all-electric it's a little bit larger, so we're not talking about one or two.

MR. ZIMMERLY: Okay.

MR. SHIRAKH: Those aren't going to be -- it has to be if you put a one kilowatt system into the software, you're not going to get anywhere close to the ZNE.

MR. ZIMMERLY: Yes, I can't remember the sizes exactly, but I think the general point is that you may be actually to utilize those larger array sizes there in column four and five, with the battery and sort of even further improve your grid harmonization.

MR. SHIRAKH: Yeah. Again, this whole discussion is for Reach Codes, so what we're defining here is the

minimum that they can put in and how much credit. If people want to put in another kilowatt on top of that we're not going to give them credit here, because they've already hit a score of zero.

MR. MEYER: This is Christopher, I think just one thing I might clarify, on one of the slides Mazi was presenting multipliers over the normal system that could work cost effectively if you added a battery. So some of those 1.2, 1.8, those are multipliers rather than the PV size.

MR. ZIMMERLY: Yes, got it.

MR. SHIRAKH: This is the multipliers we're talking about beyond what's needed in Part 6. That if you oversize by this amount and then add some DR strategies, you can get to a score of zero.

MR. ZIMMERLY: Thank you.

MR. SHIRAKH: You've got one more chance.

MR. STONE: One more chance this morning, all right? Nehemiah Stone, Stone Energy. I'm going to make a comment that you've heard before and at the risk of pissing you off, I'm probably going to make it every time.

You need to be looking at what works for multi-family differently from single family. And here's the examples from what came up this morning. PV costs are different. You put up costs there that it's around $3.50

per watt. Well, for multi-family, because it's larger systems, fewer inverters, the cost is down to about $2.50 a watt. Gas infrastructure costs are different and I'm hoping that you do include those in the cost effective analysis. You'd have to look at those differently for single family and multi-family.

Site PV availability is different, a lot of multi-family projects will not be able to have the same amount of PV per square foot as single family would. Storage costs are different and indoor air quality is a much different issue. So I want to urge you again -- and I will until it seems to make a difference -- to look at multi-family differently, have a different set of requirements for multifamily than single family.

MR. SHIRAKH: No argument, Nehemiah.

Can we go to someone on the line?

MR. WICHERT: So this is RJ Wichert of Building and Standards office. I'm going to go ahead and read a few of the online questions and then we have a few verbal questions as well from online.

The first is from Mark Gallant. "How did you achieve the 4.02 margin for the water heating?" This is earlier on in the presentation, Mazi.

MR. SHIRAKH: .02 for water heating?

(Off mic colloquy.)

MR. SHIRAKH: So I modeled this one, I think with a -- this is a mixed-fuel home. And I think I modeled it with a condensing water heater. Again, this is just for demonstration purposes, but I tried to put more efficient features here. So you know you can see the proposed EDR is slightly lower than the standard design and the difference is the water heater. I put a condensing instead of a standard tankless.

MR. WICHERT: So our next question is from Micah Mitrosky, "Will some of these concepts be being proposed from the residential sector carry over into the approach for commercial ZNE?"

MR. SHIRAKH: The answer is some of them might -- yeah, my answer is yes. I don't know which ones though.

Yeah. I mean the general approach I think is going to be the same in between both that the goal would be to maximize self-utilization and minimize exports back to the Grid. I think those are the most cost effective scenarios and with the least amount of impact on the Grid. But the specific strategies could be different.

For instance, while EV is not a very good match for residential, perhaps because most of us are not there during the day, but we all drive to a building and that's where we can plug in our EVs. So this could be actually a pretty good strategy for avoiding exports to the Grid for

non-res.

But many of the things will be the same. We'll be looking at energy efficiency first. We've been improving non-res energy efficiency over the years, but because we've been so focused on 2020 ZNE we've kind of let it go for a couple of cycles. But we need to revisit some of the U-factors for envelope. And some opportunities for air conditioning is a big load in non-residential buildings and funding strategies to limit those loads.

MR. WICHERT: So our next comment is from Charles Eley, "The DOE common definition of zero energy buildings towards EV charging is exported energy. The energy is used offsite."

And then we'll go to the verbal comments. I'm going to go ahead and call on Rachel. I'm going to unmute you now. Ready? Great, go ahead, Rachel.

MS. GOLDEN: Great. Thank you. This is Rachel Golden. I'm here representing the Sierra Club members in California. I appreciate the presentation today and all the work that went into it. I found it very helpful and a very clear presentation on what's a pretty complex topic.

Our membership feels very strongly that if California makes progress de-carbonizing the Grid, that it's essential that our building codes keep pace with these developments. And ensure that California's buildings

really transition to increase peaks of high-efficiency electric technologies, particularly for water and space heating, in order to support renewables integration and to help mitigate curtailment through thermal energy storage.

I think it makes sense that EDR doesn't penalize electric buildings by requiring more PV. But more than this, I think that we really hope that compliance can be designed in such a way as to actually incentivize electric buildings over mixed-fuel buildings given the significant climate efficiency environmental and cost benefits of electric buildings.

And overall within the constraints of Warren-Alquist, our membership wants to see the Energy Commission make greenhouse gas emissions a more predominant metric for code compliance, in order to better align with our state climate goals.

I also wanted to add that I agree with the gentleman earlier who said there's a need to include the full cost of gas in the cost-effectiveness calculations. But add that it's also important to include not just the gas connection costs, but also an adder for the cost of upgrading natural gas infrastructures, the cost of methane leakage and accidents like Aliso Canyon.

We also have several concerns about how TDV is calculated and the use of gas as a reference fuel, but

we'll provide these concerns in our written comments. Thank you.

MR. SHIRAKH: Thank you.

MR. WICHERT: So our next verbal online question is Sean Armstrong. Sean, I'm going to unmute you now. Go ahead.

MR. ARMSTRONG: Hello, everyone. Thank you very much for an excellent presentation this morning. I noted when you were going through your slides, Mazi, that you have as the space heating fuel, gas. And you were also choosing, it seems consistently even for an all-electric building, to say that gas is available on the site even if gas is not plumbed into the building. And that is not in accordance with how investor owned utilities charge a house that has electric space heating. They have a separate tiered rate that's twice or sometimes three times the baseline. And therefore are larger amounts in all the next tiers.

I don't understand why, in today's environment, that is the current default. And why the language you have there in the CBECC-Res table itself you're saying is gas available onsite is the definition. Whereas for a utility that definition is, do you actually have an electric space heater or do you have a gas space heater as your primary, or exclusive more importantly, space heating choice?

That's true for PG&E, SDG&E, SCE.

I don't see harmonization between the actual rate that's charged and the definition of how that rate is charged. And what seems to be the same choice that you have within CBECC-Res and within EnergyPro, which uses different language. And within CBECC-Com, which also uses different language. It seems that if you were to support language that allows people to say there is no gas delivered to the space heating, which then sets up a different -- in the real world, an entirely different rate structure, that would support electrification profoundly.

We do this all the time now, because we realize that this is an important real-world impact of electric space heating. And so we make sure that our CBECC-Res and CBECC-Com -- if we can in CBECC-Com -- we make sure that it shows electric space heating as the gas not available.

We get fantastic compliance. We get the highest compliance results that you can get. We get up to 50 percent in residential and over the 2016 code. You can't get that far with gas appliances at all.

Now, that is also true in the real world, when we studied in the real world actual rates we've found that all-electric homes with the highest efficiency electric devices, which are cost competitive with the 95 to 98 percent ASU and energy factor tank -- in that circumstance,

the real world bills are lower. And this actually matters to all the load up of housing developers and the tenants that we serve, which now is up to 6,000 residences that we helped. And of those about 1,500 have been working electrification, either to their the new construction or through retrofit. This is the cheaper way for low-income residents to power their homes.

So I think it's important on a social justice perspective. I think it's important for accuracy. And I think it's also a very simple solution that would show electric houses as having better TDV values and being more cost effective, which is true. And so I think that one little toggle would harmonize it with the real world and the language that supports that little toggle, that button. That is an important solution for you to focus on.

I thank you for hearing those thoughts.

MR. SHIRAKH: Thank you, Sean. We'll look at your comments and we'll have a response, appreciate your time.

Any others? Go ahead, sir.

MR. CAIN: Joe Cain with SEIA, so several speakers and commenters have mentioned that -- you know, brought us back to the idea that AB 32 is about carbon reduction. And one really good way to reduce carbon is to power homes with sunlight, power transportation with

sunlight.

Years ago, Amory Lovins published a book called "Reinventing Fire." I think we are pretty much at that stage right now in that we need to reconsider everything. I know that a lot of us, several of us in this room that I see, have been doing this on this standard for over 30 years. But I think it's time to open our minds to a substantive change.

And in Bill's comment about -- and I hear others of course -- this is about efficiency and it's about a building and it's about just this little constrained system. The question is if the scope becomes outdated, based on carbon goals, is it time to rethink the scope? Is it time to re-invent fire?

And so for instance when I hear a lot of conversation about -- I ask the question of if the furnace, the water heater, the condensing unit, the cooling coil, are those part of the building? And I generally hear the answer, "Yes." But those same people that would answer that question with yes, if you ask them if a PV system is part of the building, they'll say no. It's just something that we kind of want to push it away and push it aside. We like it, but we don't want it to get into our code.

And so I'm asking to reconsider everything. And for instance the LCCA, I know we're bound that that by the

legislation and it does not include carbon. You know, the CBECC, and I heard a comment today about whether CBECC should include carbon. I know the LCCA has changed before. I know that legislation has changed before. Is it time to rethink how we address that we should not be based only on costs, the life cycle cost to justify things?

We've been talking about ZNE for residential for a decade now, and by 2020. In that decade, building science has changed dramatically and that decade cost of renewables has changed dramatically. In that decade we've now got energy storage systems ready to be installed. And so if we push out -- what I'm going to advocate is let's not go almost zero or almost ZNE and push it out to what might be the next cycle. Or next cycle we might say we need to push it out another one again. So I'm kind of asking let's not kick the can down the road.

I know that there's some serious technical issues to be resolved, but I think that if we find the political will to resolve those questions we've got a lot of smart people in the room and a lot of people that are paid to solve problems. I think these are solvable problems.

And if we push out residential beyond 2020, what do we think about commercial? Is it 2030 or is it not 2030? Should be believe what we've been hearing or should we not believe what we've been hearing? We have heard

Governor Brown say that California will remain the industry leader even when the federal government is not. So I'm going to say that let's keep that leadership and let's keep pushing and working hard.

So like I say, the scoping thing, I think that we might even consider a change in scope for the book. I've seen that happen with other books. So I've even seen title changes of standards when they improved the scope. So let's rethink all of that during this next couple of weeks and on through the development process.

I want to say that SEIA is very supportive of quality envelopes and building efficiency. But we are also very supportive of builders having a choice to find the most cost-effective solution. And so I know that we can show that HVA and HVEW is cost effective. I know you've said today, you've shown that solar renewables, PV specifically, is cost effective.

When you get to a certain point in the envelope, and you're somewhere on that curve of diminishing returns, the question I would ask is which option, as an incremental change, is the more cost effective solution? And I've heard through multiple venues all over the nation, "Well, we don't want any tradeoff to weaken the envelope, to allow any weakening the envelope."

We're now talking about, in my opinion, not the

difference between a good envelope and a bad envelope. I think we're talking about the difference between a very high-quality envelope and a very heroic envelope, to where we're super-insulating. And I know there's value there in some cased, but I think I also advocate for builder choice. And so which is truly cost effective, when do those curves intersect?

And also again which -- when you're looking at which is more cost effective between heroic insulation measures and renewables, which are pretty easy to do -- which one reduces carbon in addition to reducing energies at the meter?

And the last thing I will say is let's not forget about solar thermal. It still exists. We've got CFI thermal. I know that our focus in on PV, but I just wanted to go put in that last little reminder that solar thermal is still there and that industry still survives and hanging on by a shoestring. But we could do something to work on bringing back thermal. Thank you.

MR. SHIRAKH: Thank you. No other comments online? Okay.

So what's next? Do you want to break for lunch or come back?

MR. MEYER: So this is Christopher Meyer. That's a question we have for people. We have the next talk is

going to be fairly short, because it's really focusing on 2016 Local Ordinances. Ken Rider worked a lot on this and we just want to sort of bring it into the fold on what we're doing, so it's a fairly short presentation and there might be some questions on it. So if you guys want to just power through it, I know --

MR. SHIRAKH: I think the presentation is short, but I think the follow-up Q&A may not be that short, Christopher.

MR. MEYER: Yeah, and it just depends. Because it's like we will remind people that there will be additional workshops on the 2019 Local Ordinances and also Part 11 Reach Codes that'll come later in the process, so this is not intended to be that workshop. This is really just talking about a model local ordinance that will help local jurisdictions adopt PV ordinances during the 2016 cycle. To sort of be those incubator programs to what we're trying to ultimately get on all houses in the 2019 Standards.

So if people are comfortable, we can do that now and even if we have a little later lunch and then people can get back to where they need to go. Or if people need a lunch now, we can break for lunch and then have that short session afterwards.

MR. SHIRAKH: Myself too, I --

MR. MEYER: Do you guys just want to break until noon and then we'll stop or just take ten minutes if you just need to stretch your legs? So why don't we come back about 5 until noon, 11:55, and then we'll keep going. Thank you.

(Off the record at 11:47 a.m.)

(On the record at 12:05 p.m.)

MR. MEYER: Hello, everyone. We'll get started again on this. As I said this is related to the 2016 Building Energy Efficiency Standards and Local Ordinances. This is an effort that actually came out of the Renewable Energy Office with help from Marshall Hunt over at PG&E. A lot of work from Davis Energy Group, Misti Bruceri, I believe, and Associates.

But yeah, Ken Rider put a lot of effort into this. And since it falls under our purview in Building Standards to make a review on these local ordinances, it just made sense to bring it into our house and work with him on this and support it. So only 20 of my slides here are in conflict of what he wanted to and complained about it. Sorry, I'm just messing with Ken.

But okay so a lot of these are sort of high level. I'll go through them fairly quickly, but those of you who have heard me talk about local ordinances before, I recognize basically the value of local ordinances incubator

programs for things that we'd like to do in the future. Things that may not have been cost effective or didn't work in enough climate zones, so it was hard to sort of incorporate them. But a lot of the locals who understand what their citizens would like to do, where their interests lie, what their climate zone that they're in, they sometimes run into solutions that are very elegant and work locally. And it's great for us to see those happen and sort of see the successes, so we can learn from them. And it gives us actual real data to base future codes on, rather than anecdotal information from different stakeholders.

So as I said whether you call them a Reach Codes, or Local Ordinances, there is a slight difference. It's like you have things that will go into sort of Part 11, CALGreen and things of that nature, that'll be different than the Reach Codes at a local ordinance. This is more helping the local ordinances find ways of easily adopting PV ordinances, in this case.

And cost effectiveness has been a big hurdle in some cases and so the effort that these gentlemen and ladies did was instrumental in making that an easier pathway to a simple ordinance that is cost effective in all the climate zones.

So basically in the past, just like we've seen

some net focus on efficiency at the core of solar, we saw recently with Santa Monica that they went actually towards full ZNE, so we're going to be watching that to see how that works down in the Santa Monica area.

One thing that's like people sort of they talk about the Energy Commission having to approve these local ordinances. It would probably be more correct to say that they've been approved already on a local level, but the Energy Commission has the responsibility to make a finding that that ordinance demonstrates a reduction or diminution, or however you want to say it, in energy consumption over the standards. So we don't actually look at all of the minutia of those. We really focus on the local ordinance and how it impacts energy consumption.

So we'll go through some of this fast, because Mazi and others talked about these briefly, but there's a lot of things that our building codes -- it'll focus on efficiency of the building. Also sort of through TDV, we tried to capture some of the GHG concerns, but they're not as emphasized in our code. So the local ordinances are sometimes able to do these additional programs that take a greater leap towards greenhouse gas reductions and other local climate action goals, renewable energy goals.

Community choice aggregation is also a great local thing that's harder for us to deal with on a

statewide level. So as we talked about the 50 percent goals by 2019, and all those ZNE by 2020, these were some really good aspirational goals that some of them were developed a while ago.

Part of the reason it's harder for us to hit ZNE in a realistic manner by 2020 is actually the success of renewable energy generation in California. When you look at back when these programs were being talked about initially, the thought was if you put a PV system on your house, anything of that nature, you're going to be offsetting a highly pollutant old power plant, maybe a peaking power plant.

In the intervening years, with the success of large-scale renewables, and also the number of people who put PV on their houses, the fact came up that you were not having as much benefit as they anticipated back then. So now we're trying to find a smarter way that takes advantages of all those successes and looks for a future that is going to minimize problems with those and with the Grid.

So I'll thank CBIA. They gave me some updated numbers, just sort of an estimate, from about 17 percent of homes built in 2016 had solar components. I think it was either 14 or 17, somewhere around there, but that's an increase when it was only around 10 percent in 2016. So I

think we've sort of seen that market transformation whether it's people at the utilities with incentives, people from Solar City, others that have been really advocating this. And we have the representative from SEIA here as well and their membership has been pushing a lot on getting the solar out there, which is why we're seeing like this very large increase over just five, ten years ago.

So these are just some of the existing -- a lot of you might be familiar, but I sort of lost a few over the side -- and I think Ken, he put together a great presentation that I've been very happy to crib from. So some of you may have seen these sort of generally, but it just gives you an idea that in California we have a lot of local jurisdictions that are very willing to put a lot of effort into going beyond the code. Because as you can imagine we're setting up a code that is sort of what we're saying this is the minimum you need to do. And we love to see people take smart steps beyond that and see what can happen.

And the solar ordinances -- as I said Santa Monica made some big steps, San Francisco, Lancaster, San Mateo and there's actually several others that we'll probably see before too long looking at adding photovoltaic to their local ordinances. And we're just trying to get the best messages out there to them on how to do this

smartly, working with their local utility whether it's a IOU, PIU or other, is just to make sure that they don't start run into problems.

We have heard that some local jurisdictions with PV codes have run into a few snags here and there with their grid on having too much over-generation. So that's something that we just want to make sure that we don't exacerbate any of those problems.

So I think we've sort of gone through this because, as I said there's a lot of local benefits, economically for these things. And it also gives us some great information to help us when we're developing our 2019 Building Standards to figure out what's the best and smartest way to go forward from the information we get from these programs. So we can jump through that.

So cost effectiveness is sort of -- there's some really good studies. And once again I sort of thank our IOU partners, Marshall's been wonderful on this, with PG&E supporting us and the other IOUs as well in some projects. Just to get this information out there, because anyone who's done these understands that cost effectiveness can be a huge hurdle for a city. It's not just the financial aspect, it's what to do.

And they have -- the IOU Reach Code team has been very good at reaching out and working with these people.

There are certain firms such as TRC that have also been working with that group to provide good technical backup to these local jurisdictions.

So these cost-effectiveness studies that go through and look at these through all the different climate zones allow a local jurisdiction to basically figure out what is cost effective, without having to go and do additional study. And the Energy Commission is looking forward to start getting these out there. And what we'll be doing after this is we'll be putting up on our website the model ordinance that people can start reading and making comments on that. And we'll look at getting a final version out fairly soon.

And I was talking to Pierre from NRDC just before this, this is really right now the study is PV. They looked at photovoltaic and the cost effectiveness of photovoltaic in the different climate zones. And so that's where our focus is, because a local jurisdiction doesn't have to do additional work to add that as a local ordinance for a cost effectiveness standpoint. But if a local jurisdiction wanted to go beyond, add solar thermal, add green roofs, add something else, it's not that they have to start from scratch. These studies provide a really good foundation.

And you could have an additional piece on top of

that. It's just that would have to get funding and have the work from someone who really knows what they're doing to get that and add that on. And the Energy Commission would be very supportive of other model Reach Codes that have that same level of attention and detail and professionalism that could then be shared with groups across the state.

So, as I say, it's like here's a couple low-rise residential new construction, non-residential is in progress, and then there's some that just go for really looking at very single items whether they're outdoor lighting or non-res.

So this is, I think we've sort of talked about, is just sort of we look at these proposed ordinances and we really focus on did they go through the appropriate process? Ingrid Neumann, she's our expert here, so she is the one if you have any questions on our local ordinances, she's our subject matter expert and has been wonderful in helping people through the process.

So basically the process, as you can imagine, is fairly simple. There's outreach that would go on to sort of let everyone know that these things are available once they're ready and then the cities can modify them. If you're not sort of making so many changes it can affect the cost effectiveness, there's not this idea that you have to

take this as a local jurisdiction whole hog and just take everything good, bad and indifferent.

Changes are most likely going to be very easy to make. And as I say, with a little bit of guidance, you should be able to make those to really fit your local needs without a lot of cost.

And then make this -- submit the application and it's just a 60-day review process. Going into the future, we might try to shorten that up a little bit, because these things have already been through a local CEQA process at the city. And we're really just focusing on the energy consumption, not that all the level of detail of cost effectiveness and CEQA process.

And one thing I really like about the way that Ken and others set this up is they put a focus on energy efficiency. That was always sort of the basis of when you're really looking over at CALGreen, it was always this idea that you hit that first, second tier, beyond what the basic efficiency was in the building.

So the fact that it's really focusing on getting better efficiency or at least meeting the basic efficiency before you start adding PV. It ultimately gives you a smaller size. It protects the consumer a little bit against other problems. So if you have a really good envelope, then you can add all the PV you want. But you'll

get the most bang for the buck of every kilowatt hour from that system.

So really at this point we're focusing on new residential, low rise. So this isn't as Nehemiah alluded to, that when you get into multi-family, you get into high-rise especially, there's a lot of other concerns. There's also different costs of it, because you have some economies of scale that need to be addressed in that, and we do understand that.

And for Greg and others who know all this stuff, building officials have the job of looking at these things and determining if you really need exemptions. If we're not looking at doing anything ridiculous with either promoting these local ordinances or our standards, we don't want to encourage people to try to get exemptions to take down heritage oaks or redwood trees. Or to get exemptions to build housing developments in protected farmland just to get solar access. So these things have to be well thought out. We don't want to save one resource at the expense of several others.

So these are just -- in looking at how we put PV into the code for 2019 Mazi, Bill and I and others, spent a lot of time just going around and trying to figure out what are the challenges that we need to address and think about to make sure that these are well-crafted ideas? And some

of them, they transfer over to these local ordinances as well. Just a question of where is NEM compensation going? Worst case scenario something happened, are we looking at things that are still going to be cost effective to the consumer? And E3 did a lot of work on that and gave us some comfort in the fact that even if we get a less solar-friendly NEM compensation, that these would still be cost effective if they were sized appropriately.

The biggest thing that I think I've talked to a lot of you about in different cases is the lack of coincidence to load and generation. And that's that whole thing of, I worry when we start talking about things in a mathematical or an accounting standpoint. As I've said before it's looking at 8,000 kilowatt hours produced and 8,000 kilowatt hours consumed over a year, gives you a picture of yes, you've hit that net, but what actual impact was that home to the system? Was there any coincidence between when that behind-the-meter PV was generating and when it was being consumed?

You add electric cars or pools or other things and it can get different. But that's where we started really focusing on looking at storage load following demand response. Any sort of strategies that would maximize self-utilization. So we sort of encourage local jurisdictions to really think about self-utilization when they're

crafting their policies.

And just trying to get that message out to people that when you produce a lot of generation in the middle of the day that you don't consume, and you're pushing that out to the Grid infill, no big deal, 1-2 percent of houses, no big deal. But when you start to get into larger levels of these houses or if you just happen to be at the end of a circuit that is already overwhelmed with all sorts of other high intensity uses, we start running into problems.

So you might have a community that's fine. You build it out and then all of a sudden you add whether it's retail, other high end uses, restaurants that are supporting that community, you can bump your grid up to the point where it has harder time dealing with that over-generation through the transformers and conductors.

And you can get to the point where it's not just an easily swapped-out conductor. There might have to be significant system upgrades. And basically the way that NEM is written, those system upgrades become socialized. So it's not the people adding them all the time, it can be people in more disadvantaged environmental or economic situations who have to help bear the cost of that systems upgrade. And we're trying not to basically solve our problem trying to go to ZNE and hand it off to the PUC to have them try to figure out figure out how to manage the

Grid and the ISO as well.

So those are some of the things that we're trying to make that we're thinking about. And we talk to these different agencies and different stakeholders, everyone from the home builders to the solar industries to the battery manufacturers to ISO, to the PUC and others, so that we understand what situations they might be dealing with.

And also, as was brought up earlier, there are other solutions within this building, dealing with electric charging. We have to be aware of those efforts as well so that we're not all either looking at the same item to solve our problems or creating problems for each other.

So the system sizing, when we started looking at this and we start looking at where we're going for 2019, these are very conservative compared to where we're going in the future. These are about 80 percent.

So we basically looked at them and found that these were not going to be having requirements, minimum requirements like this, we're not going to be creating problems based on what we are seeing in our standards. Because they're not going above the electric generation onsite to get people into NEM problems. So it was just a very simple one.

This is just to sort of give you an idea of

offsetting the electrical in a 2,700 square foot home. This is just a very generic model home and based on some work E3 does. So you're looking at fairly small systems here. So the systems that they're talking about are not getting up into areas that are big problems. And you don't run into problems with the compensation on NEM. I won't go into a lot, because Mazi did a good job of talking about that.

Current Rule 21 that's with the PUC as far as how much you can interconnect, they're allowed up to two watts a square foot, which is really based on an old inefficient house. If you put two watts a square foot on a 2016 house, you're really going to be over-generating, because the houses now are so much better as far as energy consumption. Even when people go down to Costco and get an 80-inch television set, they still should be able to be under two watts a square foot.

So basically the sizing whether you're 80 percent electric load or do a performance-based modeling, you're going to protect yourself against over-generation.

So and this is just sort of thankful to all the people that have really worked on this. And as I say, I just came in at the very end to put a tie on it. And stand up and talk about this stuff, but really Ken and others have done the yeoman's work on getting all this stuff

pushed through and we appreciate that.

So we just want to get this out. Get some comments on it. It'll be posted today, so that people can start looking at this. And see if it really meets the uses. And if people have ideas on how to improve it, that'd be great to know if there are things that can be done just to make it more universally available, that'd be great to hear from people on that.

So we're looking at the draft document getting out now, if you get comments to us, and then upsided version, you know, links on the website, so people can find this information, find anything else. We're going to be trying to get that up in June or July of this year.

So we'll put up a note there. But if people can get comments back on this thing within 30 days or so, that'd be helpful for us to figure out where to go and luckily Ken is here and he can help with questions, any general comments.

Or please actually, Ken, is there anything you can add to that? Because I know I did a very soft of quick overview.

MR. RIDER: No, thank you -- well, I do have some things to add -- but thank you very much for that presentation, Chris. I think you covered the main points.

I just kind of want to emphasize that this is a

tool for local jurisdictions who are really interested in doing a solar ordinance, to do so in a way that really aligns also with state policy. So as you heard earlier from Mazi, solar is cost effective. A lot of local jurisdictions have kind of realized that and wonder why are there new buildings being built without it then? And so they're really interested in doing, for carbon reasons and for just cost saving reasons, want to see homes with solar on top.

So what this is, is providing a tool for a local jurisdiction to kind of enable them to do that in a way that really kind of aligns with what's going on with the rest of the state too. So I think that's all I would add.

MS. DIFRANCO: Hi, so Rachel DiFranco, City of Freemont. I just want to say a lot of thanks to Ken and the folks at the CEC, Ingrid, and also to Fayrahn (phonetic) and the Air District for working on this. The City of Freemont actually has been part of the drafting and review of the documents.

And so we're the first out the gate to take this model ordinance and actually bring it to our City Council. We brought it to our City Council Tuesday night and it was approved. We did make a few small tweaks to it and so I just wanted to talk through a couple of considerations for the model ordinance.

So Freemont's in Climate Zone 3, as is most of the Bay Area. We use the prescriptive system sizing and then a percent TDV for any buildings over 4,500 square feet.

What we looked at was really the fact that we have a lot of new residential development in Freemont, coming over the next few years before the next building code update cycle. And so we really wanted to make sure we were aligning with what the 2019 code might be. And really trying to get solar on a lot of this new residential development before we missed the boat. So we were looking at how could we do this in a way that would be easy enough from a implementation perspective and would align with what the state is doing? Thinking about 2019 and also being able to utilize the cost effectiveness study that was already done, so we weren't having to do it on our own.

We looked originally at what some of the other cities had done, under the 2013 Building Code cycle. And a lot of them had required a watts per square foot PV requirement between one and one-and-a-half to two watts per square foot. Some of them looked at residentially only, some of the addressed non-residential as well.

And we were almost ready to go in our 2016 Building Code Update and then we heard about what the Energy Commission was doing with the model ordinance. So

we decided to hold off. We did adopt a couple of other Reach Codes related to non-residential lighting and also related to electric vehicle readiness. And so those were filed with the Building Standards Commission and the California Energy Commission. And this model ordinance for solar was approved by City Council on Tuesday night. And now will have to go for a second reading and go through the process of filing with the state agencies as well. So it'll probably be effective in I don't know, maybe about four months.

But a couple of considerations is in the mandatory requirements for solar ready buildings in the 2016 Code there were some exceptions. And that said if you already have the soft of minimum solar system size, then the readiness requirements don't apply to your building. And we said well we want to think about these fact that these are minimum system sizes. And a resident going into a new building may decide that they want to have an electric vehicle as well and they want to supply that electric vehicle with energy from their PV system. They may want to expand the PV system that comes equipped on their new home.

So we looked at how can we incentivize that? How can we make sure there's still solar readiness, even with a minimum system size. So we included the solar readiness

requirements for any of the solar area required under the CEC code section that addresses that.

And then in addition we wanted to make sure that our residential development would be addressed pretty fully by this ordinance. And so we do have a lot of units coming in over the next handful of years that are above three stories, so going to four and five stories. So we included residential occupancies in Group R1, R2 and R3. So that was pretty much anything five stories and below.

And then finally I just want to mention there were a couple of other considerations that we built in. We said that at the earliest feasible time, after the prospective purchaser is identified, the developer or builder shall provide the option of an expanded system size beyond the minimum mandatory system requirements. So that gives the resident or prospective purchaser that option to expand the system size.

And then also to accommodate for future system expansion, the developer or builder shall provide for an interconnection pathway as detailed like I said, under the solar readiness requirements. And then the applicant is encouraged to utilizes micro-inverter or other equivalent expandable technologies in the initial system design.

And that they are encouraged to design as an all-electric building energy system to accommodate for the

greatest possible building energy use offset through the use of solar PV.

So if anyone has any questions about that, I have a couple of copies of the draft ordinance. And it's also available in the City of Freemont. If you go to our agenda from the April 18th Council meeting, you'll find my staff report and the ordinance attached there.

MR. MEYER: If you want to give that to us, we can actually put it on the docket as well.

MS. DIFRANCO: Sure. Does anyone have direct questions for me, no? Thank you.

MR. RIDER: I just want to congratulate you on the record for getting that done.

MS. BROOKS: Hi. I'm Allison Brooks and I'm Executive Director of something called the Bay Area Regional Collaborative. And we help coordinate the four regional agencies in the Bay Area: Air District, MTC, the Metropolitan Transportation Commission, the Association of Bay Area Governments and the Bay Conservation Development Commission.

And we've been working with Ken and have a set of partners working on -- we're very interested in supporting, as regional agencies, a cohort of jurisdictions in the Bay Area to help them move through a process in passing solar ordinances. And I want to commend Rachel's great work.

Freemont is a leader on this and we want to get a lot of other cities on board and pass this in a relatively quick timeframe if we can.

I think it would be great to have more of a sense of urgency on moving through this process. And I would encourage you, maybe if you could provide some set times. It's kind of unclear what the process is for accepting. We have a whole set of questions we're going to submit via the system, not right now. And just having some clarity on the process for comments and when that revised draft will actually be completed. You give a kind of a vague June, July timeframe.

And I guess I'm just encouraging some sense of urgency around -- the Air District just passed a really visionary audacious Clean Air Plan. And they're interested in working with jurisdictions in the Bay Area in particular, to help meet these aggressive energy targets that we have. And I think we all need to be trying to work a little quicker.

But I want to thank Ken for his partnership on this.

MR. MEYER: Yeah, I appreciate your comments. We wanted to give enough time for people to have substantive comments and actually get them in. We also realize that sometimes people like to read other people's comments and

then fill in the blanks they thought were missing. But if people think that a two-week comment period would be acceptable, we could always move that up. But we wanted at least put out like a more reasonable timeframe for people.

Unfortunately, also there's a sort of a coincidence between this and some other 2019 Building Standards work that we have to make sure that we balance. But if people are interested in a quicker comment period and sort of getting on to this faster, we can definitely look at that.

MS. BROOKS: (Off mic) I don't know if (indiscernible) feedback is being incorporated into a new revised draft, and what that timeframe might be?

MR. MEYER: Yeah, I'll have to check Ken's schedule to see how he's doing. (Laughter.)

But no, the idea is just like once we see the comments, we'll look at how substantive they are. If it's something that we can very quickly more forward on, that would be our intent. But we don't want to set an artificial timeline where if there are some really good ideas brought up, that we want to actually take to fruition.

We don't want to cut things out because there just wasn't time in it. But it's definitely something we see as essential, because every local ordinance that goes

through with PV that we can learn from before our standards become effective, it's one more piece of information that gives us a better product at the end.

So did anyone else want to speak on the floor? I know I think Pierre and Nehemiah had wanted to talk as well. So does one of you want to jump up or is there anyone else? Okay. We have some online as well, so okay.

MR. DELFORGE: Pierre Delforge in NRDC. I'd like to commend the Commission, and Ken in particular, and all staff for bringing together this model ordinance. I think this is a great initiative that we completely support. It provides an opportunity for city leadership, a glide path towards ZNE, and its cost effective homeowners an opportunity to reduce greenhouse gas emissions in a way that saves people money on their bills.

What we'd like to propose in the same spirit is an extension or maybe a companion approach for doing the same thing for solar hot water. The Commission's proposal focuses on offsetting most of the electricity used in a dual-fuel building. But that does not address the energy used for water heating and space heating, which is basically natural gas mostly in California, which is responsible for a similar amount of greenhouse gases in California, as all the electricity used by residential and commercial buildings in California.

So it's the other side of the coin or the pie, if you want, that is not being addressed. And we think this is an overlooked opportunity as there are cost effective technologies available today to provide significantly lower carbon heat in buildings, particularly with heat pumps, compared to current natural gas systems.

So we propose to add a renewable water heating provision to either this or a separate model ordinance, which could be met with a number of options. It could either be met through heat pump water heating and additional PV, or through solar thermal. Or even just through additional efficiency from the whole building perspective without any incremental water heating requirements, other than code.

The heat pump option would consist of a high efficiency electric heat pump water heater instead of a gas tankless water heater and additional panels to cover the annual energy use of the water heater. And it's the combination of that heat pump, plus the additional PV that makes it a unique opportunity to make it very cost effective for homeowners, because the cost of PV electricity is cheaper than the cost of grid electricity.

So basically it means powering that heat pump with cheaper electricity. And our current analysis, we've done a preliminary analysis, the IOUs and the Davis Energy

Group, and (indiscernible) I want to thank them very much for working on this. And they will do more rigorous and in-depth analysis, but our preliminary analysis indicates life cycle savings on the order of 10 percent over the life of a 30-year life. Source energy reductions by 30 percent, and a greenhouse gas reduction by 50 percent for water heating energy.

And again that's roughly the half of the gas use in residential buildings in California is for water heating. So this is a really significant opportunity to reduce greenhouse gases and an opportunity for city leadership. And the additional benefit in addition to energy efficiency of greenhouse gases is, as we talked at length today, is the Grid stability and duck curve and renewable integration.

So our proposal is focused on water heating, instead of all-electric buildings just because water heater is a load barrier to overcome. There's no -- as Bob -- oh, he's still here -- it probably has less consumer acceptance challenges, because a water heater is a water heater. People don't really care what water heater they use.

And but, of course, builders would be completely free to build all-electric if that's one of the most cost effective ways to achieve that local code. And it's very likely it would be more cost effective, given the gas

connection fees costs that are involved.

So we will refine our proposal and cost analysis and submit it as part of our comments. And we also look forward to seeing the ROU analysis that will provide a climate zone by climate zone cost effectiveness and compliance analysis. So we encourage the CEC to consider this de-carbonization opportunity for Reach Codes and local government leadership. Thank you.

MR. MEYER: Thank you very much, Pierre.

MS. DICARLO: Good afternoon, Yvette DiCarlo, with the Bay Area Air Quality Management District. As our regional partner, BARC had mentioned, we will be providing some more detailed comments and there was a lot to think about this morning. So of course we're going to refine those a bit.

Just a few points I wanted to make in terms of today's discussion, is a few things that we were hoping would be included in the analysis that there may be opportunity for, are major renovations. Not just new construction, but where can major renovations be included in this, as well as commercial.

When we talked about EV readiness, that was such an important point today about charging during the daytime. But we didn't see commercial in here and hope that there's no opportunity to include that as well. We'd like to see

thermal included, solar thermal.

Some of the definitions, like TDV and standard test conditions hopefully could be a little bit more clarified, and they may have been in the updated version. I'm not sure. I was just looking at a previous version.

And also some accountability for natural gas that was mentioned earlier in terms of including those avoided costs.

We'd also like to better understand is this intended to be more streamlined for local governments. And we assume that there's going to be flexibility, just like Rachel was able to take advantage of, so what's the cost effective threshold for any modifications? How is that going to be accepted by the CEC when those come forward?

And also, because we're up against the 2019 Standards, it takes while for local governments to bring these forward to their councils, so is this going to be upgradable? And do you see this being upgraded in the next year or two years when those come about. So those are just some general questions and comments for today.

MR. MEYER: Okay. So thank you very much

MS. DICARLO: Thank you.

MR. HUNT: Marshall Hunt, Pacific Gas and Electric. Thank you, Chris, for recognition of our good work and I'd like to also recognize the statewide Reach

Code team. Chris Kush of SCE, is our leader. And I'm very happy that he takes over the leadership from Javier Mascowl. (phonetic) Others in the team, or course, are SoCalGas and San Diego Gas and Electric. LADWP joins us. Plus we have guests like Barry Hooper from San Francisco and then we have staff support from Misti this year. And it's very good that this team has been working together as long as it has. We'll be having a website up soon.

And Misti, when do you think that will be, the website?

MS. BRUCERI: We are hoping within the next couple of weeks, but I will say by the end of May at the very latest.

MR. HUNT: Okay, the end of May, and it will be local ordinances.

MS. BRUCERI: Local energy codes.

MR. HUNT: Oh, thank you, local energy codes. So we hope to continue our good work and thank you for your recognition of it.

MR. MEYER: Thank you, Marshall, and thank you, Chris, for coming up.

MR. NESBITT: George Nesbitt, HERS Rater. A couple of cautionary tales, the City of Berkeley has long led a building energy conservation ordinance that was hopelessly out of date, so they required less than the

energy code for upgrades. That's assuming they actually enforced it.

I had a customer who I figured she spent about $2 million on an addition remodel of her house. The City of Berkley didn't enforce their energy conservation ordinance.

The City of Oakland has had a green building code ordinance, or a green certification ordinance for years now, the problem is they enforce it at the planning level. And it's not enforced at the building department level.

So as a green rater, I could charge people. I could have actually used the same form, just changed the address, charged them hundreds of dollars, and it wouldn't have matter, because no one cared. I just figured my soul wasn't worth that.

So, and of course we have lots of issues with the energy code as it is, with enforcement. We know people aren't pulling permits. But even when they're pulling permits, building departments don't understand the code. They don't enforce the code. Even as a contractor, I have not been required to submit installation certifications.

MR. MEYER: No, thank you, George. And just to echo, if people haven't heard it before, there's a lot of discussion internally on sort of increasing compliance. Because as you can imagine, all of you here and others, spent a lot of time working in improving the building

standards, local ordinances, everything. And as a CEQA NEPA guy myself, I spent years in both writing documents and in compliance. There's nothing more frustrating than spending years working on a project and having none of the mitigation actually completed or completed correctly. So that's something that we're looking at a lot harder here and people are trying to find ways of increasing compliance. So no, thank you very much for your comments.

Do we have anyone else? Okay. We have some people on the phone.

MR. WICHERT: This is RJ Wichert, Building Standards Office. So we have a couple of comments and then we have a couple of verbal questions from online.

The first comment is from Neal De Snoo of the Bay Area Air Quality Management District. He has a few questions. I'll just go through them all and then I can repeat them if we need to. "Can PG&E's model be made available, so we may test different assumptions? Can it be updated to incorporate the assumptions used in the ZNE modeling from this morning? Will this model be updated when 2019 draft codes are available, and who is doing the commercial BC? When will it be available?"

I can repeat that if you want.

MR. MEYER: Oh we'll have to sort of punt on that, on to PG&E. Ken, can you answer that one?

MR. RIDER: I wasn't sure if he was talking about something from earlier or this in particular? We don't -- I mean, we have an energy use study that we have out there. And the assumptions are going to be wildly available, but I don't know if it talks about a model, but if you would like to respond?

MR. HUNT: So there was a lot of questions. So I'd please ask the questioner to contact me, mbh9@pge.com. I'll work with a statewide team and our team to get those questions answered. And if he has any other problems with that email we can straighten it out, I'm sure.

MR. MEYER: Yeah, and I think there might have been a little confusion.

When the 2019 Standards become effective, PV will be likely required. This is sort of where we're proposing it has to get all the way through our process and approved. But local PV ordinances, it would at that point not be necessary in the form they are now. So Reach Codes and local ordinances are going to probably look a lot different after 2020. So I think that, we would just sort of update with a new model, based on where we're going at that point.

MR. SHIRAKH: Can I please answer that?

MR. MEYER: Yeah. Please, Mazi.

MR. SHIRAKH: It's Mazi again, as I have mentioned after the 2019 Standards are adopted there's

going to be some minimum PV requirements. But most of the Reach Codes will probably go beyond that to get to a lower EDR target. So you know, the chances are larger PV systems along with storage will be installed to meet the goals for those Reach Codes.

MR. MEYER: Yeah, and as Mazi also spoke with earlier, just we have to remember that bigger isn't always better. Bigger can be much better if it's thought out well with your utility, with your loads of those individual houses, with storage, things of that nature. What we don't want to do is have the inadvertent consequences of people finding out from NEM compensation that their system is not actually getting compensated at the rate that they had figured that it was on their initial look. So that's why we always want to be sort of cautious on the sizing.

MR. WICHERT: So next, we're going to be going to Sean Armstrong. Sean, I'm going to unmute you now. Go ahead.

MR. ARMSTRONG: Hello. Thank you very much. So I am waiting for the all-electric Reach Code, model code building to be presented. I think that we saw it in comments almost universally that that is the focused interest of everyone who's paying attention to AB 32, or the variety of subsequent laws that have come afterwards.

So I continue to be surprised after all these

years of requests and urgings and legal coordination and subsequent laws that today's presentation doesn't show what an efficient all-electric building looks like. And while I applaud adding PV to buildings, because that is my passion, the Energy Commission's responsible for energy efficiency first. And so I'm waiting for an energy efficient all-electric building to be presented. And I think that adding PV to a gas-powered building causes problems. And I'm struggling to understand why that continues to be a focus at all. Why is that something that people even study? It's not important. We already know that we have to stop using gas, all of it, everywhere.

So I really want to see the Energy Commission respond to all of the requests for an all-electric building type supported through Reach Codes in just the standard. That being, I mean of course, the gas standard within the code as opposed to an electric standard, which Rachel Golden spoke to earlier.

So that's my basic comment. I'm disappointed in the Reach Codes that are being presented. They don't solve or address the legal goals that we have. I can't understand why that it hasn't happened yet, but if anyone needs support, of course, I'm here to help. But I really think the Energy Commission needs to take leadership on this. And it's past due.

MR. SHIRAKH: Sean, this is Mazi. I don't understand the statement you just made that it's a building shell (phonetic) made for a gas home? Can you explain what that means? I've heard that a couple of times today.

We're proposing a set of standards for walls, attics, windows and everything. And it could work for either gas or mixed fuels, so I don't understand what kind of distinction is there.

MR. ARMSTRONG: Well, I think that you guys have made the distinction in two important places. One is in setting a standard, so that we're always comparing against the gas building. That is how you had it set up, not my choice.

And the second place is, as I commented earlier, with the assumption that gas is always available to the building for space heating, specifically, which is a mismatch with how buildings are built. But that is your guidance still within the ACM is that if there's gas anywhere, somewhere around, we're supposed to as CEAs say that, that is providing gas to the space heating system. When that's not necessarily not even remotely correct, from a scientific perspective.

So I look at the thumb being put on the scales to support gas buildings both as a standard, by not providing an all-electric standard building for us to work with, for

a prescriptive code. You have a gas version, but not a prescriptive code. I'm saying I don't see the support.

And I think that we could agree that you have not presented today what an all-electric efficient building would look like from a TDV perspective. What it would look like if gas is not available to the building, which is a totally legitimate situation out there for all-electric buildings. It's support is what I'm asking for. For what everyone is asking for as well, is all-electric buildings. Show us what that looks like. Show us the cost effectiveness. Show us the options, the technical strategies.

MR. SHIRAKH: So it would be a building with high-performance attics, high-performance walls with a heat pump for a space heater and a heat pump for water heating. Though currently when we model it like that there is a slight penalty for the heat pump water heating. But we're working to resolve that issue. Other than that --

MR. ARMSTRONG: But I have not heard you say that you set the standard as gas not available for space heating. When you run that analysis, all of your numbers change, and you guys don't present that analysis. It's a legitimate analysis. Rural areas around here, you have a choice between propane water heating or electric water heating. And people in rural areas that do not have

natural gas available to their buildings choose to have electric heat pumps. It just happened last week for a farmer that I'm a friend with.

In that real world scenario, you guys never show it, but it'd also be relevant to bring it into the cities where hypothetically natural gas is available on the street. But maybe it isn't because it's a new construction subdivision. Where is the analysis showing us, if we don't put gas in the street and it's not there in the first place, what are the cost effective strategies? As an efficiency measure.

MR. RIDER: Sean, if I could focus you here, I don't think I understand what you mean in the local ordinance context. So in this local ordinance we're proposing, we're essentially saying comply with the 2016 Code, add PV on top of it. What would you propose -- the PV sizing is static kind of like discussed earlier between mixed-fuel home and electric home. What are you suggesting you would like to see in context of a local, like a model local ordinance? I'm not really clear on that.

MR. ARMSTRONG: Well, when you run your TDV analysis of what is a cost effective amount of solar to put in, you're not running it with the assumption that gas is not available for space heating. When you do run it that way, the domestic water heater is compared against the

propane 82 percent efficient water heater, in the TDV standard. And it shows then terrific cost effectiveness for putting in a heat pump water heater.

But you don't perform that analysis. That is never in the slides. It's what I can show to all my developers. It's what I show to building officials. It's what I show to the CAT program and the California Multi-Family Homes Program. We get fantastic compliance numbers out of setting gas not available for space heating for an all-electric building. And I have not seen that analysis yet from the staff and I think that when you perform it, it will show a whole other range of cost effectiveness that comes out of it that will support the all-electric building.

Do you understand what I'm saying?

MR. RIDER: I just don't understand it in context of a local ordinance or a model local ordinance, which is kind of where the discussion is right now. So I mean, in terms of a local ordinance wouldn't adopt its own TDV values or I just don't exactly what -- I understand what you mean in a larger context, Sean, but just in the context of a local model ordinance I don't understand your comment.

MR. ARMSTRONG: Well, the simple thing rather than getting to the technical vis-à-vis, I think that there should be a local ordinance that's a model from the Energy

Commission, that is an all-electric building.

MR. MEYER: Sean, this is Christopher. I think as I said before, just as with the work that was done by utilities, by Misty and others, to bring forth this PV model ordinance, if they wanted to bring one that added solar thermal, if they wanted to bring one that was an all-electric option, the Energy Commission would be ecstatic to see that. So we would support that local model ordinance just as we support the PV ordinance that was brought forward as a model.

We're just looking at the PV as the model ordinance that we're talking about today. And future ones, based on that would be just as welcome.

MR. ARMSTRONG: I hope that is the case. I just don't look to gas companies to propose an all-electric ordinance. And PG&E and SDG&E, which are both listed as authors of this, and stood up to accept thank yous for it, they are gas companies. And I've seen the presentations from PG&E and SoCalGas arguing forcefully against all-electric buildings and even solarization just in the last calendar year.

So I'm not going to encourage anyone to look to them for an all-electric code. I really was looking to the Energy Commission staff to devote some energy to it, because you've heard so many comments of people who are

asking for it.

MR. MEYER: Okay. No, thank you, Sean.

MR. ARMSTRONG: Thank you.

MR. WICHERT: So next we're going to go to Rachel Golden. Rachel, I'm going to unmute you now. Go ahead.

MS. GOLDEN: Great, thank you. This is Rachel at the Sierra Club. This is another great presentation, and especially exciting to see the slides of all the cities with Reach Codes across the state. We really appreciate the Energy Commission and utility staff and other partners for taking the initiative to develop this kind of tool to help our local jurisdictions go beyond the 2016 code.

And we reviewed NRDC's proposal and we want to voice support for it. And we believe it's important to include renewable water heating in this model PV ordinance or to create an additional PV ordinance that includes renewable water heating. As (indiscernible) said in the presentation, many cities are already moving forward with solar ordinances in Reach Codes.

And by modifying this ordinance to include renewable water heating, we feel that the Energy Commission can really help cities think more ambitiously and go much further than they may have gone, otherwise gone, given their own staffing and resource and time limitations.

So we feel that this type of expanded PV

ordinance that includes renewable water heating gives cities the opportunity for a new construction to achieve greater, much greater greenhouse gas reductions and energy efficiency improvements, while still being cost effective across the climates zones. And we'll also support the deep de-carbonization direction that our building staff really needs to go into, to comply with our short and long-term climate goals.

Thank you. And thanks to NRDC for taking the lead in developing this proposal.

MR. MEYER: No, great. Thank you very much.

And just when people are putting their comments in, just it might be helpful for us to give sort of an up or down of what your feeling is as far as having one ordinance, one model local ordinance that starts expanding or just have additional pieces. So do we try to get more analysis and add water heating in or do we get the PV ordinance available as soon as possible and look at other modules as adding to that?

So if you guys would give us some feedback on that, I can tell you my gut says that we try to get the PV one available as soon as possible. But Fremont doesn't seem to really be worried about that, as I jest. But and then go with additional ones after that, but we definitely want to h ear what people's thoughts on that are.

MS. DIFRANCO: If I could just respond real quick? So from the perspective of Fremont we jumped the gun, because we'd been waiting already a while on this. Ad so we took the draft in their form and worked with what we had to work with. And I would recommend not trying to build in so much that this ends up extending out until 2018. And then soon enough, we're rolling up into the next code cycle and it doesn't matter anyway.

For us, it was the most important piece was getting this in as soon as possible, because there is an administrative process that takes time before it's actually effective anyway. So we won't be enforcing this probably until August. And we have a lot of projects in the pipeline that we want to try to make sure that this ordinance will cover.

So for us that was the big piece. And I would say that it really is important to think about all of the efficiency pieces and how they overlap. And I think that it lends itself to the bigger discussion of what we do with the ZNE policy in 2019. But for this piece, in particular, I would say focus on it being a PV ordinance. And at the local level you can build in whatever you want, as long as you can prove it's cost effective.

MR. MEYER: Okay, thank you.

SEIA?

MR. CAIN: Joe Cain, with SEIA. First, I would say I haven't had a chance to review the language, but I would certainly applaud the Commission and other contributors to working and developing the model ordinance. I think it's a really great effort and will be a very valuable effort. I would also concur that though the PV one would probably be of a top priority. And working in something else, perhaps for thermal or energy storage, whatever it else may be could be an incremental step after.

Also, I mean in terms again for thanking the Commission for the things you've done. The solar ready roofs, we were able -- I worked with other proponents to move the residential solar ready roof into the International Energy Conservation Code as an appendix chapter that required talking the proponent into not giving up after the first efforts and going to an appendix chapter. And then in this last cycle, in the 2018, we have solar ready roofs in the commercial IECC.

So this gives me -- the sooner this is developed, the sooner we can start talking about what we might be able to do on the national stage. So I know this is a California meeting, but this is very helpful and I want to thank you.

MR. MEYER: Thank you very much.

Nehemiah?

MR. STONE: Nehemiah Stone, Stone Energy Associates. You're asking for up or down on the two equations. I think it depends on your timing on getting that second piece. I would support going forward as quickly with the PV draft ordinance, as long as the water heating one followed quickly behind it. If it's going to take a long time, then I would prefer to see you do both at the same time.

The other comment I wanted to make is I haven't read what you've done. I haven't read the draft ordinance, but the problem that George talked about is a real problem. And that's that the local ordinance gets surpassed, as you guys adopt the next code. And the local don't make that change. I would strongly suggest that you put in your model ordinance that this ordinance expires the day that the 2019 Standards become effective.

MR. MEYER: Yeah, and (indiscernible) that's part of our (indiscernible) --

MR. STONE: It's your responsibility to fix the problem. (Laughter.)

MR. MEYER: No, thank you very much.

MR. STONE: I'm not Dictator, sorry.

MR. CHANGUS: Jonathan Changus with the Northern California Power Agency, and I'm dangerously close to speaking outside of my knowledge base, so I will attempt to

raise the issue as broadly as I can, for the purposes of hoping to see some direction.

With regards to local ordinances and Reach Codes, NCPA members and other POUs are in an interesting spot, as being both government as well as utilities. And having an interest of supporting a variety of state objectives when it comes to climate change as you've heard me speak to earlier.

I think what we've seen some challenges with trying to adopt Reach goals that go beyond the codes and standards are that they may try and go beyond the codes for the purposes of GHG reductions. And based on your TDV methodology, at least what we've seen previously, that does discourage some all-electric or some electric end uses from being able to go forward for the primary purpose of GHG reductions, which we've been told numerous times are the top priority of Chairman Weisenmiller, and what we're trying to accomplish here.

And so I think there is a broader conversation for those local utilities in which TDV doesn't necessary pencil out for them on trying to go some electric end uses in both new residential, but I think in a bigger issue we're talking about existing. And I know the cost effectiveness in the energy math there doesn't always work out. But we have to come to some sort of agreement on how

we're supposed to then meet the state GHG goals. And make improvements to the existing buildings to reduce their carbon footprint, if it doesn't pencil out on our cost effectiveness or our energy calculations.

Those are at conflict. And then our EE goals ironically are in conflict with our GHG goals. And I don't believe that's anyone's intention. And yet that's the practical impact we're seeing, not only in some of the NCPA member communities, but in some other ones as well.

So I don't have answers at this point. I will work to provide some more detail in our written comments. And look forward to a dialogue with other stakeholders as well as the staff to see what can be done in those circumstances whether it's a change fundamentally to TDV, or if it's some flexibility on how you go about improving some of those local ordinances. We'd really like to find a common solution.

MR. MEYER: Great. No, thank you.

Yeah, basically just to say really quickly that as you saw, how many local ordinances were passed that went through local government. We just looked at the energy diminution standpoint of it without this model ordinance, both withheld from the utilities. You know, PG&E and Edison, SDG&E and others just had worked with those people to get the cost effectiveness done on very specific sets.

Some areas might have to go to that level. We're not saying that we're looking at replacing all of that independent work with this model ordinance. This is just for a step stool to make that a little bit easier. But we do recognize that there are some people that are going to be outliers.

A little bit of a teaser, we are looking not for this one, but for Title 24, Part 11 for 2019, looking at giving local jurisdictions the ability to model what the impacts at a higher carbon cost is. So we're looking at that as an option that will be built in to the next go around. So that people can look at if they want to have what is a cost effectiveness, what are things, if carbon was at $250 or $300 dollars per ton? And be able to look at that for not Part 6, but for Part 11, for the Reach Codes.

So that's something we're looking at building in to the model, so that that allows local jurisdictions to meet some of their climate goals. And it allows them to go to places that are harder for us to go with the constraints that we're under.

But we've been hearing a lot of that from Pierre and others, and Martha's been helping us with puzzling through some of those solutions. So we appreciate everyone's working, but that's where we're going to be

going and we'll talk about that a little bit later in, on our July workshop.

Is there anyone else who would like to speak? If not, I just want to thank everyone. I know some of you traveled a little bit to get here and that the conversations have been very useful for me and I'm sure for my staff as well, to help us focus in.

As I say, this is just a more of a 10,000-foot overview of things. We're going to have a much more in-depth conversation on EDR and sort of our 80 percent progress towards the ZNE goals on March 23rd. (sic)

And then, as you'll see the schedule that has published, it gives you all of the other subject matters that'll be in the other workshops. And as I say it's like towards the end we'll have a little bit more discussion on the Part 11, Title 24 Part 11, in July. So again, once again thank everyone.

UNIDENTIFIED SPEAKER: We've already marched past that. Never mind.

MR. MEYER: Yeah, no. I'm sorry, I meant to meant to say May. I hope I did, but it has been known to happen.

So thank you, everyone. Yeah, just get your comments in as soon as possible and we'll start working a way on those things and see if we can sort of push the

ordinance through as quick as possible.

So with that, thank you everyone on the phone as well. For those who were able to call in, Sean and others, I appreciate your time. Thank you.

(Whereupon, at 1:14 p.m., the workshop was adjourned)

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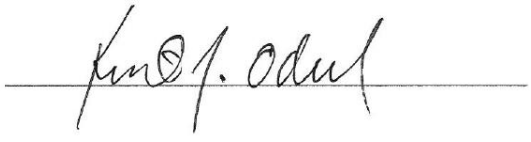

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