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BEFORE THE

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**STAFF WORKSHOP**

CALIFORNIA ENERGY COMMISSION

ART ROSENFELD HEARING ROOM – FIRST FLOOR

1516 NINTH STREET

SACRAMENTO, CALIFORNIA

TUESDAY, AUGUST 22, 2017

9:02 A.M.

Reported by:
Gigi Lastra

APPEARANCES

COMMISSIONER

Andrew McAllister

ENERGY COMMISSION STAFF

Payam Bozorgchami, Project Manager, 2019 Building Standards

Maziar Shirakh, ZNE Technical Lead & Advisor to the 2019 Building Standards Staff

Christopher Meyer, Office Manager

Bill Pennington, Deputy Division Chief, Efficiency and Renewable Energy Division

Bruce Wilcox, IT

CALIFORNIA PUBLIC UTILITIES COMMISSION

Simon Baker, Deputy Director Energy Division, California Public Utilities Commission (CPUC)

Shannon O'Rourke, Analyst

PUBLIC

George Nesbitt, HERS Rater

Bob Raymer, California Building Industry Association

Nehemiah Stone, Stone Energy Associates

Randall Higa, Southern California Edison

Pierre Delforge, Natural Resources Defense Council (NRDC)

Greg Mahoney, City of Davis, representing CALBO

Berman Obaldia, representing Asian Chamber of Commerce

Marshall Hunt, Pacific Gas & Electric Company, Codes and Standards

Olaf Lohr, Sonnen

APPEARANCES (CONT.)

Lather Kenneth (phonetic), Sonnen

Francesca Wall, Tesla

Kelly Knudsen, California Solar Energy Industries Association

Joe Cain, National Solar Energy Industry Association

Daniela Garcia, Southern California Gas Company

Jon McHugh, McHugh Energy

Brandon DeYoung, DeYoung Properties

Jeff Spies, Senior Director of Policy, Quick Mount PV

Brandon Carlson, Vice President, New Day Solar

Brandon Smithwood, California Director, Solar Energy Industries Association

Barry Hooper, San Francisco Department of the Environment

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P R O C E E D I N G S

9:02 A.M.

SACRAMENTO, CALIFORNIA, TUESDAY, AUGUST 22, 2017

MR. BOZORGCHAMI: Good morning, everyone. My name is Payam Bozorgchami. I'm the Project Manager for the 2019 Building Energy Efficiency Standards.

So, thank you for coming. We're going to start real quick by doing some housekeeping rules, information. The bathrooms and the drinking fountains are outside the double doors to your left. The snack shop is upstairs if you guys get hungry. And in case of an emergency or if you guys hear the fire alarms going, we'll reconvene at the Roosevelt Park, and we'll take a head count, and we'll decide what to do then.

Usually, I do the whole presentation of how the Energy Commission started and so forth, but this time I'm going to cut it really short just because we've got a lot to cover today, and I want to get you guys out before the afternoon traffic really hits. A lot of you folks I know came from the Bay Area, so it will be crucial to get you guys going.

Our discussions today, Mazi Shirakh,

who's our Senior Project on ZNE/EDR will be presenting most of this morning.

Mr. Simon Baker, the Deputy Director of the Energy Division, of the California Public Utilities Commission will provide a quick presentation.

Then Bill Pennington and Christopher Meyer, my Office Manager, will provide information on community solar options.

Due to time, we may change the schedule a little bit. Mr. Baker may, depending on how time moves, may do the presentation the first thing, right after lunch.

So, we're leaving that open right now and apologize if that's going to cause an inconvenience for anyone.

Our 2019 Standards process so far, right now we're in August so we're getting the Utility CASE Reports coming into the Energy Commission for our final rulemaking -- I shouldn't say final rulemaking, but to get us ready for doing our express terms presentations that will be happening later in September.

So, and then the 45-day language will be late November, early December.

So far we've gone through, as the schedule shows we have had quite a few of our prerulemaking workshops. And right now, being August 22nd, we're going to be taking about solar storage and energy design ratings as our main topic for today.

And on August 30th, next week, we'll be presenting the proposals for what we're going to present for Title 24 Part 11. This is the CalGreen Codes.

Today's presentations will not be placed under the 2019 Title 24 Utility-sponsored stakeholders. Those will be all the presentations that were done previously, prior to this workshop. All of our CASE Reports and everything is located there.

This presentation, today, will be posted in our Building Energy Efficiency Program, on that link. There you will find all of our topics, all of the schedules, and any nuance of any new measures that come forward.

And please submit your comments to our comment log, on the lower link, by September 1st, for this workshop.

Some contact information; the key person

you really want to listen to and communicate with is Mazi Shirakh and Christopher Meyer. This is their topic. Mazi drove all night last night to get her from Oregon. He had to go see the eclipse. And he's here, how do they say it, bushy-eyed -- I don't even know how to say it.

So, with that, any questions?

So, if Mazi could hand me his presentation, we could start with him.

(Pause)

MR. SHIRAKH: Good morning. I'm Mazi Shirakh. I'm going to be talking about the proposed 2019 Standards as it relates to a few of the energy efficiency measures and also our ZNE strategy.

But before I do that, as Payam mentioned I was driving all night last night. I actually got home about three o'clock. Went to Corvallis, Oregon to watch the eclipse and I wanted to share a couple of snapshots of the eclipse with you. And this was an awesome experience.

I mean, even 99 percent is not the same as totality. I mean, this was totally cool. And you can see the audiences' applause. You know, there's like clapping, and cheering, and people

crying. So, it was really worth the trip.

What's also interesting is when I came home that this is my PV generation hourly for yesterday. And guess when the eclipse happened here in Sacramento? There's definitely --

(Off-mic comment)

MR. SHIRAKH: What's interesting is like when it's at 50 percent the human eye cannot tell the difference, but the solar panels can. Every photon counts.

So, I'm sure ISO's graph shows pretty much the same thing. Yesterday there was probably a big dip on the grid.

So, this presentation is going take a while. I'll try to go through this as quickly as possible. There's four main sections. In the first section we're going to be talking about the proposed ZNE strategy, what it is, how we arrived here, and explain what Energy Design Rating is, the EDR.

Then I'll get into some of the slides that E3 has prepared for us, for cost effectiveness and, in particular, the Net Energy Metering, NEM requirement and how it impacted our decision for where we've arrived.

I'll talk a little bit about the Reach Codes, you know, how our tools are going to enable local governments and beyond-code programs to meet their goals.

And also, I'll show you a few snapshots of CBECC-Res Tools and how you can use that for compliance with Part 6 and Part 11.

The policy drivers for ZNE, you know, it's been in the making for about ten years, now. It's been a decade. It started out back in 2008 with a joint CPUC/CEC Action Plan, which was endorsed by both agencies to encourage or have a goal for ZNE, for residential buildings by 2020 and nonresidential by 2030.

There was also -- I guess 2008 was a big year for ZNE. Another CPUC California Long-Term Energy Efficiency Strategic Plan, the California Air Resources Board's Climate Change Scoping Plan, and also the 2007 and later iteration of IEPR also supports the ZNE strategy.

And this goal also has support from our current Governor Brown, an also the previous Governor Schwarzenegger.

So, when this all started a decade ago it was a simple goal, relatively. And the goal was

to make the building envelope and building features, and systems as efficient as possible. And then, put some amount of PV on the roof that would displace the annual site energy of the building in TDV terms. Presumably, that included natural gas.

So, that was the goal, but since then there's been a lot of changes. We've learned a few things and there's been new development so, you know, we have to consider those.

And some of those might be, you know, what we learn is that reality is always more complicated and more nuanced than what we imagine.

Some of the developments include the 50 percent RPS and large-scale PV development on the grid. That definitely has an impact on compensation rules and how we arrived at this decision.

Also, large-scale utility deployment of PVs and, to a lesser extent, building-based, rooftop-based have lowered the value of additional electricity around midday. You know, we've heard about the duck curve and all that. So, that also impacts our decisions for ZNE.

And Net Energy Metering Rules, or NEM, that's basically -- that was our guiding line, and lifecycle costing, and time-of-use schedules, so compensation to the homeowner. So, we have to consider all of these as we develop our recommendations.

Some of the problems, you know, we identified is that NEM rules and most ZNE definitions they treat as if the grid is vast storage where you can over generate in part of the day, or part of the year and then use it at a later time.

In reality, the grid has some storage capability, but it's very limited. So, if you don't use that over generation often what happens is you have to pay Arizona to take it from us. So, we'd like to avoid that scenario as much as possible.

Electrification is an important strategy that, you know, moves us towards ZNE homes and low-carbon emissions. But electrified homes, all-electric homes also require a much bigger PV system because their electric load is larger. So, that makes the grid harmonization strategies even more important for us to realize our

environmental benefits, and also benefits to the homeowners.

And although ZNE is a goal, it is a goal. What is the rule or the law is the NEM energy metering rules and lifecycle costing. So, we have to operate within those confines to move towards our ZNE strategy.

So, to sum it all up grid harmonization must be coupled with customer-owned PV systems to bring maximum benefits to the grid, the environment, and the homeowner. And the strategies we've developed here, you know, we think will encourage that.

And how do we define grid harmonization strategies? Basically, these are all strategies that would maximize self-utilization of the PV generation, the output, and minimize those exports back to the grid, which could be problematic.

And there's some examples here like battery storage, demand response, thermal storage and EV integration, especially for nonresidential buildings.

So, we've set seven goals for 2019 Standards. The first is to increase building

energy efficiency cost effectively. And, you know, I have some examples of some of the measures we're considering.

And the benefit of that, you know, energy efficiency reduces the cost to the homeowner. It also makes it possible to put up a smaller PV system to get to the same ZNE goal.

And so, the second goal is to make progress towards the ZNE goal, again within the confines of NEM and lifecycle costing. This is another way of saying that Part 6 is an important tool to meet the ZNE goals, but it's not the only tool. So, to get to ZNE, you need to do more than just Part 6. It will make a significant contribution but it's not going to get you all the way there, again because of these limits, you know, of the NEM and lifecycle costing.

We would like to promote self-utilization of the PV generation by encouraging demand flexibility and grid harmonization strategies.

Number five is to provide an independent path for compliance for both all-electric homes and mixed-fuel homes. This is to facilitate all-electric homes and heat pump water heating which has benefits for carbon reduction.

And number six is to do all of this in a cost-effective manner and in a way that has a benefit cost ratio to the homeowner that's greater than one.

And number seven is to provide the tools and the path for above-code programs to be able to get to low EDR or full ZNE. These would be mostly local ordinances or some builders, you know, who want to build ZNE communities.

And, you know, we think we're on track to actually meet all seven of these goals.

So, beyond this code cycle our goals would be to actually extend the seven goals that you saw on the previous slide to high rise, multi-family and nonresidential buildings, and which we really haven't addressed at all.

You know, we have had a smattering of talks about these buildings but this hasn't been our focus.

Improve integration of demand flexibility and grid harmonization strategies and perhaps making some of them prescriptive requirements as the costs reduce and performance improves.

And consider EV integration into the standards. Again, this is a great opportunity

for nonresidential buildings to actually avoid sending large amounts of electrons back to the grid in midday, when there's excess generation.

So, our goals for 2019 Standards, basically is number one to increase envelope efficiency, and then have an appropriately sized PV system. And I'll explain in a minute what I mean by appropriately sized PV system.

And then, encourage grid harmonization. And there you see some examples that builders may employ to meet some of these goals. In the lower left is a heat pump water heater. You know, this is a home automation technology here. And, of course, up here might be some type of electric storage or thermal storage.

This is the famous or the infamous duck curve. This is the Cal-ISO graph and everybody is familiar with this. I'm not going to try to explain it. But what is interesting is that the solutions that Cal-ISO has identified pretty much line up with the strategies I just described.

Target energy efficiency, increasing storage and demand response, and de-carbonization of transportation and that's basically EV integration. So, you know, we're not

incompatible with the Cal-ISO's goals in this regard.

Those of you who have been involved with the building standards, you know we take lifecycle costing and cost effectiveness seriously. We actually require or made it a requirement for ourselves to only recommend measures that are beneficial from lifecycle costing perspective. Whether it's energy efficiency measures or renewables, so we treat both the same.

And for generation we're using NEM rules with a change. NEM compensates -- the current NEM, you know, that was approved by the CPUC in 2016, I believe, has three compensation goals. Behind-the-meter, self-use is compensated at full retail.

Hourly exports are compensated at what we call NEM-adjusted retail, those non-bypassable charges which makes it a little bit less than full retail.

And then, for over-generation they use net surplus compensation, which is a very small amount, about three or four cents.

So, for our analysis we actually made it

a little bit more conservative. And that is for hourly exports, instead of using NEM-adjusted retail we're using avoided cost, which is about half of what NEM-adjusted retail would be.

So, I have slides that will explain that a little bit better.

So, for the first time we're proposing to have PV requirements for new construction, low-rise residential buildings. And there's an equation here which is if somebody wants to do compliance prescriptively, which is very uncommon for new construction, but we have to have a prescriptive path.

So, don't get too hung up on this. This is a multiple regression equation. This is a curve fit and it's got some components here, and there's going to be some look-up tables. And it will get you the right size of PV for your size of home in the climate zone that you are.

So, that's all I'm going to talk about this. This is going to be posted on the web. You can, you know, look at the details. But again, there's going to be a prescriptive way of complying with this and this is the equation, and this is going to be coupled with a look-up table

that you can plug in, you know, for these coefficients here, A and B.

We're also providing a series of exceptions. This is going to be the first time we're proposing to have PV requirements. We'd like to be a little bit cautious and we know there's going to be situations where exemptions may be warranted.

So, what are these exceptions? There are five of them here. One would be addressed where existing barriers extend to where the dwelling exists. You know, you could be this is an infill. You could have adjacent buildings that are basically limiting solar access and all of that. Or, there's going to be hills, you're going to be building a house in an existing neighborhood with redwoods and all that. So, there's going to be exceptions for that.

Number two is to allow some variance for Climate Zone 15. Climate Zone 15 is our most severe climate zone and the PV sizes, as I'll show you later in the presentation, can get rather big. So, you know, we're basically providing some flexibility for Climate Zone 15 to make sure that we don't have a requirement that

may not -- you know, the PV system may not fit on the roof.

Number three is reduce PV size for single-family homes with three stories. Again, because you have a single-family with three stories, you know, the roof is going to be a smaller size than the single-story or two stories. So, there may be limited solar access on that roof. So, you know, we're allowing an exception for that.

Number four is to address dwelling unit plans that were approved by the planning departments prior to January 1. That's the effective date, January 1, 2020. And there could be a situation where, you know, the planning has been in progress for some time but the permit hasn't been pulled but, you know, the plans are there.

And so, we're recognizing that some of these developments may fall within that grey zone so, you know, we're going to provide an exception for that.

And the last one is to allow a reduced PV size if it is installed in conjunction with a battery storage system. There's a dynamic here

in the standards that allows you to do tradeoffs for the PV size, not only against energy efficiency, but also against battery storage and other demand flexibility. So, this exception is taking care of that flexibility.

We're also stretching the energy design metric as a tool to our compliance. So, I'm going to spend a little bit of time explaining how the EDR or Energy Design Rating Tool works. Basically, it compares the building that you're building against, you know, standard reference. In this case that's the reference buildings of the 2006 IECC.

So, if you build a building that performs exactly as the 2006 IECC, you get a score of 100.

So ZNE, then, by definition will be the score of zero. Most buildings are going to fall someplace in between here.

With the 2016 Standards, the EDR score is in the mid-fifties. With the proposed 2019 improvements to the building envelope, we're going to be in the mid-forties. And then, if we include the contribution of the PV system, we'll end up with an EDR score in the mid-twenties. So, that's where we're going to stop with Part 6.

So, energy design rating has three components, again, an EDR level of efficiency that's based on the 2019 efficiency standards, proposed standards. And then we're going to have an EDR contribution from the PV system that it's sized to displace the home's annual kilowatt hours.

So, again, this is probably a good time to explain what our PV sizing requirement is, as it's explained on this slide, in the red text.

The requirement, the prescriptive requirement is going to be a PV size for each home, in different climate zones, that is just large enough to displace the home's annual kilowatt hours.

And in most climate zones, as I'll show you later, it's going to be between 2.7 to around a 4-kilowatt system. It will be larger than that in Climate Zone 15.

So, that's the PV size that we're recommending. And the reason for that is, you know, that's actually the most cost effective, as I'll show a little bit later.

And then what we do is we subtract the contribution of the PV system from step two, from

the EDR score from step one and that will be one final EDR.

So, as part of the efficiency EDR we're proposing some improvements to the building envelope. A high-performance attic that was introduced back in 2016, we're proposing to increase that level from the current R-13 to R-19, or thereabouts.

For high-performance walls, we're proposing the U factor to be improved to a range of between .043 to .046. The current requirement is .051. It generally requires 2-by-6 walls, with about an inch and a half of continuous insulation on the outside.

A slight improvement to window U factor and SSGC, another big change there. And also making QII, quality insulation installation a prescriptive requirement. That's actually a significant change.

And then we'll establish an EDR rating based on these features that can only be met with efficiency features alone. And that means the current PV tradeoff against high-performance attics and walls is proposed to go away. So, the PV by itself cannot be used to trade away those

features.

Then we'll calculate the EDR contribution of the PV system. Again, based on a size that displaces annual kilowatt hours in each climate zone, and then we'll subtract that from the efficiency EDR for one final target EDR.

Why use EDR? EDR provides many advantages. It's sort of in line with our performance standards and all the performance tools that we have developed. And what it does is it provides a target for the builders, but it allows the builders to actually get to that target any way they wish. So, they're not set to one set of prescriptive requirements, they can get there however they want.

And, for instance, they can use more efficiency to install less PV to get to the same target EDR. They can even put like high-performance glazing. You know, the windows are getting better, even triple-paned windows are getting better and cheaper, and so that may become an option to install.

Or, the buildings may even choose to put in like energy efficiency appliances, or air conditioning equipment, and furnaces that are

much higher than federal minimums. We cannot require that in the standards, but builders are totally free to do that. And by doing that, they can downsize the PV system or move the EDR closer to the target.

They can also take advantage of grid harmonization strategies, battery storage, thermal storage, demand response, demand flexibility. Battery storage with advanced controls provides a huge credit. And again, they can use that to either downsize the PV system or move closer to a target EDR with the same PV size. I'll have some examples of that.

And EDR also provides a convenient tool for beyond code programs. As I mentioned, you know, the cities and counties could identify a lower EDR target than Part 6 requires. They could have an EDR target of zero, five, ten, whatever they wish.

This is a screen shot from an output screen from the CBECC-Res. And this shows how compliance must be demonstrated. There are three boxes here. This first one is the EDR of standard efficiency. So, this is the EDR target that the building must meet using energy

efficiency features, alone. So, your proposed EDR must be equal or smaller than this.

So, in this building that I've modeled, it's slightly more efficient than the standard design.

Then the second target is EDR of minimum required PV plus flexibility. So, this would be the contribution of your PV system plus battery storage, and other demand flexibility, demand response. So, your proposed EDR must be equal or greater than that.

And then, we combine the two together in this final EDR. So, there, your final must be, again, equal or less.

So, for compliance you have to look at two different numbers, the final EDR and the efficiency EDRs. They must be equal or smaller than their respective standard design.

I also want you to take a look at this column here. And this is going to be relevant to a slide I'm going to show a little bit later.

Up here, this is a 2,700 square foot home in Climate Zone 12 here, in Sacramento. Up here what we have are budgets for space heating, space cooling, and IAQ, and water heating. Look how

these numbers compare to plug loads.

So, you know, even when you look at the not-so-efficient referenced building, you'll still see the same trend, but it's definitely more pronounced here. Which means over the years we've done a hell of a job making our regulated loads more efficient, to a point that plug loads are actually our biggest loads in our homes, at least in most climate zones.

Remember those numbers because I'm going to come back to it.

Again, we'd like to have to parallel prescriptive paths, one for all-electric homes and ones for mixed-fuel homes. And the reason for that is that, you know, we don't want to disincentivize construction of all-electric homes. You know, we'd like to have two equal paths so builders can go either way.

And for all-electric paths, you know, of course they have to use heat pump water heaters and we're finding that in NEEA Tier 3 heat pump water heaters, in many cases they can actually meet the standards requirement.

(Off-mic comment)

MR. SHIRAKH: If it's a quick question,

George.

MR. NESBITT: Yeah. So, are we going to have two separate packages, again? We used to have multiple packages for prescriptive compliance and that used to include one for all-electric homes that had higher insulation requirements. And then, we went to one package, no-electric home.

Are we going to go back to two packages?

MR. SHIRAKH: There's different ways we can do that, George. One is to basically have the same Package A, with some footnotes where we allow -- you know, because when you do all-electric homes you can replace your gas furnace with a heat pump water heater and, you know, it's all cool, it's all even. So, the difference is a heat pump water heater.

If you use a very basic, non-Tier 3 heat pump water heater, you're going to fall short. So, you have to make that up somehow. And we're proposing to do that with additional PV system. In most cases, it's going to be kind of a very modest amount of PV system that will make up the difference.

And then, an alternative to that would be

to use a Tier 3 heat pump water heater, which really lines up nicely in comparison against your tankless instantaneous water heater.

So, we haven't really decided on the final format. It could be two entirely different packages or we could handle it through footnotes at the bottom of the table.

MR. NESBITT: Okay.

MR. SHIRAKH: I actually like what George did. If you have questions about the specific slide, feel free to come up because there's a lot of information and you can ask that.

But for more general comments like, you know, you love this or you hate it, you know, kind of save that for the public Q&A at the end.

So, we just talked about for mixed-fuel homes. We are going to require a PV system that is just large enough to displace the annual kilowatt hour of that home, not including natural gas.

So, what about all-electric homes? What size PV system should we require for that?

Our proposal, staff's proposal is to actually base that -- have the same PV size for both all-electric home and mixed-fuel homes,

which is based on the electric load of the mixed-fuel home.

The reason for that is, you know, the electric load is much -- the electric load is much bigger in an all-electric home. And so, it's sometimes twice as big as a mixed-fuel home. And that could be an additional 3 or 4 kilowatt of PV system, which is another $12 to $15 thousand costs. And, really, by having that requirement you make it less likely that builders will actually do that. Because, you know, who wants to fork out another 12 thousand bucks?

So, by having the same PV size requirement we're going to take that disadvantage away. It's not to say that people can't put in a bigger PV system, if they want, it's just we're not requiring it.

And a bigger PV system also requires more attention to grid harmonization strategies and the grid impact, and all that, so we're trying to minimize that.

Also, all-electric homes and GHG reduction, we looked at several scenarios that included both mixed-fuel homes and all-electric homes. And what we found, not surprisingly, is

that an all-electric home that is equipped with PV panels and battery storage can actually result in very small carbon emissions. That's good to know. Using our current construct, hand tools, and all of that. An all-electric home with an appropriately sized PV system and battery storage can result in very significant carbon reductions.

So, I hope you can read these numbers. I know they're small. But it's actually kind of important. We used to have these big, large screens here, and they decided to have these TVs, which are nice, but it's smaller.

So, what I have here is the different PV sizes for various ZNE strategies, for different climate zones. This is for a 2,700 square foot home in Sacramento, Climate Zone 12. Actually, it's in all different climate zones, but this is for a 2,700 mixed-fuel home.

What we have in this first column is the climate zones. I don't have all 16 climate zones. I think I've got 10 or 11 here.

The first column is efficiency EDR without PV. So, basically, this is the EDR that you would achieve by energy efficiency measures only. And as you can see, it kind of bunches up

in the mid-forties for most climate zones.

So, if you do high-performance attics, walls, those windows, and QII, and all of that stuff, you'll end up with an EDR in this range.

Column four is the PV size in DC kilowatts. That's just large enough to displace the kilowatt hour of the homes in each climate zone. And these are the sizes that we're proposing. Again, this is the larger of the two prototypes, 2,700. For 2,100 prototypes, the sizes will be smaller.

But again, looking at this, these are not gigantic PV sizes, they're fairly modest.

And since I live in Sacramento, I like to use that always as an example. You know, in Climate Zone 12 it's a 3.1 kilowatt system that will be the requirement for this climate zone.

And if you add the contribution to the EDR for the 3.1 climate zone and combine it with this, these would be the target EDRs that will end up for different climate zones, for this prototype.

And again, you know, you look at them and you've got some in 26, you know, some of them drop down to 18. Climate Zone 8 and 7 are very

mild climate zones, they have lower EDRs. That's San Diego and I think 8 is Fullerton.

But most other climate zones, they kind of bunch up in the kind of mid to lower 20s, so those would be the target EDRs.

So, then what I also did, I said, okay, this is the PV size that you need to displace the annual kilowatt hours. But what if we, you know, wanted to have a different strategy? Like if we wanted to install, you know, go through an EDR score of zero, full ZNE, using a PV system by itself. What I call the DOM PV here basically means a PV system with no grid harmonization strategies. You know, just slap on a bunch of PVs, annual direction, and then call it a day.

As you can see that strategy, to get you to an EDR score of zero, you need a 7 kilowatt system. A huge increase from 3.1.

But if you equip that same battery, the same PV system with a battery storage system, with very limited control capabilities, and the size goes from 7.0 to 5.8.

But now we can also improve our control strategies in a way that maximizes utilization of high TDV hours. And the way battery helps is the

PVs are going gang-busters in the middle of the day. You know, there could be an over-generation problem, so the TDV value of that generated electricity is low at the hour that it's being produced.

Batteries can store that and then make it available to the homeowner or the grid at 6:30 or 7:00 on a hot day, when the TDV values are high. So, this going from low to high is what gives this benefit to the batteries.

And because EDR targets recognize the TDV differentials, then batteries can take advantage of this. And that's why you can get to the same EDR target by putting in storage and downsizing, you know, the PV system.

So, continuing the story, you know, if you have batteries with kind of basic controls, the size drops to 5.8. But if you have more advanced controls that can really utilize those really high TDV peak hours, in late July, August, then your size actually drops to 3.8.

And if you want to go one more step further and put in condensing furnace and condensing water heater, you're down to around 3.5, which is not actually much bigger than the

3.1 that we started out, but this one actually meets the full ZNE definition.

But look at the cost, the size difference between 3 and a half and 7, or even 5.8. This is like a 2 to 3 kilowatt or more reduction in the PV cost. That's like a $9 or $10 thousand cost saving that can actually pay for the storage system. The storage systems could actually cost less than that.

So, here you have a strategy that you can meet the full ZNE or low EDR target with a modest size PV system that is grid harmonized, at a lower cost.

So, as you design your buildings and all that, you need to take advantage of the tools and, basically, both minimize cost and enhance benefits.

The next slide is the same thing, except it's for all-electric homes. And the story is the same, but because all-electric homes have a bigger electric load the numbers tend to be bigger.

But again, if you look at, again, Climate Zone 12, you go from 3.1 to 4.4, instead of going to 8.4, by employing some of these strategies and

technologies, and you can still get the full ZNE at a much lower cost and bigger benefit for the grid, the homeowner, and the environment.

So, extreme efficiency and ZNE. Can extreme energy efficiency, regardless of cost, achieve full ZNE or even low EDR scores?

And, Bob Raymer, you cannot answer this because you've seen this before.

(Laughter)

MR. SHIRAKH: How many of you think we can actually get to low EDR scores using extreme energy efficiency?

Come on. Yeah, you're not going to get scored. Remember that slide I showed you, you know, that I asked you to remember these numbers, that's where this comes in.

Look at this home. I mean, this is probably a passive house. It's got walls that are two-feet thick, probably filled with insulation, and probably a lot of -- but even if you eliminate all heating, cooling, and hot water, and say we don't want IIQ, I don't want an air conditioner, I want to take a cold shower all year round, no hot water heater, even on Christmas Day, you still end up with an EDR score

of about 25 to 30.

So, extreme energy efficiency is going to get you so far. That's because as I showed in most of our climate zones the dominant loads, nowadays, are plug loads. Look at what's going on in this home. You've got lights on. There's probably a couple of different TVs in there. You've got dishwashers, clothes dryers, clothes washers, the plug loads, the chargers and all that. So, that's what's driving, you know, the energy use in homes, more so than unregulated loads.

Again, with 2019, EDRs tend to be in the 43 and 48 range. Practical energy efficiency measures can reduce your EDR target by about 7 to 9 points, depending on the climate zone. So, realistic targets are more in the 34 to 41 range for energy efficiency features, alone.

Conclusions. Limited opportunity for regulated loads to lower EDR in the future. And if any community wants to go lower than these numbers, they need to depend on PV plus demand flexibility to achieve low EDR or ZNE goals. They can't do it with efficiency, alone.

Standards and PV sizing. Again, in Part

6 the requirement is the PV size that displaces the annual kilowatt hours. And, you know, you may install a larger PV than that, but you're not going to get any credit for it.

However, for Part 11, if you install a battery storage system that is at least 6 kilowatt hours, then the software will allow you to oversize the PV system by a factor of 1.6. And that is to basically allow these beyond-code programs to get to a ZNE target.

Why 1.6? It provides additional flexibility for the grid. The battery enables the increased PV capacity to be used by the utility to meet high demand during critical periods. Basically, it provides additional benefits to the utility and the grid.

It promotes self-utilization of the PV generation. Because you've got a battery in there, you can store it and then use it when you need it, and not send stuff back to the grid.

And also. 1.6 ensures that the cap, that in all climate zones there is actually a positive or greater than 1 benefit to cost ratio for the homeowner. And those are in some of the slides and I'll show you how we came up with that.

Now, CBECC also will allow you to exceed, bypass that 1.6 size. We don't recommend it but, you know, you can do it because we think we can actually get to full ZNE with a 1.6 and advanced batteries and demand flexibility measures.

But there is actually the checkbox that allows you to bypass the 1.6 size.

This is -- yeah, it's really hard to read. The estimate cost for our prescriptive efficiency measures, plus PV system by climate zone. I'll read it for you, if you can't read it.

(Off-mic comment)

MR. SHIRAKH: Pardon me? Yeah, so let's look at -- you know, the costs actually are driven primarily by the PV system. And so, the cost of the PV system, this is PV average of two prototypes, it tends to be around $9,000, $7,000. You know, in some climate zones like 11, it's about 10 and a half. Climate Zone 13, it's $11,000. The biggee is Climate Zone 15, with $16,000. But most of the other climate zones, they tend to bunch up around 8 to 9 thousand bucks for the PV system.

And when you add the cost of the high-

performance walls and QII, and high-performance attics and all that, so the final cost is in this column here. Again, it ranges between $8,000 and $9,000 in the milder climate zones. And Climate Zones 11 and 12, they're about $10,000 to $12,000. Again, Climate Zone 15 with $17,000. That's the kind of the outlier.

Okay, we're done with the easy part of the presentation. Now, we're going to get into lifecycle costing.

So, what I'm going to show you, now E3 helped us with a whole bunch of different scenario analysis, and I didn't present all their slides, and graphs, and all of that. What I'm presenting is what I call the E3's greatest hits, basically. What's, you know, we think the most relevant.

And so, what they found is based on a PV system that is sized to displace the annual kilowatt hours are cost effective in all climate zones. So, that PV system that I showed in that graph, we found that to be actually very cost effective in all 16 climate zones.

Again, even if we change NEM rules to only allow avoided costs for the hourly exports

and we didn't assume any federal ITC, the investment tax credit, which is going to phase away in a few years, anyways.

So, again, these are going to be hard to read for you guys, even for me standing here. But we have two scenarios here. This one is the all-electric home and this is the mixed-fuel home.

For mixed-fuel home, we have three scenarios here. The blue bar here -- and these are the climate zones. The blue bar is the size of the PV that offsets the annual kilowatt hours, those are the blue bars and that's the basis of our standards.

The next one is what I call the gold, is the sizing that offsets the electric load in TDV terms.

So, the blue is just basically hour-to-hour kilowatt hour -- I'm sorry, kilowatt hour-to-kilowatt hour offset. The gold is doing that in TDV terms.

And the red is displacing both natural gas and electricity. And as you can see, the red bars are much larger. Obviously, because we're including the natural gas load in it.

So, again, our standard requirement is going to be the blue lines in all 16 climate zones.

The one to the left is the all-electric version of that. So, again, the blue line is the size that would displace the annual kilowatt hours of the all-electric zone. And it's larger than this one, again because you have more kilowatt hours in an all-electric home. And the goal is the same; it's displacing electricity using TDV.

So, our recommendation is the blue line that you see here for both all-electric and mixed-fuel homes.

For the cost of a PV system, E3 looked at three different scenarios. The high cost is $3.55. That's assuming a little reduction in the PV cost in the future. The mid cost is about $3.00 a watt. And the low cost is $2.60. That's assuming more aggressive reduction in the PV cost.

What we're using for our recommendation is the mid cost. And I should note that this mid cost, about $3.00 a watt, also includes inverter replacement every ten years. So, our

recommendations are based on this.

For compensation, you know, we talked quite a bit about NEM rules. NEM II is represented here. This is the blue is the self-consumption, behind-the-meter electricity use, and NEP compensates that at full retail.

The gold is the compensation for the hourly exports. And again, for NEM II, that's what we call the NEM-adjusted retail. It's a little bit less than full retail.

The second scenario, behind-the-meter self-use compensation is the same, but the hourly exports are not compensated at avoided cost, which is about half of this.

So, the absolute most conservative scenario would be avoided costs for both behind-the-meter self-use and also exports. So, we looked at all three of them.

And this fine graph puts it all together. And if you have your magnifying glasses, you know, you can see. And, basically, the scenario that I described is this gold square, which is the mid cost PV system and avoided cost for exports. So, it would be these boxes here.

This is the breakeven point line right

here. Our recommendation is based on this, which basically says that it is very cost effective in all 16 climate zones.

What's also interesting is that even if we went to avoided cost for both self-use and exports, it is still in a lot of cases cost effective. It only is not cost effective if you assume no further reduction in the cost of the PVs. So, that's an interesting thing to keep in mind.

So, again, for Reach Codes we have to oversize the PV system by some amount. And we recommended a factor of 1.6. So, how did we come up with 1.6?

So, E3 looked at more scenarios. Again, one is basically the electric kilowatt hours that, you know, we've talked about. The other one is the maximum net benefit.

So, what scenario, what PV size would give you the maximum net benefit?

The third one is the electric TVD. You know, it was that gold graph that we saw before. And in almost all cases it results in a larger PV system and not quite as cost effective as this.

And then, what's important is this

breakeven point. You know, you can oversize your PV system and get to a point where there is no net benefit for the homeowner. Where's that going to lie?

So, the convention here, everything that you see is in blue is E3. Everything that's red I put in there so I know what I'm talking about. This basically summarizes.

So, this is the NEM II scenario where you have retail for behind-the-meter, self-use and exports, avoided cost and also -- and, I'm sorry, the exports are NEM-adjusted retail. And net surplus compensation for over-generation.

And the blue graph, again, is the PV size that would displace the annual kilowatt hours. It's the blue line, which is the smaller of all four lines.

The gold is the PV size to maximum net benefit. What is interesting is that the blue and the gold line are exactly the same, which means that the PV size that we require to displace the annual kilowatt hour also has a maximum net benefit in all 16 climate zones.

The red is the TDV. I'm going to ignore that for now.

The green is the PV size that will give you the zero net and that's the breakeven point. Basically, in these climate zones you can oversize your PV system. And as long as you remain below that PV size there is a net benefit to the homeowners. They're going to have a greater than one.

And what this does, it's a ratio between the green line and either the blue or the gold line. And as you can see, you can actually do oversize by quite a bit and still have a net benefit.

George, a quick one?

MR. NESBITT: Yeah, George. Traditionally, solar installers have sized systems at around 80 percent of people's electric use. And now, NEM II changed that a little bit, but not much.

So, what you're proposing is we size a system based on 100 percent electric use of the standard design being a mixed fuel.

MR. SHIRAKH: Right.

MR. NESBITT: So, assuming it is a mixed-fuel house, you're generating 100 percent of your annual electricity.

A couple of things I want to point out is I believe on your NEM application your fixed -- you're limited to I think no more than 110 percent of your electric use, although you can justify a larger system saying you're going to add EV or electrify. You can get around it a little bit, but there is a limit there.

And I mean, I guess the point is sort of that 80 percent was sort of, I think, a fairly sweet spot as sort of maximum sort of benefit and cost effectiveness of the system. So, when you go beyond that, it might be still less cost effective, but it's less cost effective. Or, essentially, you're getting less benefit for it.

MR. SHIRAKH: But George, I'm kind of losing the train of thought here. You need to get to this quickly.

MR. NESBITT: So, I can't put in 160 percent of my electric use. I can't oversize my PV system according to NEM.

And the other point I want to make is the relationship between predicted electric use and actual. Because I have a couple of real high-performance projects where the difference between the predicted electric use and their actual was

quite significant, which means we're sizing systems for way more use than they have, and there's no economic benefit. And there's actually -- there's negative impacts on the grid from oversizing and over-production.

MR. SHIRAKH: Yeah. So, again, just to answer quickly, this is for new construction and nobody exactly knows, you know, how much the kilowatt hours are going to be, the building hasn't even been built.

Some utilities are using a 2-watts-per-square-foot rule, which is actually much bigger than the sizes we're talking about here.

And so, yeah, you know, it's a gray area. But if you anticipate larger loads, like EV and all that, you know, I think you can install a larger system. And that's what, you know, this number is supposed to accommodate.

Bill, do you have anything to add to that?

MR. PENNINGTON: No, I think you should go ahead.

MR. SHIRAKH: Okay. So, again, going back to this, the ratio of the green, which is the breakeven, to the maximum benefit is much

greater than 1.6 in every climate zone.

So, we also looked at a scenario where, basically, it's retail for behind-the-meter but avoided cost for exports, instead of NEM-adjusted retail. And I'm calling that NEM III. I know there's no NEM III but, basically, this is shorthand for, you know, this strategy here.

So, what happens if we change the compensation rules so it's only avoided cost for exports going back to the grid? These numbers do come down. But again, it is almost right around 1.6 in every climate zone except one. So, that's where the 1.6 basically came from.

And if you do a statewide weighted average, it is slightly greater than 1.6. So, that's where it came from.

Now, if you look at another case where the retail is for self-use, but only net surplus compensation for the -- that's only the 3 cents or 4 cents a kilowatt hour.

For both the exports and the annual surplus, these numbers significantly drop. But again, in most, in almost every other climate zone it's right around 1 or above. So, it's just a sensitivity analysis that will show you that,

you know, if the compensation changes, you're still going to have greater than 1 benefit to cost ratios.

So, what about storage? What happens if we add storage, how is that going to impact cost effectiveness?

So, we looked a couple or three different scenarios. Behind-the-meter receives full TDV at about 20 kilowatt hours. Exports receive, you know, generally about 3 cents. The battery storage that we looked at here was 14 kilowatt hours in capacity. It's a 5 kilowatt charge discharge rate, 90 percent round trip efficiency, and the cost was about $500 per kilowatt hour installed.

Looked at one scenario. This one is based on retail for self-use and net surplus compensation for exports and annual surplus. So, again, this is actually a very conservative scenario because, you know, you're only valuing hourly exports at 3 cents a kilowatt hour.

But by adding storage to this, again I call that the generous Santa option because what would happen is Santa gives you the power and for Christmas he doesn't charge you for it. How does

that improve your efficiency?

You can see these green lines are basically going through the roof. I mean, storage can have a very positive impact on the kilowatt hours that are generated and you can see these ratios here.

But what if Santa actually charges you for that? You can see the numbers come down significantly but it's still much greater than 1.6.

We also looked at what happens for some of the MUNIs. I mean, most of our discussion related to NEM only applies to IOUs. But, you know, we do have MUNIs in the State.

So, we looked at three of them here. That's the IID, is the Imperial Irrigation District, SMUD, and LADWP. So, this is the TDV retail and that's the average for the IOUs. And SDG&E's NEM rates are up here. PG&E is here. And SCE is there. So, in those cases, you know, they're kind of bunched up.

LADWP, their NEM rates are kind of right up there with the IOUs. That's the blue line, the LADWP.

The red is the Imperial Irrigation

District and the green is SMUD, here. So, anything that's below these lines, that is cost effective, and these are climate zones.

Anything that's above these lines is not cost effective. So, what's not cost effective is these yellow diamonds, which is the high cost PV at avoided cost for everything. Again, you know, that would be a scenario where you have avoided cost for behind-the-meter, and exports, and also high-cost PV system. So, that would not be cost effective in any climate zone, for any utility.

But if we get to some of these scenarios here, which is even like the high cost PV system, and only avoided cost for exports, these are all cost effective for all MUNIs that we're considering here. Not all the MUNIs in the State, the ones we're considering here, and in all climate zones.

So, the scenario that you saw before, where you have retail for self-use behind-the-meter, and avoided cost for exports at different PV sizes, they're virtually cost effective in, I would say, 99 percent of the State.

There may be some MUNIs up north where they get very cheap hydro power that might be

different.

So, what would be the impact of the PV on the universe of PVs that are out there on the grid, as a whole?

The blue line here is total statewide capacity, that's installed and projected to grow in the future, regardless of our standards.

The red is a total residential retrofit. Again, it's there and it's going to grow regardless of what we're proposing here.

The green is the total residential new construction, which is this line. And this is basically the amount that builders are putting in on the homes already, in the absence of our standards.

So, this blue line is the impact of 2019 Standards. And at the end of this line here is basically 2023, which is the end of the three-year cycle for the new standards. So, the impact of 2019 standards at the end of the cycle would be only this much relative to the universe of PVs that's already out there.

Software tools, so we're getting close here. We've been working on CBECC-Res, continually adding capabilities to it for both

Part 6 and Part 11. The software can be used to size the PV for Part 6 compliance or, you know, you can also use it for larger PVs, for Reach Codes.

It will assess the impact of battery storage on lowering the EDR, assess the impact of pre-cooling and other DR strategies on lowering EDR, and assess the impact of heat pump water heater demand response on lowering EDR, and there are additional options.

This is an input screen from CBECC. This is a screen where you can specify your PV system. If you have a simple PV system that's only facing one orientation, you can use the simplified approach.

But if you have a more complex PV system, like the one I got, you can have two or three different orientations, and then you've got to go to the detail tab. And then, you can specify different arrays for orientation. You can either specify CFI orientation, which is 150 to 270, or you can have the actual orientation specified in this tab.

You can either accept an inverter efficiency or you can input your own.

Up here, this is for Reach Codes. If you want to reach a certain EDR target, you can actually put in that EDR target and the software will calculate the PV size based on the energy efficiency features, and your storage, and demand flexibilities. And it will tell you what size PV you need to get to that target EDR. It's a very useful tool. Without it, you get into this analyst iteration and you've got to put in 3.1, 3.2. So, this greatly simplifies.

But you don't want to use this too often because when you check that checkbox and it has to run through the simulation two or three times, it really slows down. So, once you figure out what your size is, uncheck this.

This is the battery tab. That's where you specify the size in kilowatt hours. Again, for controls we have two, we could have actually three here pretty soon. It's a default, best case, and you know, we can have something in between for controls. And that really changes the amount of credit the battery will get.

So, this is the efficiency, the round trip efficiencies and the charge discharge rate.

And here is where you have a checklist

that allows excess PV generation credit for both. That's basically when you put in the battery storage system the software will automatically allow you to oversize to a factor of 1.6. For some reason, if you want to go above that, you can check this checkbox and the software will allow it, but it will give you a warning sign, be aware of the NEM rules.

In this software, on this screen, under the building tab, you can check the checkbox and the software will give you credit against PV EDR for precooling strategies. And what is precooling?

These buildings that we're building with 2019 Standards, with high-performance attics, high-performing walls, really good windows, tight, you know, you've got continuous insulation, it's like a thermos.

So, the idea is that during those low TDV hours in the middle of the day, when electricity, PV is generating, you can actually use that to precool your house. And then, shut off the air conditioning when the high TDV hours or high TOU hours arrive, and you can very likely coast through those hours. And that strategy gives you

a pretty decent TDV credit or EDR credit.

The problem with that is this is highly occupant dependent. So, we cannot probably give you the full credit for it. It's sort of like the whole house fan, we have to discount it.

We saw this screen before. That's where, you know, you have to meet or beat these EDR targets and these are the numbers that I showed before.

To comply, this is a little bit different than the past, those of you who are familiar with the software. Again, in the past you only had to meet the energy efficiency target. Now, you've got both energy efficiency and the final EDR, which includes the PV numbers.

That's it for now. Bob?

MR. RAYMER: Yeah, Bob Raymer, with the California Building Industry Association.

Could you do me a favor and go back about five slides, where you were talking about the battery and having a midrange? That one.

Some of my comments in a minute are going to be getting into, you know, the administrative process. And there's going to be some here today that this is their first regulatory process with

the CEC. Namely, the battery industry and some of the solar.

And where you've got the blue line there, sort of the midrange that could be later done --

MR. SHIRAKH: Yeah.

MR. RAYMER: It's important, I guess, for everyone to know that the first version of CBECC is not the only version of CBECC, that there will be updates to it.

MR. SHIRAKH: Yeah.

MR. RAYMER: And those don't all have to take, necessarily, effect the day the CEC adopts the standards.

MR. SHIRAKH: Correct. You know, we're constantly -- Bruce is sitting there.

MR. RAYMER: Yeah.

MR. SHIRAKH: And we're keeping him real busy. And his job has been, the last few months, to constantly upgrade and update this software, adding more capabilities, and this is going to continue.

Of course, you know, we don't have unlimited resources. You know, so we have to prioritize, but we're doing the best we can to provide these tools.

MR. RAYMER: And I anticipate it's sort of a living type of a process here, and particularly, the storage industry is going to be coming up with upgrades. I'm sure right now, today, you'll probably hear that your costs seem to be on the large size, or the high side. But there's a lot of new technologies that are going to be coming out and so I see a lot of upgrades.

Anyway, is it time to go ahead and get into my comments here?

MR. SHIRAKH: Sure.

MR. RAYMER: Okay. Just in general, you know, CBI would like to extend our thanks to both to Commissioner McAllister and to staff thus far. In our view there has been and continues to be a general desire to work with the parties to seek a collaborative solution on a host of issues.

Kind of making matters more difficult, industry is trying to learn how to implement the existing 2016 Standards, while at the same time working with the CEC staff to develop the 2019 Standards. And I know that's a challenge on both sides here.

Both of these standards represent historically large changes in common design

practice and both represent historically large increases in the initial construction cost.

To restate the obvious, we are attempting to implement a series of major changes to our building codes in a remarkably short period of time. And we do appreciate staff's patience as we go about this.

And I'd like to particularly note some of the recent discussions we've been having on the potential for, once again, reviving the alternative compliance approaches. You know, in each climate zone having a dozen or so of those packages out there. I know that's going to be well received by both the enforcement community, who's here today, and by the building industry.

Particularly, as we find sort of new and emerging technologies, you know, such as the roll-in bat insulation that may be able to be used in the high-performance attics that could definitely overcome some of the other problems that we've had.

So, we're very appreciated of staff taking the time and effort to do that. We know it's not easy.

Regarding the administrative process, it

would be good for the CEC in the coming weeks to clarify what aspects of the solar, the storage, and the prescriptive and alternative compliance packages that I just mentioned, you know, when those will be addressed as part of the Part 6 update, and what aspects of all of that will be addressed as part of the ACM development and adoption process. The ACM process presumably taking place in the June to November time frame.

For those of you in the audience, who weren't familiar with the last update of the standards, we hear a lot about the PV compliance credit, and the fact of the matter is almost all of the work related to that was done post-adoption. It was done as part of the ACM update, which took place in the six to eight months after the adoption of the last set of the standards.

So, moving on, CEC's proposal regarding renewable energy storage in the EDR, CBI strongly supports a robust compliance credit for storage technology. In addition, we also support a significant compliance credit for storage compliance technology when used in conjunction with renewable energy above and beyond that amount that the CEC is seeking for sort of a

quasi-mandate in the EDR.

So, in essence, if in Climate Zone 12 you earmarked, you know, a 3.1 kilowatt system for that 2,700 square foot home and you're going to put in 4.5 kilowatts instead, what about that additional .6 kilowatts, you know, with storage?

And most importantly we support the use of this compliant credit -- or, these compliance credits as part of both the renewable and the energy efficiency portions of the EDR for the following four reasons.

With time-dependent valuation, number one, and today's storage technology is advancing rapidly and the related costs are dropping like a rock. Storage technology allows for the gathering of low-cost PV energy around the middle of the day, as you just mentioned, and keeps it on site for use during peak load periods in the late afternoon.

From an EDR perspective, this is similar to a highly efficient air conditioning system on steroids.

In short, CBI thinks storage should be modeled like an extremely efficient appliance.

Number two, grid harmonization. Over the

past nine months the CEC staff presentations have been placing an increasing emphasis on the rather dire need for this update and future updates of the standards to address grid harmonization issues head on. Industry completely agrees with staff on this.

It could be very problematic if we don't get this right early on and promote it as strongly as possible. On site, storage is perhaps the best way to accomplish this.

Time-of-use rates. Prior to the implementation of the 2019 Standards, the utility ratepayers in California for the most part will have made the switch to time-of-use rates.

Looking at the SMUD description for time-of-use rates that they're proposing, that I recently got in my bill, SMUD's time-of-use rate in the late afternoon, in the summer, will be approximately two to two-and-a-half times what it is in the morning and early afternoon hours.

Once this happens, ratepayers are going to get a wakeup call in the form of huge increases in their summer bills. SMUD was estimating $10 to $12. I see it being a whole lot more. People in Sacramento love their air

conditioning.

It goes without saying that the consumer support for storage technology is going to skyrocket once those bigger bills start to arrive.

And number four, industry needs to familiarize itself with storage technology. Similar to the PV compliance credit in 2016, industry needs to get very familiar with storage technology in a very short period of time. We cannot be waiting for 2013 to 2016 to get this. We need to be doing it effectively, now.

Providing an unrealistically low compliance credit for storage and limiting it to the renewable portion of the EDR is a sure way to suppress the usage of this technology at a time when the CEC and other agencies need to be promoting it.

And lastly, with regards to I don't want to say exceptions, but the limitations on solar depending on certain circumstances, we'd like to work with you. I noticed that exception number 5 mentioned building plans, dwelling plan submittals.

MR. SHIRAKH: Right.

MR. RAYMER: It may be better to put subdivision map back. You know, that's stuff that we can work on. You know, I'd particularly like to get CALBO's comments on that stuff, once you start really kind of fine tuning language there.

MR. SHIRAKH: Yeah, we need to get the terminology correct there.

MR. RAYMER: Gotcha. Anyway, thanks a lot.

(Off-mic comment)

MR. SHIRAKH: Yeah, we have a transcript here.

MR. RAYMER: Yes. We're going to be putting all of this into the docket and then some. We'll get it to you by your September 1st deadline. But Mike Hodgson is on a fact-finding mission in Tanzania right now and, you know, we may have to do a little augmentation.

MR. SHIRAKH: He has internet access, too.

MR. RAYMER: He's the smart one, yeah.

MR. SHIRAKH: Yeah. Thank you, Bob.

MR. RAYMER: Okay.

MR. SHIRAKH: Hi, Nehemiah.

MR. STONE: Hi. Nehemiah Stone, Stone Energy Associates.

Most of my comments have to do with the cost effectiveness analysis. And in the cost effectiveness calculations, I'm urging you to include the cost of installing natural gas to the neighborhood, piping it to the building, installing the meter, and piping within the building. Since gas is not required for buildings, like electricity is, all of the costs of gas infrastructure must be counted if you're going to treat the two energy sources fairly. Otherwise, you are giving an unfair advantage to gas.

And just to put it in context, we have a couple of quotes from PG&E for projects that were going forward, that are in the range of $13,000 for a single-family home. And I think that if you compare that to what you said, Mazi, about the cost of a PV system, of $5,000 to $8,000, it seems pretty clear that it's an important element that should not be left out of the cost effectiveness analysis.

At the very least, a gas package should have measures or requirements that balance out

the higher cost of having to install a gas infrastructure to and in mixed-fuel buildings.

And a question related to that. I know that before the standards become effective you have to do, essentially, an EIR equivalent analysis. When you do that are you -- how will the impact of allowing unnecessary gas appliances to be installed in already impacted air quality districts be handled? How are you going to handle that piece?

I've got a couple of other things, but I've put that out as a question, if you have an answer?

MR. SHIRAKH: How are we going to handle the impact of gas? They're already there.

MR. STONE: No, I'm talking about adding, allowing people to add more gas appliances in an air quality zone that is already impacted. How is that going to be handled in the EIR analysis?

MR. SHIRAKH: Well, I guess I don't know. We'll get to that at the time, you know, but we're not -- haven't really spent any time on the EIR, yet, so I don't know.

MR. STONE: Okay. And also, unrelated to that, but similar to how the Commission required

homes to be solar ready well before the CEC required solar, we're recommending the CEC should require controls to ensure that EVs are charged only at times that are beneficial to the grid, even if EVs are not being used right now, but any time an EV charging station is installed.

And then the last question I have is, are the algorithms within CBECC-Res that are estimating the output of the PV system the same algorithms that are within the newish software that is used with NSHP? Is it the same? Is it being calculated in those two pieces of software --

MR. SHIRAKH: I'll let Bruce answer that.

MR. WILCOX: So, there used to be a CEC PV calculator. It's going away and now there's -- I can't remember what it's called. I don't know what it's called. But anyway, there's a new calculator for estimating the output from the PV within the --

MR. SHIRAKH: And we're using a version of the PV Watts, but I'll let Bruce answer you.

MR. STONE: The New Solar Homes program.

MR. WILCOX: Yeah, I'd have to check on that, Nehemiah. I don't know what the new

software for the New Solar Homes Program is. But we're u sing a version of PV Watts, which was a federal government support NREL program. And I think it's, you know, an accepted software product, and that's what we're doing.

MR. STONE: Right, right. So, if they're not the same, in other words if what's going into -- what's being used for NSHP is not the same as what's being used for this, it could cause some problems down the line for --

MR. SHIRAKH: Well, the difference between the two aren't actually that big. And the problem with the NSHP is that, you know, it has to be maintained continuously. There's a large database behind it.

So, what we're doing here is basically eliminating the need for having a large database behind it by providing some default assumptions, and allowing the user to actually directly input. You know, the efficiencies of the inverters and all that, rather than trying to support this whole database.

MR. STONE: Are you confident that the answer will be close enough it's not going to cause any problems?

MR. SHIRAKH: We looked at it early on and the differences weren't that great.

MR. STONE: Okay, great. Thank you, Mazi.

MR. SHIRAKH: Thank you, Nehemiah.

Randall?

MR. HIGA: Good morning. First, I want to thank Commissioner McAllister and -- oh, my name is Randall Higa, Southern California Edison. Sorry.

I first want to thank Commissioner McAllister and CEC staff for their dedication and hard work for the continuing development of the Title 24 Building Energy Standards.

Southern California Edison supports the Commission's overall approach to the proposed energy standards and look forward to our continuing support of the Commission to work out any remaining issues, including implementation and supporting compliance improvement.

SCE supports efforts to enable customers to have options to manage their energy use. And to that end, SCE is modernizing the grid to support California's transition to a cleaner and more sustainable future. That includes

distributed renewable energy generation resources, energy efficiency, energy storage, electric vehicles, and demand response. Thank you.

MR. SHIRAKH: Thank you, Randall.

Any other questions in the room? Hi, Pierre.

MR. DELFORGE: Good morning, Pierre Delforge with NRDC. Let me just get my notes here.

I'd like to thank the Commission and staff for the opportunity to have this discussion and share this wealth of information. It's going to take a little time to digest.

But I'd like to offer some comments, some of which have been addressed today but, for the record, I still want to bring them up and others which have not, or at least I don't think so.

So, generally, I think NRDC supports, very, very strongly supports the general direction of the code.

We support, in particular, the prescriptive requirement for PV for new residential construction.

We do seek some clarification on

implementation. For example, we want to make sure that the exemptions or exceptions are narrowly and clearly defined, and would like to see the proposed language for stakeholder review and feedback.

And we also encourage CEC to establish alternate requirements for buildings that cannot or are not suitable for PV, so that they can still do their fair share for energy savings and carbon reductions. For example, through community solar, higher efficiency, grid flexibility requirements.

Alternate requirements would also reduce the risk of loopholes by avoiding the temptation of some get-of-out-of-jail-free option in the code.

We're open to flexibility as to where PV should be sited. I believe this afternoon there will be a discussion on community options, so I'm not going to go into details. But I just want to mention that as long as we can do it in a way that's additional, that's proximity requirements, and that the customer benefits are equivalent that the customers would derive from a rooftop PV we think that it's important to provide some

flexibility in the market for PV siting.

The second point is that one of, you know, the things that we most strongly support is CEC's direction and the PV credit in the code. You know, that was a tradeoff that would add homes with solar PV in the 2016 Code to have less efficient walls and attics than non-solarized buildings. And, you know, the idea was to have a transition. I think the transition is well under way. Costs are dropping.

And to ensure that this transition is complete by 2020 -- well, to ensure that the transition is complete, we need to ensure that the credit ends by 2020, something that we feel very strongly about. This is important because envelope efficiency remains critical to achieving the de-carbonization of buildings that we need to meet our climate goals. And it's not sufficient. You know, we did all the things like grid flexibility, which is something that we also support, but we do need high-performance envelopes, as well, and we need to complete the transformation that we have started.

On grid flexibility, we support valuing the grid flexibility in the code. Particularly

for battery storage, also thermal storage, like precooling and electric water heating. We support the principle of valuing that flexibility in a manner that sends a meaningful market signal, but also that does not jeopardize high-performance envelopes.

In terms of how exactly to do this, we need to go through what you've presented this morning to better understand it. But one related issue, which hasn't been addressed today, which I think is important to include in the mix because we need to look at this from a system perspective not just, you know, measure by measure is how the electric baseline that you have indicated that you're working on and you're going to provide, how is that going to be implemented?

You know, this is a part of the package. If we have electric baseline that truly provides a level playing field that is implemented both as a package and in the software, I think that provides a different level or a different baseline for how to ensure that all-electric buildings can be --

MR. SHIRAKH: Well, we're actually planning to do that, Pierre, both prescriptively

and performance. And, you know, we can lay it out for you.

MR. DELFORGE: Okay, Mazi, when are you planning to share this information so we can look at it and analyze it?

MR. SHIRAKH: So, the 45-day language will have to be released soon and it has to be before that. So, I would say in the next month or so we should have the outline for both the prescriptive package and -- I mean, we've been working on this for a while. We have a pretty good idea how it's going to look like, we just haven't gelled it, yet. But, you know, we'll share that with you.

MR. DELFORGE: So, I appreciate that information is something, you know, as you said, we'd like to see that to be able to fully evaluate the code as a whole but --

MR. SHIRAKH: But conceptually, it's going to use the Tier 3 heat pump water heaters to establish equivalency. That's for both.

MR. DELFORGE: Which sounds directly on the right, as long as we have enough room in the market for the higher performance water heaters, you know, the tier, the energy factor at 3.5, and

et cetera and, you k now, I think that's --

MR. SHIRAKH: It will actually allow credit for better performing Tier 3 water heaters.

MR. DELFORGE: So, this sounds promising. Thank you for thinking about this. And we look forward to seeing the information.

So, this concludes my high-level comments here. We'll obviously, you know, put some written comments with more detail.

But again, I'd like to thank the Commission for this opportunity and for this presentation.

MR. SHIRAKH: Thank you, Pierre.

Doug?

MR. MAHONEY: Good morning. My name's Greg Mahoney with the City of Davis, representing CALBO. And I have a question regarding the PV requirement and, specifically, your exception number three, which says in, essentially, three-story buildings there's going to be, I guess, some room for an exception or a limitation of the size of the PV system.

And I'm asking this question, one, to see if I can get some detail on how you're going to

handle that and, two, because in the City of Davis we're working on approving an ordinance that would offset 80 percent of the electricity use. And I'd like to, if we are going to provide or allow some exception, I would like to do that in a way that would be consistent with Energy Commission's proposal, so we don't have to kind of change it.

MR. SHIRAKH: You know, we actually have developed the prescriptive language for the Standards language. What we have here is just a description of the exceptions.

So, what the exception says is that for buildings that have three stories, you either have to meet the prescriptive requirement of the standards or what is allowed by the solar axis of the roof, but not less than one watt per square foot of the --

MR. MAHONEY: So, it would be dependent on the design of the roof, period?

MR. SHIRAKH: Yeah. You know what, it is dependent but we also want -- there is a backstop for it, and it's not just like, you know, you can just get out of it. You have to provide at least one watt per square foot of conditioned living

area.

And that generally results in a PV system that's about, you know, two and a half kilowatt hours -- kilowatts, something like that.

And so, it's going to be the lesser of, you know, what the standard requires prescriptively or what can actually be installed, but not less than one watt per square foot of conditioned floor area.

MR. MAHONEY: Okay.

MR. SHIRAKH: And it's a modest -- it's going to be a really modest size and it probably requires about less than 200 square foot of decent solar access on the roof to accommodate that lower level.

MR. MAHONEY: All right, and no exception for two-story?

MR. SHIRAKH: No, two stories, no given the PV sizes that we have and how much the roofs have, we don't think there's going to be any problems.

Again, then we also provide that exception with if you install a PV system of six kilowatts, you can reduce the PV size by another 25 percent. So, you're really talking about

solar access that's less than 200 square foot, sometimes 150. And most homes should not have a problem to meet that. But if there is, let us know. I mean, we're still developing these exceptions.

MR. MAHONEY: Okay, thank you.

MR. SHIRAKH: Thank you.

MR. OBALDIA: Good morning, how are you?

MR. SHIRAKH: Good morning.

MR. OBALDIA: Berman Obaldia, representing the California Asian Chamber of Commerce, over 600,000 small businesses throughout California.

We are here not to ask a particular question but just to, hopefully, be part of the process, to be engaged in the rulemaking process over the next couple of years or so forth.

Folks in the Legislature are debating affordable housing. There is clearly a shortage of affordable housing in California and it's not getting any better. It's getting worse.

So, as we debate that in the Legislature, and there's proposals to increase developer fees, any number of ways, public policy issues to address the problem, that a concern that we have

to a certain extent is that in the process of developing these rules that we keep our eye on the prize in terms of the ability to provide affordable housing.

And if there are measures in the regulatory process that could exceed or exacerbate the cost of a home to a fair number of Californians then that -- the goals are laudable in terms of what we're doing. But if it raises the bar, so to speak, financially for a segment of the California population to afford a home in the first place, then we're not addressing the issue in a viable way.

And I think the concern that we have is that in the process of developing these rules that there seems to be that we be afforded the opportunity to determine and to ask what were the costs associated.

Case in point, the use of the insulation, the cost of the insulation for these homes, we'd like to be part of that dynamic and the discussion in terms of how did you come up with certain costs associated with insulation? Were the manufacturers of the insulation or the home builders brought into that discussion?

So, I think that's the concern that we have. The goals are laudable in terms of zero energy homes. I think we're in concert with that. But it's the means to that end that concerns us in light of the fact that we have a shortage of homes and it's affordable homes that we're in dire need of. And by the rulemaking authority it could push those affordable homes even out of the price range for a certain segment of the population.

So, as we move forward, hopefully you'll work with the industry, you'll work with the Chamber of Commerce as constituencies, as part of your constituencies to help develop this.

I think, like I point out, we're there to be part of the solution, but not the problem. But the means to that end I think should encompass and incorporate the stakeholders from throughout California. So, thank you so much.

MR. SHIRAKH: Thank you. And if I can make a couple of points on the very important issue of affordability. On the question of insulation, how we do the costs, we actually do talk to both builders and the building insulation manufacturers often. Sometimes we have meetings

here and bring them all together to come up with new ideas and then exchange ideas. So, it's all of them.

MR. OBALDIA: Yeah.

MR. SHIRAKH: On affordability, what I can tell you is that in our standards we're required to demonstrate cost effectiveness to the homeowner. Every single measure we put in has to be cost effective from the homeowner's perspective.

With the 2016 Standards we did that, we're going to do it for 2019. That $10,000 cost that I mentioned in an earlier slide, it will result in an increase in the mortgage to the homeowner. It might be, based on a 30-year mortgage, 3 percent interest rate, I mean I don't know the math, but we worked it to be around $11 to $12. I don't know, but I'm just speaking.

MR. OBALDIA: Yeah.

MR. SHIRAKH: But the utility bill reduction for that same home is going to be reduced by probably more than twice that amount. So, from day one there's going to be a benefit to the homeowner because their overall cost is going to be -- there's going to be a reduction.

MR. OBALDIA: I think we're in agreement of that. But I think before that homeowner purchases that home, they first have to get the 20 percent down, and so forth.

MR. SHIRAKH: They have to quality, right.

MR. OBALDIA: Because I've been in that situation. I'm not looking at what my energy costs are going to be once I'm in there; I'm looking at what's the cost of buying a home, period. And if you have inflated numbers, if there's a disparity between what you feel, what you think based on your analysis in terms of what the insulation costs are, and the home builder's providing perhaps a different perspective, I think that's the part of the discussion that needs to take place.

MR. SHIRAKH: Of course.

MR. OBALDIA: That ultimately the costs are going to be borne by the consumer in some way, shape or form.

MR. SHIRAKH: Right.

MR. OBALDIA: And I think that's a discussion that, hopefully, will be entertained. And that in the course of your rulemaking

authority that a greater discussion take place or opportunities for real-world scenarios to come into place. Because what you're talking about is laudable, but if you talk to a mortgage broker and so forth, and they say, well, those are -- if you just added an additional $10,000 cost based on the rule that you're trying to promulgate, well, that will have an impact on that person's mortgage for 30 plus years. So, that takes away the whole concept of what my electricity bill, which is wonderful, but I think those are the real-world discussions. How do we get affordability and how do we get people into these homes within a reasonable price point.

MR. SHIRAKH: Okay, thank you.

MR. OBALDIA: Thank you.

MR. STONE: Nehemiah Stone, Stone Energy Associates. I want to respond to the previous speaker. A couple, well, I guess it was the last round PG&E sponsored a study that --

MR. PENNINGTON: Well, I think part of the purpose of your comment is to explain this to the previous speaker --

MR. SHIRAKH: We can't hear you.

MR. PENNINGTON: So, start over, please.

I think we need the attention of the previous speaker for your comments to be useful, so my opinion.

MR. OBALDIA: I'm sorry?

MR. STONE: I'm responding to you.

MR. SHIRAKH: Nehemiah is going to respond to your comments.

MR. STONE: So, in the last round PG&E sponsored a study that the UCLA Anderson Forecast did to try and figure out what the relationship is between the cost of construction and the price of a home, and changes of costs due to standards in particular. And they found that there's absolutely no relationship.

So, making an argument that increasing the measures in the code towards efficiency increases the price of a home is not correct.

It is correct to say that it affects the contractor's profit. It is not correct to say that it affects the price of the home.

That study was -- I'm happy to put it on the record again, if necessary, but the study was pretty conclusive that this is a demand-driven market. It is not an inputs-driven market. A lot of things, the cost of the inputs affect the

price, the sale of the object afterwards. In this market that's not the case.

MR. OBALDIA: Great. And that might be the case. But our concern is let's have that transparency, that really is. Because it's an apples and oranges concept here in terms of how the costs are ultimately going to be borne. And that's all. Like I pointed out at the outset what you're doing is laudable, it's in concert with what we're moving towards with renewable energies and so forth, but it's just the end. The means to that end may have some unintended consequences, that's all.

And having been in the public policy arena, I know what happened with deregulation in the early nineties and so forth, and the consequences of that.

So, it's just as you're formulating public policy issues you can never discount things that may transpire. So, that's all we're saying. Thank you.

MR. SHIRAKH: Thank you.

MR. PENNINGTON: I'd like to also respond a little bit. Mazi understated the extent to which the Commission tries to engage the industry

related to costs, and having discussion with the builders that are thorough to try to vet why cost estimates might be different. The Commissions spends tons of person hours to address that and get into dialogue with the industry. Not only the building industry, but also the suppliers. So, there's a bunch of dialogue that occurs that's natural in our process.

The other thing I wanted to say is that, so, there's two different brands of affordability that's in discussion here. And you're bringing up one brand of affordability.

There's another brand that is basically HUD's definition of affordability, affordable housing. And that definition includes the cost of ownership and the cost of operation of the home, and those two in combination need to be affordable.

And so, explicitly in HUD's definitions, HCD's definitions is included the ownership cost and the cost of utilities. And so, the totality of that is what actually defines affordability for affordable housing from their vantage point.

And so, as Mazi was saying, we have an obligation to make our requirements cost

effective. So, any additional cost that we impose, we're required to demonstrate that we exceed that cost in savings through the utility bill. So, as long as we do that and, you know, we work hard to do that, by definition we're making housing more affordable according to HUD's definition and HCD's definition.

So, in terms of I appreciate there's more than one brand of affordability, but according to that brand we're kind of one of the only agencies that impose building code requirements that actually cause the housing to be more affordable by definition, and we're required to do that.

MR. OBALDIA: And I agree. It's just how you view that, through what prism in terms of affordability.

And affordability, you're using the HUD standards and so forth. But the real-world standards, trying to buy a home in San Francisco, as opposed to Fresno, there's a disparity. I mean, you have to make over $100,000 in certain instances, as a family, to afford a home in San Francisco, as opposed to Fresno.

So, I think the notion of affordability now has been interchanged in terms of what it is.

MR. MEYER: Yeah, I think you left a zero off on the income for San Francisco. But, yeah, it's something that I know that CBIA, and others at the Energy Commission have had a lot of discussions with the financial community trying to get them to recognize initial cost versus cash flow.

MR. OBALDIA: Yeah.

MR. MEYER: And as Bill talked about, really, we're looking at saving people money on cash flow so that they're not -- get into a house they can afford initially, but they lose the house because they can't afford the utilities.

MR. OBALDIA: Precisely.

MR. MEYER: But we can advance standards so that they have a house that's affordable for long term. But if they can't get into that house because the financial community doesn't recognize that, they just look at that initial cost, then that's where we have a disconnect, and that's something that CBIA has brought to our attention and we've looked at a lot. And, ultimately, that would be a wonderful thing to get the financial community to put more emphasis on the long-term affordability of the house, instead of the

initial first cost.

MR. OBALDIA: No, I agree. I think that's why we want to be part of the discussion, the overall discussion not only at the CEC, but CARB, and any other rulemaking regulatory authority. So, thank you, appreciate that.

MR. SHIRAKH: Thank you.

Marshall?

MR. HUNT: Good morning, Marshall Hunt, Pacific Gas & Electric Company, Codes and Standards.

I personally want to make the observation that this is an amazing instance of leadership and creativity. If you'd told me a year ago we'd be at this place, I wouldn't have believed it. So, I really appreciate the way in which you've all, all the staff --

MR. SHIRAKH: You're making me blush, Marshall.

(Laughter)

MR. HUNT: That's okay because I've been doing this for long enough to really appreciate the work that's gone into this.

But we need more time to comment. You've really shaken things up and you've really

challenged us with a lot of good ideas.

So, the due date on the comment I think is September 1st. And if you could give us at least another week and maybe two weeks, you'd get a much higher quality response. It just takes time to get the various groups within our organization to get focused and get a good comment letter into you.

MR. SHIRAKH: Simon, can you find it in your heart.

MR. BAKER: Give me a minute. I can't make a motion, but thank you.

MR. SHIRAKH: That's Payam's call. What do you say? George?

MR. NESBITT: George Nesbitt, HERS rater.

MR. BOZORGCHAMI: Hold on, George, one second. Sorry.

This is Payam at the Energy Commission. Would September 6th work for you, Marshall?

MR. HUNT: I think the 13th. The 6th is over Labor Day weekend.

MR. BOZORGCHAMI: I understand. The reason is we're trying to get everything wrapped up by the end of September to have the express term workshops here, at the Energy Commission.

So, I'm sorry --

MR. HUNT: I'll take what I can get, personally, and so we can work over the Labor Day weekend, that's good.

(Laughter)

MR. BOZORGCHAMI: Sorry. I'll be working, too.

MR. NESBITT: Double overtime. George Nesbitt, HERS Rater.

The grid currently, roughly, has about 20 percent renewable, and that's eligible. So, non-eligible adds to that. And our goal is for 50 percent.

So, my house, sitting as it is without PV, is only, you know -- the electricity use is only increasing in the amount of renewables over time.

So, the question is does it really make sense to have a new house generate 100 percent of its electricity? I don't think it does.

Some potential consequences of this, I think in the short term we're going to see what we saw when demand in Germany went up. We'll see some supply shortages. There will be less price competition. We may have labor shortages. We'll

get over those eventually. Those will be short-term implications.

But I think the longer-term implications are really back to my comments on sizing and 100 percent, and based on predicted use, not actual use.

And some of those consequences, what we have is people will use more electricity because for some reason they're not getting the benefit. We've seen that with net metering all along. They didn't get their credit back so they through in an electric water heater to use more electricity.

So and then there's the impacts on the grid, the duck curve. Currently, there's something like 5 megawatts of behind-the-meter, net-metered PV. Grid-side, there's like 12 megawatts.

And I'm not sure of the exact number but what, approximately, 20 percent of new homes have PV currently. And I believe that someone mentioned that Bob and CBI said, and he'll correct me if I'm wrong.

We're looking at potentially what, a sevenfold increase of PV installed on new homes

and we're not even talking about existing buildings.

So, if the duck curve is already a problem, that one-third net meter is a part of the duck curve, whether people recognize it or not. So, we will only be making the problem worse.

And storage, and especially battery storage is the most expensive way to deal with this problem.

Now, I've installed PV. I like renewable energy. It's all good, right. But I think the proposal as it is, is too much PV and not requiring storage is the wrong proposal.

Just a couple of other things. Enforcement. We know we have enforcement problems. So, what happens if one person builds a house, they have to put their PV on and the next person doesn't?

And another issue is I've installed PV systems on my parents' house in Berkeley, and we had to have an appraisal because my mom died in January, and the appraiser flat out said the PV systems actually detract from the value of your house because people don't want to buy it and

they don't want to have to deal with it.

So, we have major problems in how efficiency and even renewable is valued in the marketplace.

MR. SHIRAKH: Thank you, George.

Next, please.

MR. LOHR: Good morning, Olaf Lohr from Sonnen. Yeah, great initiative, great proposal that you have brought forward. Really appreciate the efforts that you put in there.

I just want to speak a little bit about, actually, the value of energy storage and challenge a couple of the assumptions that you are making.

Initially, you outlined the duck curve and the problems that it poses, resulting in low value of power during the midday, low value of PV export and, actually, a higher demand of evening energy. And also, a tremendous need for DR.

And as it stands, and that it was also outlined in the presentation, all of the assumptions were based on net metering 1.0 that is --

MR. SHIRAKH: 2.0.

MR. LOHR: Well, I would actually say

1.0. Because initially the time-of-use value, as we see it in 2.0, which is really a 1.5, isn't really that tremendous. Many of the studies right now actually outline that even if you install energy storage right now at the current time-of-use are going to be implemented, the value of energy storage isn't all that great.

Exactly that slide here actually outlines that the value of PV exported is very similar to the retail value.

MR. SHIRAKH: This is the one we're using, actually, this scenario.

MR. LOHR: Okay, but this is only for the surplus generation.

MR. SHIRAKH: So, yeah, surplus is going to be avoided cost. Behind-the-meter, self, uses that retail.

MR. LOHR: Exactly. So, I really think in the end the current rate structures of net metering 1.0 and also the rate structures that are going in for the next two years really don't reflect value of energy storage. And I think it really needs to go into those calculations that are proving in. I also encourage you to, and that's maybe not specifically your task, but I

think it's the task of the Energy Commission to move forward and really work on rates that encourage energy storage, right.

MR. SHIRAKH: Yeah.

MR. LOHR: That actually value the time shifting, value the DR, value also the evening time-of-use rates. And really appreciate the tremendous value that energy storage can provide to the grid.

And as that, I would also challenge the assumption that energy storage prices will drop like a rock. They're definitely going down, but they're not going to be at a point where it's free, right. Energy storage will have its cost because it also has its value.

My wife always said things that are cheap or free, they don't have any value.

(Laughter)

MR. LOHR: And because I want to conclude with that we don't want to end up with in a scenario where we encourage the installation of energy storage in our new homes and then the end customers, they don't see value in it because it doesn't change anything in their rates, and then they actually turn off those batteries.

So, that's what I really encourage you to move forward and create rates that actually encourage the usage of energy storage.

MR. SHIRAKH: Thank you.

MR. BOZORGCHAMI: Excuse me.

MR. SHIRAKH: Am I correct that the time-of-use rate schedules that correctly evaluate -- that values energy at different times that could favor PV and storage, but that is important but it's not part of the building standards development process. That's more of a CPUC, utilities realm.

MR. LOHR: Right, I do understand it. But we actually have to look into this, paint the picture from all of the different aspects, and also put those assumptions in there.

MR. SHIRAKH: Thank you.

MR. BOZORGCHAMI: Excuse me, sir can you repeat your name and your affiliation one more time?

MR. LOHR: Yes, my name is Olaf Lohr, with Sonnen.

MR. SHIRAKH: Thank you, sir.

MR. BOZORGCHAMI: Thank you.

MR. KENNETH: Well, my dear, esteemed

colleague from Germany, Olaf Lohr, I am also from Sonnen. WE are a leader in residential energy storage. We are a German company in the United States, now. We have 20,000 real installations around the world.

And I think what I'd like to do is just start out by saying that there's a little to be learned, I think, from our friends in Germany. I'm sure some of you have already studied the electricity grid in Germany. The episodes that we go through.

And I was just on the phone this morning with my boss, our CEO and founder. He continued to remind me that, you know, the Germans have been through some of the same stuff that we're going through right now ten years ago, with the extensive amount of renewable energy penetration.

So, we learned a little bit about this topic and that's why we came here to make sure we just at least share a few items. And it is absolutely the case that we support this direction of the code. It's a wonderful direction.

Sonnen has the largest distributed network of energy storage systems in the world,

in Germany. We have 17,000 systems that are already aggregated to the virtual power plant software layer. We already do what most people talk about here in this country and we've been doing it for years in Germany.

And what have we learned? Well, grid harmonization enables a true clean energy future. We've learned that.

We've learned that a distributed network of energy storage systems, coupled with rooftop PV should be deployed for the purpose of supporting the grid and offsetting many of the challenges associated with the intermittency and unpredictability of renewables, helping to kill the duck.

So, solving a problem, enabling a mass adoption of clean energy. This is somewhat of a repeat of what you've already heard, but I think it's still important because this is the position I wanted to make sure everyone heard on the record.

A distributed network of energy storage systems can also add net new value to the overall grid infrastructure, as I think most of you know, and not just solve a problem. Now, that's a

different thing.

For example, offsetting peak periods as an aggregated virtual power plant, we already do that. Coupled with demand response programs and we already do that.

The ultimate idea is to create a significant investment deferral opportunity, try to get rid of some peaker plants, for instance. Cheaper, cleaner and more efficient due to the decentralization. I challenge you to Google Sonnen Community, S-o-n-n-e-n Community and learn about how we do that now.

We also have a peer-to-peer clean energy trading platform.

So, other grid services, like frequency regulation and voltage support can actually add value and help defer grid investments, including TND investments. So, energy storage can become a fully effective, non-wire TND investment deferral.

That said, and this is an important point and why I'm here, utility support is the key to the overall affordability. At least that's how it works in Germany. That's how the math works. Otherwise the math doesn't work. The costs that

you're talking about are a little nuts.

We do real energy storage systems that are actually installed and work. And right now the costs that you have on there, on the board are based on some assumptions, perhaps from some other companies, and these assumptions are not very well, in my mind, vetted.

If a utility proactively invests in energy storage systems that a home builder is standardizing on in a development, which are coupled to PV rates to bring real value to the overall electricity grid then, my friends, there's a shared cost which enables an affordable home and a low electricity bill. Which is what our other friend was talking about trying to get an affordable home and a low electricity bill and we've got some very nice proofs of concept.

In Germany, a home builder doesn't have to increase anything, obviously, because the utility is investing directly in the energy storage system and utilizing it, which is quite nice.

So, there's great support for this zero net energy new construction initiative. We are very excited about it. There should be an

option, in our opinion, for true energy independence which is, of course, when you have an energy storage system that is not being controlled by the utility because you want to be independent.

Or, an energy self-sufficiency and security system which assists in the overall stability of the electricity grid, that more carbon-neutral living. That, of course, alludes to an energy storage system and PV rate that are controlled by the utility.

So, in Germany you can join the Sonnen Community, which would mean that the grid operator is working with your battery every day, but you don't have to. It's not a mandate. You could just stay completely independent. So, that choice, I think, is a pretty important benchmark. Because as soon as you say every energy storage system must be controlled by the utility for grid stabilization, then you get some really unhappy consumers who say you're taking away their freedom.

But if you offer an incentive for utilities to get involved, then utilities seem to get involved. There's not a lot of pushback

against it. And then, you also have your independence people who can remain independent and not have the utility use their battery for demand response and frequency regulation, et cetera.

So, that's the prepared remarks from Sonnen. And we hope to be a part of this more. We're obviously only in this country, now, for about a year. But I think it's a very important benchmark and we have a lot of good information.

MR. SHIRAKH: Thank you for your comments.

MR. PENNINGTON: Just a quick question. In Germany, do you have tiered rates that you're dealing with or, I'm sorry, time-of-use rates?

MR. KENNETH: Yeah, so the German structure has -- it depends on what area of the country and the grid operator. There's four grid operators. Right, Olaf?

MR. LOHR: Correct. So, there are --

MR. SHIRAKH: Please come up to the podium so you can --

MR. KENNETH: You also have a lot of limitations on grid --

MR. LOHR: Right. So, there are

definitely tiered rates. And most of all the biggest difference is a different valuation of PV export. So, you can only export up to 60 percent of your self-consumption. And also, anything over that is basically worth only the wholesale cost of energy.

MR. PENNINGTON: Okay. I mean, do you have like at different times of the day are there different rates?

MR. LOHR: Yes, absolutely.

MR. PENNINGTON: Okay, thank you.

MR. KENNETH: Just to add onto that, I want to point out that that was a matter of necessity that started to happen. I mean, there's so much renewable in Germany, right, that in our Sonnen Community when existing rates go negative because there is more renewable generation than there is load in the entire country, on a sunny and windy day in August, we have to take the -- our Sonnen Community members take energy off the grid and are paid to do it because there's literally no place for that energy. The duck curve is so fat that it can completely bring down the grid. And they can't just send it to France, right.

So, it's an interesting benchmark and I think it's nice to look at because I always hear every day, and I was at Tesla before I was at Sonnen, and we talked all the time about different U.S. States. No one every talks about a country that some days has over 100 percent of its load renewable. That's probably a good benchmark.

MR. SHIRAKH: Thank you.

Francesca?

MS. WALL: Hey, Francesca Wall with Tesla. I'd also like to thank the Energy Commission staff for their leadership on this code cycle, especially in terms of incorporating storage.

I'm going to focus just briefly on a couple of comments around storage that Tesla's made in the past, and also build off of some things that Bob, from CBIA focused on.

And then, I'm also going to read comments from CESA, on behalf of them. They were not able to join.

But I'll start with Tesla's comments. So, as has been discussed a lot today, batteries can help meet state and local GHG reduction

targets for deficiency and home design ratings. We believe that battery storage is one of the most flexible measures to meet the EDR and reduce the home TDV, considering its ability to offset electricity consumption from any home load, at any time of the day.

Furthermore, a builder should have the flexibility to achieve design standards and batteries should be evaluated as their own category of credit/measure.

You know, a lot of people talked about the ability of batteries to be charged from inexpensive, or off-peak TOU, or negative priced electricity, load GHG emission grid power, or zero emission onsite renewables.

So, building on that, if PV is installed above and beyond the prescriptive PV amount, then we believe that additional energy generated from PV that is used to charge the battery and discharged to avoid the electricity imported from the grid should be valued at the full TDD that it offsets.

And, furthermore, batteries have their own set of customer benefits that vary from other efficiency measures or renewable measures, so

they should be evaluated accordingly.

Finally, we said this before, but we believe that batteries should be fully valued for their ability to reduce the EDR and TDV. And batteries should be allowed to offset prescriptive energy efficiency in PV measures through the perform compliance approach.

And creating a battery credit that is allowing for the adoption of a new and very valuable technology to compete on an equal playing field, with all technologies, is incredibly important. A battery credit should not be seen as a competitor to other specific industries but, rather, batteries can offset all technologies and are not meant to offset any single measure, efficiency or renewables.

So, I'll end my remarks with that and then I will read CESA's comments.

So, the California Energy Storage Alliance, or CESA wasn't able to be here for the public remarks, but CESA's policy director, Alex Morris, requested that I read this statement.

"CESA supports the path forward where the benefits of storage and promoting a low EDR, integrating, helping customers smartly capture

and manage electricity use, and potentially supporting the grid are valued. The information shared so far indicates P values for storage are being considered. We look forward to further ensuring storage has a place in new building standards.

We know that many in the buildings, safety and firefighter groups, or trades are looking actively at storage. Storage is key with helping with the duck curve and is not only a smart addition to most new-build buildings, but also is cost effective in many applications.

Furthermore, storage should be fully valued for the benefit it provides as a separate category and thereby given the opportunity to offset prescriptive efficiency in PV measures in the performance compliance approach."

That's it, thank you.

MR. SHIRAKH: Thank you, Francesca.

Good morning.

MR. KNUDSEN: Good morning. I'm Kelly Knudsen with the California Solar Energy Industries Association. Thanks again for the opportunity to comment here. I'll keep my comments as brief as possible.

We're urging the CEC to reach the full zero net energy goals in this code cycle for the stated goals. Efficiency is important and generating and storing your own electricity is equally important in meeting that goal. And I'm hoping that we can all work together to get there, as it sounds like the tone that's coming through today.

Echoing what Bob had mentioned earlier, builders should be allowed the flexibility to choose the compliance option and at a minimum the compliance credit for the PV should remain in place. And we're seeing that PV and storage could be combined into that compliance credit, as what's been discussed here today.

As number seven in the goal you listed earlier, the model ordinance, we signed on to NRDC's comments earlier in the cycle. As somebody who deals a lot with the different jurisdictions that are trying to figure out how to meet the stretch goal, these model ordinances can be very helpful and it's great to have that guidance. So, I'm glad to see you guys are developing that.

On the grid harmonization, I'm pretty we

may have some written comments, especially what dumb PV might be. But I might just say that there are smart inverters that can be coupled, or inverters in general with solar that can, hopefully, make it harmonize well with the grid as is and then, of course even with storage on site.

And then, I'm just curious about what some of those optimum battery controls are, but those are things that can definitely be discussed further.

And also, I appreciate seeing about the all-electric homes and how we can meet that. I just want to make a point for solar water heating and solar thermal, as well. I know that's been a different session. But since I saw the mentioning of the heat pump, I just want to at least put the plug in there for solar water heating. It can also help out with that.

So, we'll be providing written comments as well, likely the CIA has before on these technical issues, and figure out what we can do to have strong zero net energy homes, with solar and storage on the grid. And, hopefully, we can all get there without Santa Clause. Thanks.

MR. SHIRAKH: Thank you for your comment.

MR. CAIN: Joe Cain with the Solar Energy Industry Association, and that's a national solar energy association. Kelly's with the California.

I'm going to do this without a net because of so many things I've heard today. And some of the points Kelly made I think are really important points and I want to expand on some of those.

And the first one is I think that, you know, we've been hearing about zero net energy for about ten years, and there's hundreds of articles written about California's going to get to zero net energy by 2020.

And I see videos of our Governor, Governor Brown saying that, you know, with pulling out of the Paris Agreement that, you know, where the Federal Government fails to lead, California will continue to be the leader.

I just have to say that I think we could get to zero net energy in this cycle and I'm really not looking forward to reading a couple of hundred articles about how California couldn't get there, even California couldn't get there in this cycle.

So, I'd like the Commission to continue the efforts to try to get there and I'd like to see zero net energy.

Another thing that is, again, more of a general comment is that we -- well, first, I'm going to say that I really hate clichés. And sometimes I say if I hear one more person say low-hanging fruit, I think I might scream.

But efficiency and renewables, you know, about 12 years ago we started talking about loading order, and we put distributed energy and PV, you know, essentially in the last position.

The basis of that was, at that time, it costs less to save a Btu than it does to generate a Btu.

I ask people all of the time what has changed in the last 10 or 12 years and the answer, of course, is everything. I mean, the state of building science then, the cost of solar then, things have radically changed.

But part of the, well, maybe unintended consequence, part of the negative part of the loading order is that we have put ourselves in silos. And we have even organizations that have energy efficiency people and renewable energy

people in the same organization. What I find over and over again is that they don't talk with each other. They're each doing their thing.

And in our industry, we're kind of accustomed to my stuff is better than your stuff. But I think we really have a case where energy efficiency and renewable energy are equally important and should have equal standing. And that we have storage, we have EV charging, we have all of these other things to go with it.

And they should all be part of a clean energy economy, they should all be part of the solution, and they should all have equal standing.

And in one particular case we heard, you know, we've heard of course testimony that, you know, we should discontinue the credit for PV against any other measure.

Now, you've found in this proceeding we've seen that -- I've seen multiple ways to shrink the size of the PV, multiple ways to put it in last position and make it smaller.

But then when it comes to can I offset some other measure to have an overall building that is more affordable, and that's another key

word we heard today, can I do any other performance tradeoffs? And the answer so far is no, you can't. And some people still argue for no, you can't.

So, my question is why would the Commission that is so bound to cost effectiveness force builders to choose and option that may be a less cost effective option?

And I'm going to give an example. I hope I can spend the time. Driving to 2-by-6 walls, when it's not required structurally is one thing. I'm a civil engineer, I do structural engineering. And when I think about Green Codes that typically say we should save lumber waste and we should be thinking not only about carbon, but about embedded energy, and transportation, and everything else, I think about driving walls to 2-by-6 walls simply to fit more insulation is -- that's a cost driver.

And so, I would think that if 2-by-4 works structurally that that should still be an option for the builder to consider. And by the time you get to an end of a project you should be able to find the most cost effective.

So, I think that there's certain measures

that on their own may be found to be cost effective, but I think there's also an opportunity cost if you don't allow another option that is more cost effective to be part of the overall solution.

So, those are some of the key points, I think. In terms of tradeoffs, in terms of the overall solution and bringing everything together, the Solar Energy Industries Association is extremely supportive of storage, to bring that into the overall solution. We understand that it solves multiple problems and we're ready for it.

In terms of cost effectiveness, one of the issues that we have is, you know, we have often asked questions about where do these cost figures come from? We've heard that they come from talking with the manufacturers and from industry. SEIA would be happy to share cost information. I report into the research team there. We still feel, and we've commented on this in the past and received zero response, we still feel that the cost estimates for PV are over-estimated. And then, we also heard that some of the value of PV is discounted, cut in half.

And then, we have heard questions coming from the building industry about where do some of the cost figures come from for the efficiency measures.

So, I think because the whole thing is based on cost effectiveness, you know, we would like to see more dialogue, open dialogue on where do these figures come from.

So, again, I just want to close with we feel efficiency, renewables absolutely important. You know, you have to have a great envelope, you have to have a good quality of construction, but we do feel that renewable measures should be on equal standing with efficiency and that there should be an overall cost-effective solution that makes us have more affordable housing.

MR. SHIRAKH: Thank you, Joe, appreciate it.

Any other comments from inside the room. Good morning.

MS. GARCIA: Hi, I'm Daniela Garcia with SoCal Gas. SoCal Gas wants to thank the Energy Commission for the work that has been done on the 2019 Building Standards. We support the CEC's focus on our ratepayers, the lifecycle cost and

grid harmonization issues. We also support your sensitivity analysis that was shared today for the possible future changes for the NEM rate.

We commit to reviewing the content presented today and will provide any substantial comments in the docket. Thank you.

MR. SHIRAKH: Thank you, Daniela.

MR. KENNETH: This one will be quick, promise. So, I just think one of the very important details I want to encourage --

MR. BOZORGCHAMI: I'm sorry could you state your name, please?

MR. KENNETH: It's Lather Kenneth, Sonnen.

So, once again, a very important detail from the energy storage industry. Again, from a learning that we had in Germany, as well as in the U.S., but the make and model of an energy storage system is a pretty important thing. And I think in the very immature and early stage American market a lot of folks aren't really looking at that specific detail.

In other words, how long does this energy storage system last? What is the battery chemistry? What is the cycle count? And what is

your original stated charge at 700 cycles, 800 cycles, 900 cycles?

So, if you have a battery that lasts 10,000 cycles versus 800 cycles, or a battery that claims it can last 1,000 cycles, but has never been proven to last 400 or 500, this is a pretty important detail when you look at cost.

Because if you're just basing your analysis on cost of the energy storage system and not the cost of the energy storage system when taking into account all energy stored in the life of the system, so what is the cost of kilowatt hour stored versus just taking the price and divide it by kilowatt hours of one single stated charge and saying that's the price.

Well, if the system only lasts 500 cycles, which we learned pretty quickly in Germany -- Sonnen wasn't doing it. But a lot of companies, hey, we've got the cheapest energy storage system around, hey, the cost is down. Yeah, when you cycle it every day it's done in a year and a half, two years. That's not so good for your efficiency standards.

So, if you have an energy storage system that lasts 25 years there's value to that. And I

just would love to make sure that the organization that you guys look at cycle count. Longevity of the actual energy storage system is pretty important in the battery world.

MR. SHIRAKH: Important point, thank you.

MR. MEYER: Okay, it is. Christopher Meyer with the Building and Standards Office. I just want to make sure that everyone who's made comments get your card or your information to the reporter so that she can get your names accurately.

MR. SHIRAKH: I just want to say that this is running a little bit longer than anticipated. We may have to start the CPUC's presentation after lunch.

What do you think, Payam, are you --

MR. BOZORGCHAMI: I think so. I think if we go -- I don't know how many more commenters are going to be presenting or talking at the mic but --

MR. SHIRAKH: We still have online comments. You know, we can decide at --

MR. BOZORGCHAMI: We have one commenter online and maybe one more in here. So, yes, if it's okay, we would like to do the presentation

with the CPUC after lunch.

MR. SHIRAKH: Jon, did you have a comment?

MR. MCHUGH: Jon McHugh, McHugh Energy. I'd just like to respond to a couple of comments made previously. I got started in the energy industry back in the early 1980s, installing solar water heaters, so I've got a great appreciation for renewable energy.

But also related to the issues of longevity, looking at tradeoffs between the efficiency of the envelope for the building, it does really bring back the whole question of the duration of the measure.

You know, and relates to the whole issue of what's considered lost opportunities.

Retrofitting solar, retrofitting air conditioners, those sorts of things are things that are -- they're more costly, of course, as a retrofit. But installing insulation after the fact, as a retrofit, is extremely expensive.

And in addition, if we look at the longevity of envelope components, those are things that affect the State even beyond our 30-year period of analysis that we use.

So, this is actually describing that there actually is, potentially, a reason and a rational for the loading order when we do look at efficiency. And it does relate to the use of resources. Those 2-by-6 boards that are brought to the site, that additional energy of bringing those boards to the site are well outweighed by the value of having a more efficient envelope. So, thank you very much.

MR. SHIRAKH: Thank you.

Any other comments inside the room? We're going to go to -- go Joe.

MR. CAIN: Joe Cain with the Solar Energy Industries Association.

We're not by any means saying that efficiency is not important. We say that efficiency and renewables are equally important. And just as one -- and I don't want to drag up all of the arguments because there's a lot of them on this particular topic. But there's also a benefit to installing solar with original construction and full system size of the original construction. And that has to do with, you know, the construction methods that are used.

And one example I might give is that

there's a guy who figured out how to get a rocket to return to earth and land upright, and he is working on a solar roof.

And I'm not pitching a product; I'm just saying one example. I'm just saying one example. If a conventional roof covering was already installed then, you know, at the time of the original construction, then that is the retrofit situation that we're talking about.

So, we want to have more flexibility for the builders to choose whatever product and whatever methods are most cost effective for that particular building and that particular site.

MR. SHIRAKH: Thank you, Joe.

Nehemiah, a quick comment, and then we're going to go to --

MR. STONE: Nehemiah Stone, Stone Energy. I meant to ask this when I was up before and I forgot. So, on the slide where you showed the exceptions to solar you had single-family, three-story. I didn't see anything for multi-family. And can you just clarify what the -- how this would apply to multi-family three-story?

I mean, is that exception supposed to extend to -- that's the wrong slide. Showing the

exceptions to the size of the PV. Yes, there it is.

So, exception three is for single-family homes, three stories. What about multi-family?

MR. SHIRAKH: We should probably have the similar for multi-family.

MR. STONE: Thank you.

WEBEX COORDINATOR: So, we're going to go to a question online. Brandon, if you're ready, I'm going to unmute you now. Go ahead and state your name and affiliation.

MR. SHIRAKH: Brandon, can you hear us?

MR. DEYOUNG: I can hear you. Can you hear me?

MR. SHIRAKH: Yes, go ahead.

MR. DEYOUNG: All right, this is Brandon DeYoung, with DeYoung Properties. We're a production home building in Fresno, California.

I'm going to try and be brief because I know this is going long. I've got four key points here to go through. The first one, and I probably sound like a broken record to some of you, but I just really want to urge everyone to not call a home with a score, an EDR score of zero, a zero net energy home, or ZNE, because

that would be inaccurate.

An EDR score of zero is based on TDV value, as we all know. That's zeroing the value of the energy, not the energy itself. So, labeling a home zero net energy based on TDV is not a good idea.

Builders, in my view, would get sued all over the place for misleading advertising. And, unfortunately, we live in California and that's inevitable regardless. In fact, we're already having debates, with our own attorneys, about calling homes of ours that are zero net energy based on a site or source definition, we're already getting debates with our attorneys about that and having to -- how to explain it correctly, and should we even call it zero net energy if you can't guarantee that it will be after they move in.

So, I just really, really want to urge everyone, please think seriously about calling a home with an EDR score of zero as zero net energy.

Can you still hear me?

MR. SHIRAKH: Yes, we can hear you.

MR. DEYOUNG: Okay. So, that's the first

thing. And also for time purposes here, you know, yeah the next code we're seeing is not going to be full zero net energy. And maybe it never is because it will be based on TDV.

But builders now can, in theory, build a home to EDR zero, right? And so, if that's the case then some of them may start already hearing you guys talk about that being a zero net energy home and incorrectly start labeling their homes done at EDR zero, as zero net energy.

My proposal is just call it an EDR zero home, or a home that achieves a score of zero on the EDR scale, or maybe just call it TDV zero. Or, here's one last one, zero net value of energy, ZNVE. Whatever you want to call it, other than zero net energy because we're missing that crucial value word in there. So, that's the first point.

Another point is that I haven't really heard any discussion about any analysis about shading of solar systems on single-story homes, where adjacent to two-story homes. And this is especially an issue where you have a higher density single-family development, with a mix of two-story and single-story homes.

In our analysis, the issue of potential shading of a tall, two-story home next to a single-story home is actually pretty significant.

So, I encourage you guys to maybe look into that a little bit more and consider the ramifications of that.

MR. SHIRAKH: Isn't that in exception number one, Brandon?

MR. DEYOUNG: I'm sorry.

MR. SHIRAKH: Isn't that our exception number one where --

MR. DEYOUNG: Well, I guess. But let me ask you this; let's talk about an example here. If I have a single-family development, you know, and one of our buyers -- and we don't pre-plot our communities, right. Maybe some builders do and they know exactly what plans are going to go on exactly what lots.

But in our case, we allow our buyers to select any one of our plans and build them on generally any one of our lots. So, imagine one buyer selected a two-story on one lot, and then just randomly another person selects a single-story home on another lot, so are you saying that you would get a site-specific like exception for

that one single-story on that one single lot next to the two-story?

MR. SHIRAKH: Yeah, I see what you mean. Yeah, the exception number one is for an existing building that's already out there. So, you're talking about within the same subdivision having a mix of --

MR. DEYOUNG: Yes, exactly.

MR. SHIRAKH: Yeah, we'll have to think about that. I understand what you're saying.

MR. DEYOUNG: And believe me, like I said, we're seeing this first hand in our own analysis that that could be significant.

So, I also wanted to, so moving onto my third point of the appraiser issue.

I know George already mentioned this, but I just really want to emphasize. Again, I'm telling you first hand that appraisers, at least here in our area of the Central valley, appraisers are not giving the true, full value of a solar system. And so, therefore, if a buyer of ours wants to purchase a system instead of doing a lease, then that cost, that extra cost, whatever is not appraised in the home value ends up having to come out of pocket cash. And that,

obviously, is thousands of dollars.

Now, I understand Nehemiah's point, saying, referencing that one study that, well, that doesn't mean -- it's all based on the demand, right. And if there's enough demand, then the seller can force that extra cost onto the buyer.

But if there's not enough demand, then it's forced upon the builder to absorb that extra cost.

Well, the problem is it's bad either way you go. If it's the way Nehemiah says, then that means builders will not -- it will start eroding -- I'm sorry, hopefully, you can still hear me.

MR. SHIRAKH: Yeah, we can hear.

MR. DEYOUNG: Okay. It will erode the builder's profits at some point and they will either leave the State because they're no longer profitable here and it's not a sustainable business practices, or they'll go out of business. And that's only going to exacerbate our housing shortage issue of not building enough supply to meet the demand. Which, obviously, is not good right now because that just further puts upward pressure on home prices, making

affordability even much more of an issue, and that hits families here in the Central Valley even more so, as we kind of referenced earlier, because they tend to be a bit more lower income than families in other parts of the State.

So, I just really want to urge that appraiser issue. I mean, if appraisers were able to fully value the cost of the system, and we're hoping to do that in the monthly mortgage payment, then we'd have much less of an issue, frankly.

But I'm just telling you firsthand it's not happening right now, at least in our area.

And then one final point here is that someone also mentioned the cost of gas. It may have been Nehemiah. The cost to include gas into a community and in a given home.

I've actually run the numbers myself, in our specific community, with the drought and if we did go all-electric how much would that save us on gas infrastructure and the cost of all of that?

And while that cost savings was pretty substantial and significant, there was also cost increases. And maybe not in the long term, but

in the short term we would have to switch to electric heat pump water heaters, heat pump space heating systems, electric cooktops. You know, we can talk about some of the residual use and why they would cost us more.

But in all what I found is that it almost ended up being a wash, if not a little bit of an extra cost, still, to actually go fully electric, even when you factor out the cost reduction of removing gas infrastructure.

MR. SHIRAKH: Is that something you can share with us, Brandon?

MR. DEYOUNG: Yeah, sure.

MR. SHIRAKH: That would be good. Thank you.

MR. DEYOUNG: So, that's my four main points. So, thanks for the time.

MR. SHIRAKH: Thank you, Brandon.

Any other comments in the room or online?

WEBEX COORDINATOR: Mazi, one comment online. "Can you explain the proposed solar-ready exemption for Climate Zone 15?"

MR. SHIRAKH: Again, Climate Zone 15 has -- let me go to this. Climate Zone 15 is this one down here. And where most climate zones are

in the mid threes and below, Climate Zone 13 is at four, and Climate Zone 15 is at 5.7.

And Bruce?

MR. WILCOX: Yeah, Mazi, this is Bruce Wilcox. Maybe you should explain that Climate Zone 15 is Palm Springs in the Southern California Desert.

MR. SHIRAKH: Exactly.

MR. WILCOX: And the reason that it's so big is because of the cooling loads there are enormous.

MR. SHIRAKH: Yes. So, you know, that is Palm Springs. It's more like Arizona than the rest of California.

And there's almost no cooling load in there and it's entirely electric load. So, our concern is that, you know, there may not be, and especially when you go to the two-story prototype, there may not be enough space, available solar access on that roof to accommodate an almost 6-kilowatt system.

So, you know, this is basically just to be a little bit cautious and provide a variance so, you know, we can have a PV system that can be accommodated by the solar-ready zone that's

available on that house. So, that's the rationale behind this.

MR. MEYER: Yeah, this is Christopher Meyer, just to clarify when we talk about exceptions that these aren't exemptions from the requirement. They're just exceptions that allow for an alternate way of remaining in compliance.

So, we're talking about a smaller system.

MR. SHIRAKH: Right.

MR. MEYER: Not that they don't have to have a system. We're just making sure that we're going to require a system in that climate zone that can reasonably fit on the roof.

MR. SHIRAKH: Good point, Christopher. So, this is not an exception that you can just entirely get out of this requirement. You know, basically you can accommodate the smaller PV system.

But still, it's kind of basically the exception kind of brings the PV size in line with Climate Zone 13, which we think a 4-kilowatt system, roughly around 230 square foot, should be accommodated rather easily.

WEBEX COORDINATOR: Jeff, I'm going to go to you next. Go ahead and state your name and

affiliation.

MR. SPIES: Yes, fine. My name's Jeff Spies. I am the Senior Director of Policy for Quick Mount PV. We're a Northern California manufacturer for PV roof attachments. We employ about 85 people at our manufacturing facility in Walnut Creek, California. And we, as a company, are working hard every day to reduce the cost of rooftop PV for homeowners.

I just want to say that I support full zero net energy in this code cycle per the California Energy Commission's goals for the past ten years.

Efficiency measures are important, but generating your own electricity is equally important, particularly since plug loads now have become the dominant load with the growth of electric vehicles.

So, I would say that builders should be allowed flexibility in the compliance option. At a minimum the compliance credit for PV should remain in place, as in the 2016 Standards. And PV and storage could be combined to maintain this compliance credit.

So, thank you for your time.

MR. SHIRAKH: Thank you. And again, if I had a note that -- we recognize that ZNE has been a goal. But again, as I showed in our earlier slides, what's driving us are net energy metering compensation rules, both how they appear today and how they may change in the future. So, that's actually the overriding concern. And that's part of the reason why we landed where we've landed.

Any other questions online?

WEBEX COORDINATOR: Yeah, we're going to go to Brandon next. Go ahead and state your name and affiliation.

MR. CARLSON: Yeah, my name's Brandon Carlson. I'm in Southern California. I've a Vice President of New Day Solar. I'm a solar contractor.

I wanted to echo the support that Jeff Spies just mentioned there. I want to thank -- the presentation you guys have put together, I know how time consuming it is to put together something like this.

I also support the full net zero. I hear a lot when we talk about this stuff, especially when you get into I-code and making panels, like

with the CEC and the NEC, we basically hear all the time is, well, we can do it in the cycles down the road.

Well, it's important and I'm sure everyone's aware that cycles down the road that can add quite a bit of time. So, it's important to keep our mind on the fact that whatever we decide now, you know, we're kind of stuck with for a little while. So, it's just something to keep in mind for all of us.

Thank you for your time, I appreciate it.

MR. SHIRAKH: Thank you. Any other comments online?

WEBEX COORDINATOR: So, we have a comment from Jean Woo that I'm going to go ahead and read.

"I would ask that the standards allow for increased load for adding EV charging and utilizing onsite solar and storage, as this is a relief for the grid. Also EV charging when solar installation is greatest is a net benefit re: duck curve, and reduces GHCs, too.

In addition to this, I believe that the standards should look to incentivize EVs and EV charging. Also, the appraisers in the CEV should

be educated on the true overall value of the solar plus battery system, which is significant with the new TOU rates."

MR. SHIRAKH: So, the question of requiring EV chargers in residential, well, you know, I showed you the screen shot from CBECC and, you know, you have plug loads and EV is not a part of that. It's not part of the building load, yet.

But, you know, some of us own EVs. Most of us don't, you know. We cannot really predict which home is going to be occupied by someone who has an EV or not.

So, you know, requiring it would be a stretch especially, you know, when you don't know who's going to occupy that. And, basically, that doubles the amount of kilowatt hours that a home uses.

So, we need to be more deliberative about this before, you know, we talk about requiring it as part of Part 6.

But what we're doing is we're working with the Air Resources Board. And as part of the Reach Code, you know, there are two tiers in the Reach Code, the Tier 1 and Tier 2.

What we're proposing is that the EVs will become an elective that builders can choose. There are several electives and EV will be an additional elective on that list that they can choose to.

And perhaps for the second tier, then EV charger, a level 2 EV charger, a 40 amp will be required to meet the Tier 2 requirements.

So, that's something we can do, but at this point to actually have it as a performance measure in the standards, you know, we think it's a bit premature.

Any other? So, Christopher?

MR. MEYER: Yeah, I just wanted to sort of echo some of the really good comments on EVs in the crowd, and that emphasize the value of aligning EV charging with solar -- with renewable energy generation. I think that was sort of a very good way of thinking about it.

And what we don't want to inadvertently do is incentive EV charging that is non-coincident with renewable energy generation. So that instead of it becoming a benefit to help with the duck curve or help with over-generation of renewables, it actually becomes a load that is

likely, at least in the short term, to be met with peaking power or, you know, sort of higher GHG sources.

Also, you know, we try to be cognizant of other things when we talk about grid harmonization. If we incentivize EV charging at home at night, we need to understand, you know, when you take that in combination with houses using net energy metering that are having a lot of interactions with the grid, you know, in the mornings and sort of that solar peak, then you have the utility peak in the afternoons and evenings.

And then if we add another load at night, that would be a big question for the PUC and the ISO, for utilities to figure out how their distribution system, how the transformers would handle that. When would they ever cool off? You know, are they designed, are the circuits designed to handle that continual delivery of energy without the system cooling down?

And that's the kind of things that we need to be cognizant of before we advance anything.

So, it does sort of sound like we're

kicking the can when we say we need to look at this in future code cycles, but that's the kind of items that we want to make sure that we fully understand. That we've coordinated with not just utilities, but also our sister agencies so that we understand -- we can take advantage of their expertise to make sure that we're in step with them on codes that we're introducing.

So, you know, that's all. Thank you.

MR. SHIRAKH: Thank you, Christopher.

And again, we fully recognize the benefit of EVs. If they're done correctly, they can help with grid harmonization and especially in nonresidential buildings, you know, there's a huge potential for that.

But, you know, we need to kind of -- we know that EVs are going to be here, too. So that this interaction between EVs, PVs and battery storage is very important and we need to get it right.

But for the current cycle, you know, having it as a performance tradeoff of any kind, I don't think we're ready to do that.

Any other comments?

So, this concludes, you know, this

segment. Again, we're at the noontime. I don't know, Simon and Roy, you know, we can plow through this if you guys want to continue, or we can break for an hour. I think Simon's hungry, too, and he's nodding.

So, if we come back at --

MR. BOZORGCHAMI: So, yeah, we will start again at 1:00 sharp, and we'll continue with the rest of our program. Thank you.

MR. SHIRAKH: Thank you.

(Off the record at 12:01 p.m.)

(On the record at 1:10 p.m.)

MR. BOZORGCHAMI: Good afternoon. So, if everyone takes their seat we can get started. We've got a full day, a full afternoon.

(Pause)

MR. BOZORGCHAMI: So due to this morning's -- Mazi's presentation this morning, we're a little bit behind. So, as I said earlier, we're going to start with Mr. Baker's presentation. And if everyone's ready, we're going to do it now. So, Mr. Baker.

MR. BAKER: Thank you. Good afternoon, everybody. It's a pleasure being here. Thank you for the opportunity.

And I'm also joined here at the table by Shannon O'Rourke, and she's an analyst that works on cost effectiveness and, in particular, the net energy metering proceeding. So, if there are questions about that, we can certainly use her expertise to answer some of those questions, as well.

The next slide. So, what I want to talk about today is a study that our Commission commissioned, done by our consultant, DNV-GL. And we also have DNV-GL on the line, I believe. Is that right? Okay, so we have our technical consultant online, as well, if there are questions about the study.

And the purpose of the study was to examine what the distribution grid integration costs of zero net energy and of net energy metering policy is, generally.

So, just to set a little bit of a policy context, and we heard about this earlier in the day, beginning in 2006 with California's adoption of climate goals under AB 32, there was a real push, a continuing push as there has been for decades in California, but to find evermore energy efficiency. Where could we get evermore

energy efficiency?

And that work began at the CPUC in 2007, in an energy efficiency proceeding there with the adoption of big, bold energy efficiency strategies in a 2007 decision. And the work that we did to adopt those goals was done in concert with our colleagues at the Energy Commission, as well.

And concurrently, in 2007, the IEPR also adopted these residential ZNE goals, which are that by 2020 residential new construction will achieve zero net energy.

And by virtue of the fact that these goals, for the PUC, came out of the energy efficiency proceeding, I think it's important to always remember that the PUC really does see these zero net energy goals as an organizing principle for getting more energy efficiency. So, it really, first and foremost, is about getting more energy efficiency.

So then, in 2008, the Public Utility Commission adopted the Energy Efficiency Strategic Plan. And that incorporated this same zero net energy goal. And then it also laid out a number of different strategies by which to

animate market transformation towards ever greater energy efficiency involving non-utility market actors, partnering up with the Energy Commission through the Codes and Standards cycles to get to higher levels of energy efficiency.

And then, from then on and up until today, the PUC has authorized significant IOU ratepayer expenditure towards a number of different programs that have supported this push towards more energy efficiency and evermore stringent energy efficiency codes through new construction programs, through advocacy support for codes and standards, through emerging technologies programs, and also through research.

And there was a study that was conducted a couple, maybe three years ago as part of that research effort, which really highlighted how much new solar growth could potentially come from a zero net energy goal. And that, I think, really kind of brought into focus for some people, in a new way, that the PV dimension of the ZNE goal also needed to be examined very closely.

And in 2012, the staffs of our two Commissions worked together on a Codes and

Standards Action Plan, which was really sort of taking the goals in the Energy Efficiency Strategic Plan to another level of detail, and laying out some more specific milestones.

And one of which was to, because we had long acknowledged that the cost effectiveness frameworks that the Energy Commission uses to consider new standards does not -- had not incorporated an assessment of what the potential cost to the distribution grid might be of interconnecting large amounts of behind-the-meter PV.

And so there was an action in that Codes and Standards Action Plan to develop that methodology. And so, that's what this study does that we want to share some of these results with you today.

Also in 2015, we put forward the Residential Zero Net Energy Action Plan which, again, is kind of a deeper effort to mobilize the marketplace and it was a partnership, as well, between our two Commissions to get towards the residential ZNE goals.

The next slide, please. So, I think people are well aware of the net energy metering

policy. I'm not going to explain what it is. But just to state that in 2016 the Commission, pursuant to statute, AB 327, did adopt new rules for net energy metering. And there are different rules for systems over one megawatt. But for our purposes here, the rules for under one megawatt I think are most pertinent.

And among the key changes that were made at that time is that the customer now pays a one-time interconnection fee.

And then, also, grid interconnection costs, to the extent that they are incurred, they're socialized. Those costs are socialized over all ratepayers.

But the Commission did require the utilities to track those costs and they do so, and it's in their filings.

And so far, I've got a data point just to share that between June 2015 and June 2016, so far $25 million of costs had been tracked, associated with distribution grid updates.

And also in that same decision, in 2016, the Commission signaled that in 2019 it would revisit its NEM policy. And later on I'll have some slides to talk that through a little bit

more.

The next slide, please. Thank you. So, as I said, we hired DNV-GL to do this study for us. And it's a similar study in some ways to studies that the utilities themselves did, as part of the NEM successor tariff proceeding.

But what we wanted to do is have a Commissioner overseen and sponsored study so that we could really scrutinize those methodologies and then kind of come to our own assessment.

The study objectives are twofold. First, to inform the residential ZNE policy determinations. And so, primarily to feed into this process, provide information into this process so that decision makers in this process can have this dimension of the cost benefit analysis considered in the policy determinations.

And secondly, as the Commission turns to its review of NEP policy in 2019, we wanted to have some analysis to inject into that process as well.

So, overall the study evaluated two cases looking over the 10-year period. This actually goes out to 2026. And it looked at two different cases. The base case, which is just the growth

trajectory for PV that's expected, using assumptions out of the most recent IEPR demand forecast mid case.

And then, the second case is looking at, okay, what additional growth might occur as a result of a decision to require residential ZNE in code? And those assumptions came out of a sensitivity case, also out of the IEPR analysis. So, we used assumptions out of the IEPR process.

It's really important to point out, however, that this is not a benefit cost analysis. It's purely coming up with methodology here to attempt to quantify what one cost component is.

The next slide. So, just to provide an overview here of the methodology that DNV-GL put forward for us. The first step was to take the projected annual PV growth from those assumptions that I just showed you, and then map those onto distribution circuits. And they can up with geographic allocation method, using GIS layers.

And as part of that, they assumed that the average system size per home would be about 2 Kw.

Then, they went about categorizing each

of those distribution circuits in the three IE service territories into a subset of representative circuits.

And then they performed power flow studies on a sample of those circuits, and they looked at what the cost would be to integrate PV up to 160 percent penetration level.

And as part of that power flow study analysis they evaluated various different technical criteria that are used in distribution planning, including voltage levels, thermal capacity limits, reverse power flow, and so forth.

And then, as increasing amounts of PV were added to a circuit and as technical criteria were violated, the researchers added in first the least cost, traditional measures that could be used to mitigate those particular violations. Whether it's reconductoring, or capacitors, until more expensive options were then layered in.

And as part of the kind of base case analysis here, the measure that ended up kind of being the determinant of cost here was energy storage. Because that mitigation measure could mitigate any number of different technical

criteria violations. And it was used as a last resort after the least cost options were layered in.

Now, as I'll show later, we did do a smart inverter sensitivity case, which shows potentially lower costs. And we also did a case in which we optimized the locations or we looked at a different perspective of where the PV systems would be installed on a given circuit.

And those two perspectives that we looked at, really, was there was a high cost case where we assumed that all of the ZNE homes would be lumped together in one place, on a circuit. And if I'm not mistaken, I think it was towards the end of that circuit.

And then, we looked at a low case, a low cost case and said, well, okay, what if the new PV was really just distributed throughout the circuit, how would that change the cost results?

And so the two charts on the right there, they show for the three utilities they -- it's an illustrative example of what the cost results showed, adding more and more PV onto the utility systems, you know, going from zero to 160 percent.

And you can see that there are very different slopes in terms of the high cost case and the low cost case. And that's, again, because of the attributes of where the PV is being added on to a given circuit. It's more costly to integrate PV when it's being brought on at the end of a circuit, rather than nearer to the substation.

And you also see that there are clear differences between the utilities, in terms of the architecture of their systems, and so there are clear cost differences, and we'll get into that a little bit more.

The next slide, please. Okay, so getting into the results here. For the high cost scenario and, again, this is kind of a conservative bookend analysis here, for the three utilities is shown here.

And you can see that, you know, without ZNE, where most of the solar growth is happening just because of NEM policy, alone, and no additional growth due to ZNE, there already is potentially significant costs here for integration of these resources.

In PG&E's case we're talking about, you

know, over three-quarters of a billion dollars in costs over this 10-year period.

And then the increment, in PG&E's case, of going to ZNE is fairly significant. That's about $600 million in incremental costs.

But in Edison and San Diego's case the costs are much lower, and I'll explain later why there are significant differences in terms of the estimated costs amongst the three utilities.

The next slide. So, as I said, we did a sensitivity case looking at what would the impact on the results be if we made assumptions about the use of smart inverters to address some of the violations that were found in the power flow studies.

And what we found was that one of the primary drivers for integration costs that the researchers found in this analysis, was due to voltage issues in a reverse power flow situation.

But a potentially cost effective mitigation measure would be if smart inverters were required and set to have reactive power as a priority, which is not the current requirement for smart inverters. The current requirement is for real power priority.

But it seems like a reasonable sensitivity case to look at because smart inverters, with phase 1 capabilities, are going to be required in California beginning in September of this year. And with the exception of this reactive power priority, which is not currently required, but has been proposed by staff to be required, many of these capabilities will be available beginning in 2017 for new installations.

There were some small amount of costs required due to capacitor banks that were assumed to be installed on feeders in these instances. And this analysis also did not assume that there were any real power losses, although those are expected to be small.

Also, it's important to point out that this smart inverter sensitivity case only really affected the high cost case. And for the low cost case the results basically remain the same because the storage mitigation measures were never really required in that instance, anyways.

The next slide, please.

MR. BOZORGCHAMI: Sorry, we're having a little technical problem.

MR. BAKER: So, looking at the results for the smart inverter sensitivity case here, we can see that in PG&E's case, just sort of the baseline without a ZNE requirement, it drops down significantly from, in the high cost case, $850 million down to $262 million.

And so, overall, you see a third to a two-thirds lower cost than the high cost scenario.

The next slide. So, we also looked at this low cost scenario, which is where the PV development would be sprinkled evenly throughout a distribution circuit, rather than lumped together in one location. And this is where we saw significantly lower costs, so 80 to 95 percent lower costs in this scenario.

Even in the instance of PG&E which had much higher costs in the high cost scenario.

MR. BAKER: The next slide. So, the main reason for these differences is that it depends on three main factors. So, average PV penetration at the starting point of this analysis, kind of the baseline starting point is a key factor. And PG&E has had a lot of PV growth already in their service territory. So,

their starting point is much further along the curve in terms of PV penetration.

A second factor is the number of homes projected per feeder. And it so happens that PG&E has the highest home per feeder ratio of amongst the three utilities.

And the third factor is the distance from the substation to the end of the circuit and that longer circuits tend to be more sensitive to voltage issues. And again, PG&E's circuits are generally the longest.

So again, here, by virtue of the fact of the way that the systems have been built out, and the architecture of the systems, we see some of these cost differences.

The next slide, please. So, staff's assessment, you know, having reviewed these results are that these integration costs of high penetration PV, whether it's driven purely due to NEM policy alone, or due to an increment that would be driven by a ZNE policy, they can be high if they're not mitigated.

But we clearly do have mitigation measures that are available to reduce those costs to more acceptable levels. Smart inverters being

first and foremost. And so, we do recommend that the PUC update the smart inverter settings to require a reactive power priority.

And then, also, optimal location matters a lot. In the distribution resource planning process that the utilities are before the Commission now, responding to AB 327 requirements to come up with methods and proposals for most cost-effectively integrating distributed energy resources into the distribution grid.

There are tools that are being developed there, one of which is called the integration capacity analysis. It's not cost analysis. And that's basically what that is, is it's a hosting capacity analysis which we expect the Commission to review pilot results, which the utilities have put before the Commission, and make a determination about the expansion of the use of that tool. Which will provide data that will be available publicly and can be used by developers and other interested parties to know exactly where which circuits on the utility systems are reaching capacity such that some of these reverse power flow issues could begin to surface.

We think that the most likely case of the

ones that we've shared here, and that the study looked at, is probably the smart inverter sensitivity case. Again, because in September of this year the smart inverter Phase 1 capabilities will be required. Staff has put forward this proposal to modify Rule 21 and require reactive power priority.

And, you know, we think it's debatable, this assumption about where PV development would be expected to occur within a given circuit. We know that when you're talking about new housing development, you're often talking about developments which are concentrated in a given location. And so, that's going to tend to give you attributes that look more like a high cost case.

But we also know that, you know, there can be an infill along a circuit, or there can be multiple developments that might happen throughout a circuit. So, that assumption I think is definitely more debatable.

The next slide. So, we did put this draft study out for comment and we received comments from four different parties.

This went out to probably about a dozen

proceedings, related proceedings within the PUC. We also put it out to the Residential ZNE stakeholder group that's part of that Residential ZNE Action Plan.

And we wanted to just share with you a little bit of the sampling of some of the comments that we received from stakeholders.

PG&E pointed out that this study does not assess the system level grid integration costs of the duck curve. And we're well aware of that it was never really -- it was never the intent of the study. Things like the IRP proceeding are looking at those issues.

A big question, as well, whether the 2 Kw system size per home might be too low. And they pointed out that the start date for the 2019 code update could be too early.

Edison, they contend that not all the costs were included in the analysis and that the multi-family housing starts should also be included in the analysis, which the analysis did not. That other variations of NEM should also be looked at.

And San Diego believe that the more likely case is probably the high cost case

because new housing starts are highly clustered. And that smart inverter implementation costs should also be included. So, they believe that there are additional costs related to the smart inverter option.

And then, SEIA pointed out that the study did not consider benefits, and we're well aware of it that, it's not a benefit cost study. And that costs will be reduced when a ZNE mandate is incorporated into distribution planning. And we think there's some validity on that point. And that storage costs are too high and that it provides other benefits.

So, those are some of the points that were made by stakeholders.

Then, finally, I just want to take the opportunity to share, next slide please, what I can about the future of NEM. Unfortunately, I can't share very much. It's really a crystal ball exercise at this point.

We understand and appreciate the approach that CEC staff, in an attempt to quantify that uncertainty in a cost effective analysis that E3 did for staff.

As I said, NEM's going to be revisited

again in 2019. We know, per the 2016 decision that the Commission will consider an export compensation rate that takes into account locational and time differentiated values. So, we know this issue of the location on the grid is going to be taken into consideration.

And as part of that there is this ongoing effort that I mentioned, in the Distribution Resource Plans proceeding to develop specific methodologies not only to identify the available hosting capacity, but also to develop something called a locational net benefit analysis. Where the specific locational values of deferred investment value to the distribution and transmission grid will be quantified. And we expect that to then be brought into the NEM "3.0" review.

To try to kind of triangulate from indicators we've gotten from lawmakers about what certain dimensions of this revisit might entail, we know that back in 2013 the Legislature required the PUC to do a review of the cost effectiveness of NEM from a ratepayer perspective.

And so, in the cost effectiveness

parlance, that means looking at the cost effectiveness from a ratepayer impact measure perspective.

But then, in AB 32, when the NEM -- when the framework for the NEM successor policy came forward, the Legislature basically gave the PUC a difficult balancing act, to strike a balance between ensuring that behind-the-meter renewable DG continues to grow sustainably, while at the same time ensuring that total benefits to all customers and the electrical system are approximately equal to cost.

And so, what the PUC ended up doing in the NEM successor decision was to look at various different cost effectiveness metrics, one of which was the ratepayer impact measure, but also the total resource cost measure and others, and then make its decision based on a broad review of all of that information.

We know that the NEM 2.0 proceeding examined a very broad range of different compensation structures, from the very austere to the very beneficial, from a PV owner perspective. And we would expect the 2019 review to do the same.

So, that's what I had for our presentation here today. I've got a link there, provided for people to be able to go and look at the study, itself. And also, just to indicate that Rory Cox, who's also here in the audience with us, today, he's the lead analyst for this study, so he can certainly take further follow-up questions, as can I. And I'd be happy to take questions at this time.

MR. MEYER: This is Christopher Meyer. Before I go to questions, I just want to thank you very much for you and your staff both putting all this work in, and working with us. It really helps us understand the possible pitfalls that we may not have anticipated. And as I said earlier, in some of these meetings, that we don't want to run across the finish line with our arms up, saying we met our ZNE goals, and then I have to spend two years ducking your phone calls.

(Laughter)

MR. BAKER: Yeah, and I just want to also thank the CEC staff because we've been working really closely with you guys from the outset of this, and it's been very helpful. You guys have helped us to hone our assumptions. We wanted to

make sure that our assumptions were consistent with the IEPR and a number of other dimensions. So, we appreciate the collaboration.

I'm just going to make one other comment because there may be some parties that come forward and want to make comments, and I just want you to know that we have two advisors for Commissioner Peterman's Office here. So, to the extent that there are any pending matters in rate-setting proceedings at the CPUC, please hold those comments so that our advisors here don't need to get into ex parte issues. Thank you.

COMMISSIONER MCALLISTER: So, I just wanted -- this is Andrew McAllister, Lead Commissioner on everything we're talking about today. Well, not all the issues that Simon just mentioned, but at least the building standards update.

But I want to just essentially echo the message that Christopher just made, which is thanks to the PUC and all the collaboration across the agencies. I mean this is really the way -- so, these are complicated issue, okay. It's hard to imagine sort of making everybody happy all the time as we work through these and

all the related issues that have already come up. And what we're trying to do is make good policy overall, and that has strong equity components, and that also helps us meet our energy and environment goals, energy and climate goals for the State.

There are just so many interlocking gears in all of this that, you know, you push over here and something happens over here, and it does get actually very complex. And we have a lot of -- fortunately, we have a lot of expertise in this State that can help us pick over these issues and understand the implications to a fairly great extent. I mean, foresight is never perfect, obviously.

And then there are lots of timing issues involved. You know, so we, the two agencies have been working for over a decade, now, of conceiving of what zero net energy means, what kind of a goal should be set, how we should or shouldn't chart paths that eventually lead us to that goal.

And so, we both, we share kind of ownership of this ZNE discussion. And at the same time, you know, we live in a different world

now than we did 10 or 12 years ago when the ZNE goal was in initially conceived and sort of put into place as a broad policy goal.

So, we are fortunate now that in the State we have all sorts of technologies, The costs have come down for solar. They're coming down for batteries. The electronics are almost a commodity now that -- they really are a commodity now. The inverters have really come along. So, we have a lot of technological options that we didn't have a decade ago. So, many of you, all of you probably know all of this.

But I guess my call here is that let's, you know, keep our thinking caps on. Not just now, but for the next few years. And, certainly we, at the Energy Commission are going to do that. And we really appreciate our colleagues at the Public Utilities Commission, from the Commissioner level on down for doing that. And bringing all of these considerations to the table so that we can, you know, make course corrections and how we're going to reach that goal and what it really looks like.

You know, we didn't have a strong RPS back then, when we adopted this goal. So, now we

have clean energy and we're going to have even more clean energy that we buy from the grid. So, what role could that play in a world where metrics are really all about carbon?

So, you know, what does that property envelope look like? You know, how does the meter really change as a point of analysis, right?

So, these are the kinds of issues that are coming up and will continue to come up. And certainly in the net metering process will absolutely be front and center. And how do we do all this in a way that is equitable and to make sure that we're not leaving certain people behind.

So, having said all that, I think where the proposal that Energy Commission staff has come down on is a pretty middle of the road proposal in terms of it does, you know, propose to require self-gen for the first time.

But also, I think it's a relatively modest proposal and I guess pardon the literary pun.

So, I'm actually optimistic for this conversation going forward. I think, certainly, in the same way that the PUC has really held

hands with us, and moved forward with us, and provided a lot of good insight to Commission staff on this round and developing the update that we're talking about today, we are more than willing to reciprocate that as these other issues come up in the PUC in the various proceedings. You know, net metering, different ratemaking issues that will come up and distribution proceedings, et cetera.

So, to the extent we can be helpful and help create the narrative that provides clarity and allows everyone to get their heads around what the best solution should be, we absolutely want to do that.

So, you know, this is a step forward in this bigger conversation, but it's a really important step forward. Buildings are our bread and butter in this State for, you know, most -- a lot of energy gets used in them, a lot of carbon gets emitted from them and by them. And we really need to -- we need to deal with them.

So, we end up talking largely about new construction in the code update, you know, conversation. And certainly zero net energy is a new construction conversation for the most part.

But the code generally covers all building and all projects that have to get a permit. And so, I think we really need to focus on our building stock, generally. And again, we have to collaborate across the agencies, and with the ARB as well in that, as we move forward.

So, I just wanted to really express thanks to the PUC and to everybody that's here today. Certainly, to the Commission staff and the Building Standards Office for all the great work that they've put into this. So, there's a lot of blood and sweat in here already, and there's going to be more. And we really look forward to having everyone's participation in building the docket and really forming a good foundation for the formal rulemaking, when it actually happens.

So, thanks again, everybody.

MR. SHIRAKH: Thank you, Commissioner McAllister.

Again, this is Mazi Shirakh. I'm with the CEC staff.

Simon, if that's okay, before we go to Q&A, there's two slides I'd like to present and then we can to Q&A.

Simon just presented the results for the DNV-GL's study and impact on distribution system as a result of the ZNE policy.

But how does the actual measures that we're proposing in the 2019 Standards, how does that measure up against what the study is concluding? And is there anything in there that can help us decide whether we should go towards the high cost, or the low cost, or someplace in between?

So, the 2019 Standards, again we talked about many of these extensively this morning, so just recapping. Will require or encourage the smart grid-harmonized PV system that will greatly reduce or eliminate the distribution system impact of the proposed PV system for new buildings, and may also serve as a model for PV system install on existing buildings.

It limits the compliance credit to a PV system that is just large enough to displace the annual kilowatt hours of the building. And we showed this building, what those sizes might look like. It's very modest in most climate zones, perhaps with the exception of Climate Zone 15, maybe 13.

We actually will, as a part of installation criteria, have specification for smart inverters. And I think Simon's presentation just showed the benefits of the smart inverters and the services they provide, and the voltage controls, and so forth, and how they can actually mitigate some of these impacts on the distribution system.

And we also have a strong compliance credit encouragement for grid harmonization strategies, such as battery storage. And I think battery storage will also have a very positive impact on mitigating some of these impacts on the distribution system.

So, earlier, the study assumed 100 percent of the homes will have a 2 and a half kilowatt PV system. This is going close to what staff is proposing, except we're going to have a number of exceptions that will basically bridge, bring down the average DC kilowatt per dwelling maybe a little bit lower.

The study was based on a Phase 1 inverter. Our proposal is to actually have the Phase 3 inverters that Simon just talked about.

The study did not assume any onsite

storage. Again, the Part 6 of these standards do not require storage, but it does allow a tradeoff that would allow storage as a tradeoff against PV system. And any strategy that goes beyond Part 6, whether it's a local ordinance, whether it's a builder who wants to build ZNE communities, they will have to -- if they want to use our software, they have to put in at least some amount of storage before they can oversize their PV system.

And the low PV self-utilization and high grid exports, that is something also we're trying to discourage. We're doing exactly the opposite through the standards, having high self-utilization of the PV generation and minimize the amount of PV that gets exported to the grid.

So, considering all of that, you know, at least our conclusion, staff is that if anything we should be much closer to the low end cost of the scale.

So, now, we can go to questions.

MR. MEYER: Yeah, and one thing just to clarify here is that despite the title of that slide, it's the PUC shared some of the draft versions of this study and sort of their thinking, very early on, that actually did help

and sort of move and, you know, influence our direction that we were going in our standard.

So, when we say some of the things it's like, well, you know, we went one direction and your study went another. Just the stuff you guys were doing here, studying the conversation we had, we were sort of trying to skip ahead thinking, okay, what could the conclusions of this study come out with and how do we sort of position ourselves to be ready for them.

So, just the study's been great, it's been really useful. Just the fact that you did this study was really helpful, as well, so thank you.

MR. SHIRAKH: Thank you, Christopher.

And we can go to questions. Nehemiah?

MR. STONE: Nehemiah Stone, Stone Energy Associates.

I want to thank you, Simon, and for this report. This is actually very good. I read the whole thing and I'm -- you know, it put me to sleep a couple of times, but I got through it.

(Laughter)

MR. STONE: I have a concern about the scope of what we're doing here. And I want to

draw an analogy, first, before I get into the details of it.

I have a whole bunch of grandkids. When the grandkids live with us, they make much more mess than they clean up. And that's normal, the adults clean up for the kids.

When you have a houseful that's all adults, you expect that everybody cleans up to the extent that they make a mess. We don't have that situation here.

There's roughly 19,000 megawatts of solar in California, two-thirds of which is utility-scale solar, only one-quarter of which is residential.

The PUC has required, recently, that 500 watts -- 500 megawatts, you know, as opposed to the 19,000, of storage be installed by the utilities. It seems to me that we are spending an awful lot of time and being very conservative with how much storage we are asking people to put in, in the standards because of the duck curve. And the duck curve is not caused by what's going in buildings. It's being caused by the utility-scale solar.

And I would encourage you to take back to

the Commission to solve that problem before asking the Energy Commission to back off any farther on installation of solar. It's not where the problem is caused.

You know, living in a household of adults, I'm not going to quick cleaning up my mess because somebody else is not cleaning up theirs. But by God, I expect them to clean up their own mess. Thank you.

MR. SHIRAKH: Thank you, Nehemiah.

Any other comments in the room?

MR. BAKER: I'd just say that the PUC has an open proceeding right now, the Integrated Resource Plan proceeding, which is designed to do exactly that. It's to find the most optimal solution to the grid integration challenge. And we're at a stage right now there, where some preliminary results have been shared and there are a number of different resource options that are being evaluated as part of that process.

And in September, we're going to be seeing, at some point, some proposals coming forward as well for consideration. So, I would encourage you to monitor that proceeding. But the PUC is definitely on that path.

MR. SHIRAKH: Thank you, Simon.

Please introduce yourself.

MR. SMITHWOOD: Yeah, Brandon Smithwood. I'm the California Director for the Solar Energy Industries Association.

I want to build on the last comments, which I disagree with the premise that the utility-scale generators are causing a mess. But I do think we do have to think about ZNE in the context of getting the higher penetrations a little more holistically, than just being solely concerned about the duck curve.

So, I want to talk to some of these kind of higher level grid integration, like generation level integration issues, and then speak specifically to the DNV-GL study.

So, at a high level, if you look at that IRP study, staff is looking at a carbon price that ranges up to several hundred dollars per ton, would drive in an optimal portfolio up to 10 gigawatts in the next decade of PV, of utility-scale PV alone, on top of an assumption of robust distributed generation.

And this is really being driven by our carbon goals. So, you know, the RPS is

potentially softer than our carbon goals. So, we're going to have to go to 50 percent and we're going to have to go well beyond. And not pursuing or dialing back ZNE is not the way to get there.

We've already seen the National Renewable Energy Laboratory show that you can get to 50 percent of the State's electricity through both generation, through both distributed and utility-scale solar generation by making the fossil fleet more flexible. I'd argue that's what's causing the mess. We have a lot of thermal generators that keep running as we're curtailing our renewables.

Electrifying transportation and buildings, and managing that electricity use, enhancing demand response. We had a great example of that yesterday, during the eclipse over a gigawatt and a half dropped. And bravo to the CPUC for leading that effort.

And then, we need to regionalize the operation and planning of the generation and transmission system. We act far too much like an island, when we're part of the continental U.S.

So, anyhow, I just want to emphasize that

we have a number of strategies, all of which or most of which we're pursuing to get to much higher penetrations. And the several hundred megawatts of incremental DG from the ZNE is really just a component of getting to those higher penetrations.

I also want to emphasize that distributed generation has been important to meeting these climate goals, but it's also helped us avoid a lot of distribution and transmission spend. There have been some high profile projects, in the hundreds of millions of dollars, just in the past couple of years that have been cancelled because of distributed generation and efficiency.

There's been a study in the San Joaquin Valley, alone, showing $300 million in benefits, mostly from avoiding transmission.

And particularly, as we electrify loads to decarbonize other sectors, we really have to be mindful that there's a lot of value of having that generation out at the load.

So, anyway, again, some high level points. The things I want to speak to specifically on the DNV-GL study which, thank you, Simon, for kind of giving the high level

outline.

The first is, as Simon mentioned, is we -- while the study is very clear that it's only about looking at a certain category of cost distribution, grid upgrades that may be needed to incorporate more DERs, or more rooftop solar, we have to be careful that we then don't take those costs and apply them to the Building Code, which is only looking at the participant cost test, without recognizing the other benefits.

The Public Utilities Commission is looking at societal cost test. As Simon mentioned, we're doing a whole redo of the cost effectiveness framework.

So, again, we totally recognize that the study is clear that it's only about a certain category of costs. But once it's applied, it needs to be balanced with a full portfolio of benefits.

We also noted that the study uses 75 existing circuits throughout the utility service territories, but presumably a lot of this new construction is going to be on line extensions, which could be designed differently. So, you're not building kind of status quo lines and then

having to go and upgrade them.

And then, and finally, and I think this is the biggest issue which, again, is recognize in the study, but which we think makes its assumptions, or its findings a bit questionable, is how storage is assumed to be deployed.

Mazi, as you mentioned in your own presentation, the Building Code could move towards incentivizing a lot of storage.

We also think that we are a few years out from storage being broadly deployed with solar, behind the meter. A lot of that depends on rate design. And I'm going to quickly make sure I don't get myself into trouble here.

I guess I'll just basically say that a lot of it depends on rate design. SEIA has rate design ideas that are revenue neutral and cost-based. And so, there's a way to actually get there on rate design. And if you're putting it into the building, you're going to make it far more cost effective.

Once you do that and you have a lot of that benefit going to the customer, the idea that you're only going to deploy storage once you've done all these distribution upgrades to manage

over-voltage conditions, just seems unrealistic to us.

And then, finally, you know, SEIA believes that smart inverters are going to provide a lot of benefits to customers on the grid. We have, as we've expressed to staff on their proposal, we just have some concerns about some of the differential impacts between different customers that are not caught in the average. The difference smart inverter studies look at. And we really think that kind of how inverters are moved needs to be part of -- how we move into inverter functions beyond Phase 1 needs to be part of a process that's more robust than an advice letter process.

So, thank you for doing the study. Thank you for taking the time to hear me out.

MR. SHIRAKH: Thank you, Brandon.

MR. NESBITT: George Nesbitt, HERS Rater. On your first sort of cost impact slide, you sort of talk about the total cost in the different utilities. And well, yeah, $800 million, $400 million not as big a deal.

But the cost difference per customer was more than a 10-to-1. I don't really care if it's

$100 million or $100 trillion, is it going to cost me a dollar a month or $100 a month? I mean, ultimately, since the customers, the ratepayers are all paying for it.

So, I think that's really important to look at. It's not just total cost.

So, before net metering it was easy. The utilities, if they needed resources, they'd procure them. They'd decide what they want, where they want to put it. In theory they had a duty to do it probably least cost. They probably also tried to maximize their profits, that's fine.

So, then with net meter we sort of democratized having a power plant. Anybody who wanted to invest in a power plant could on their property, regardless of the cost to the rest of us.

So, what we're proposing under the Building Code is now everyone has to do this regardless of the cost to the rest of us and where you're putting it. Because nobody is planning where this is going. It is going to go where it goes, regardless of the cost to the grid.

Now, it's possible in places it has a positive and it's possible in places it has a negative. As opposed to planning where -- what are we trying to get to? We're trying to get to a high percentage of renewable energy. We want to keep costs down, right?

So, I mean that requires planning. That requires someone deciding what do we need, where do we need, what are the cost implications, what's the best for the whole system and trying to balance everything. The problem is we have the right to unbalance it, you know, cutting off your nose to spite your face kind of thing. It's not that renewable energy is not good.

The other thing I want to say is, well, the duck curve. Yes, it's not all about the duck curve, but it's an incredibly important thing. And net metering, behind-the-meter PV systems are part of the duck curve.

And I suggest you go to the June 28th workshop, IEPR workshop on distributed energy resources, and there's one Cal-ISO presentation that shows slides. Net metering has already taken the top of the load curve off of the utilities. The duck curve is the net result of

their total load minus renewable.

So, every watt of renewable energy we add from 7:00 a.m. to 5:00 p.m. adds to the duck curve. It doesn't matter what side of the meter it's on, the physics don't care.

So, I wonder, yeah, you know, zero net energy buildings, great idea. But like I say, the grid has renewable energy. Maybe all we really care about is getting to a 100 percent renewable electricity grid.

How does the building support that? How do we implement it? How do we have rate structures or ownership? You know, what's wrong with putting the PV where it makes sense, but I can have ownership in it? Because it doesn't make sense to put it onto my house.

Because I think, ultimately, we are hurting ourselves if we don't truly plan in a better integrated -- I mean, yes, this is enough years off we can say, well, hopefully, we'll have it all figured out by 2020 when people start pulling permits.

But this is what will happen, potentially. What happened in Nevada, it's happened in Hawaii. You're not going to be able

to interconnect or you're not going to be able to export excess to the grid.

So, if we've oversized our systems, over-invested, now you can't get money out of it because you can't sell it. So, you're now losing even more money or it's less cost effective, or you're going to have to invest more money in storage so that you can absorb the excess, use it and/or send it back when it has more value. Thank you.

MR. SHIRAKH: Please.

MR. KENNETH: Hello. It's good to see everybody again. Okay, so I'm going to have sort of a reoccurring theme from this morning?

MR. SHIRAKH: Can you reintroduce your name and affiliation?

MR. KENNETH: I'm so sorry. Lather Kenneth from Sonnen. So, we're a leader in residential energy storage behind the meter.

And again, one of the lessons that we learned over the years, when we were deploying just under 20,000 energy storage systems that are actually working and installed, and 17,000 of them under a virtual power plant that's the largest distributed network of energy storage

systems in the world, is that we needed to work with the grid operators in Germany to understand a lot.

What is the locational value of distributed clean energy storage resources?

Within each part of Germany, literally? Like where -- what's important to the grid, what could be useful?

As a for instance, we found that with three out of the four grid operations that frequency regulation was a very important topic. So, we decided to make sure that our energy storage systems could really do some frequency regulations. Right, that was a high priority.

And again, other things are very important as well, but frequency regulation in one area of Germany was more important than the other.

So, my point is that understand the locational value of distributed clean energy storage resources, stored sunlight energy. Where could we help mitigate the challenges of greater renewable penetration onto the grid, which is what you described? By way of a virtual power plant. By way of an aggregated network of energy

storage systems. And from a homebuilder's development, as well. Why not?

Why can't we go to KB Homes, our friends at KB Homes, or Lennar, and say, okay, it would be really nice, it looks like you have a development going here. This is an area where there's an argument, an actual argument. This particular feeder is stressed and needs support.

Okay, maybe that's demand response, regulation of voltage support, reactive power, whatever you want it to be. But where can we help defer TND investments and peak demand investments? Where is there a stressed feeder?

So, I guess my point is that as we develop this it would be really nice to have continued studies around, well, where could a distributed network of energy storage systems help mitigate problems and actually add value to the grid?

And then in coupling that nicely with ZNE, we would be able to talk to homebuilders. Well, we already are talking to homebuilders, so that's already happening and, hopefully, we'll do more of that. And homebuilders can say, okay, well, we have projects here, we have projects

here, where can we help?

As an example, we're doing this in Arizona right now. We're doing this in Western North Carolina, where the utility has a specific need, a very specific need because a peaker plant is going offline. Hey, can KB Homes help?

So, I think that would be cool and it would be a nice way to give ZNE a nice -- like you said, energy storage is not mandated by ZNE in this current rendition, but at least we would be able to do some cool projects and create some really nice proofs of concepts on grid stabilization.

MR. SHIRAKH: Thank you.

MR. KENNETH: Thank you.

MR. SHIRAKH: He's asking me to bring up the slide that I showed earlier that shows the -- yeah, this one.

MR. CAIN: Joe Cain with SEIA. So, in the report we saw from DNV-GL there was a case where the grid modernization might cost $800 million, and then if you add PV without smart inverters it might cost an additional $600 million. And then, there was a smart inverter case which made that scenario much better.

And I did not see a case that included storage. But I'm trying to imagine how that lowest curve in the first case could almost double the grid integration. I mean, when that's such a tiny percentage of the overall contribution to the grid.

So, and then I have additional trouble trying to imagine if we are successful, and it seems like everybody is supportive of adding energy storage into the mix and what may happen with that tiniest curve.

So, if that tiny curve gets tinier, it's hard for me to imagine that being such a large contributor to grid modernization.

And then, of course, you know, this is the curve of what's going on now. It doesn't even begin until 2020. So, we have another two and a half years before we start to see the effective date of this standard.

So, I'm just interested to know what does that curve like if you do have the smart inverters and what does that look like if you do have energy storage, and how could these impacts be so significant.

And I think that, you know, as I listen

to various testimony, you know, I'm trying to bring everything -- imagine bringing everything all together, you know, so that instead of being I'm an efficiency guy, and I'm in this silo, or I'm a renewable person so I'm in the silo bringing this all together.

And what I actually see, still, is systematic bias. What I see is you can use envelope measures to make your PV system smaller. You can use storage to make your PV system smaller. You can use the climate zone exception to make your PV system smaller. You know, so everything is driving -- you know, the systematic bias of everything trying to drive the PV system down.

Now, granted, I understand that the fundamental of the contribution of, you know, you do so great efficiency measures and you don't need a huge PV system. But it's really more about getting to zero. And so, I still don't see a reason why we couldn't get to zero.

And it's just frustrating to me when I hear some people that wish to not only put renewable energy in last position, but wish to put renewable energy in a position where we just

either make it go away, or we make it deferred, or maybe it will happen, maybe it doesn't happen, we don't care. So, again, I'd just like to see everything come all together.

But I would be interested in the answer to, you know, per the studies what those grid optimization costs, if we brought it all together and we did have the smart inverters and we did have the storage?

MR. SHIRAKH: Just one point on this graph. This is graph is mostly a comparison between the capacity, the installed capacity of various PV scenarios. It's not a direct measure of distribution system impact. That has other parameters you have to consider. This is strictly, this size here is megawatt hours. This basically tells you how much capacities are really there, how much it's going to grow in the future, and how much ZNE standards might impact this.

So, for the true impact on distribution system, that's where you have to consider the inverters, the storage, and all the ancillary services, and everything else that the DNV-GL study is trying to capture.

Any other questions in the room? Anything online?

So, with that, we're going to close this section and move to community solar.

MR. MEYER: Okay, thank you everyone and thank you, Simon.

Okay, so this is -- initially, we thought we'd sort of have a lunch break between this and the rest to sort of really just sort of say, you know, we have our Part 6 we're talking about and the alternatives -- or sorry, the exceptions to PV requirements in Part 6. And we want to make sure that this is -- when we talk about alternative compliance options, this is a completely different topic.

This is looking at things that would be in sort of Part 11 as an alternative to behind-the-meter storage, you know, period.

There's been a lot of interest for quite some time, from a lot of different quarters, on looking at the advantages of having your renewable energy resource, you know, still distributed but in sort of a scale of mode that's in these community solar options.

What we did notice is there weren't a lot

of -- there wasn't the penetration of community solar that we thought there would be by this time. So, questions from Commissioner McAllister, discussions we've had with the utilities, with CBIA, with the PUC and others just on, you know, what is the status of this. You know, what are the barriers? You know, what are the advantages?

So, we were asked by our Lead Commissioner to look into this. And Bill Pennington took this on with, you know, the enthusiasm he takes on everything, with efficiency, and really jumped into this and did a great job. So, wanted to share that with you.

But just the oversized, this is something we're just bringing out there as, you know, here is how we're looking at community solar from a Building Standards perspective, which is going to be a little bit different than if we were looking at it from like a CEQA planning. You know, we're not looking at a green field, brown field, you know, on site, off site, all of those things. Those are different metrics.

We're looking at it, you know, how community solar, community-shared solar projects

compare to behind-the-meter PV in a Building Standards component.

So, with that, I'm going to hand it over to Bill and let him run through this for you.

MR. PENNINGTON: Thank you. The next slide, please.

So, before we get into, you know, our thought process related to how community solar might be an alternative compliance option in the building standards, I just wanted to start with kind of what's the background here? What are the things that exist now and how do they work?

And so, first, with the IOU programs, with the net energy metering options. In general, net energy metering requires that the generation resource be on the property of the customer and that its purpose is to reduce the energy bill of that single customer.

There are some options that maybe look at more than one customer in some respects. And so, one example is virtual net metering, where multi-family property owners can allocate the PV production that they're responsible for, that can be allocated to all the tenants in that property. So, there's a way of sharing that happens in that

narrow case for virtual net metering for multi-family.

And then there's another possibility of sharing in the net energy metering aggregation option that allows multiple meters, on properties that all belong to the same customer, and are contiguous to the property where the PVs are located.

So, there's an example of how you can think about perhaps more than one meter, the concurrence of one meter and one generator.

These are really the only options that relate to residential. There's, I guess, some options for local governments, but in a different space. But this is what's available right now in terms of net energy metering for residential.

Okay, the next slide, please. So, the other program that's out there, that is community-shared solar, in terms of IOU programs that's authorized by statute is the Green Tariff Shared Renewables Program. And this is just a -- there's a bunch of details about this program and there's variance, and different options within it, and so forth, and it's quite complicated in total.

But just a real, 30,000-foot look at it, the GTSR allows customers to subscribe to receive energy bill credits for generation from a shared renewable resource. And so, that renewable resource is some central resource that is not on the customer's property, but that customer can subscribe to get credits back to their bill.

The customer, and this is an important point, the customer can cancel that subscription at any time. It might be a little bit of a startup thing where in the first few months this is not true, but after a certain period it is true that they can cancel the next day, or the next month, and they'd never have to participate again after that.

If the customer moves, the subscription moves along with the customer to their new address. And this is all about the customer.

These resources that are used in the GTSR program are big resources, 500 Kw or bigger. It's secured through a power purchase agreement with the IOU. It's all conducted through PUC oversight and rules.

And, in general, it's located somewhere in the IOU service territory. So, those are some

key points.

The next slide, please. So, the 2015 IEPR provided some guidance on thinking about how community solar might be a possibility within a Building Code environment. And so, these are the key points.

To identify pathways of compliance for buildings where offsite renewables aren't feasible.

To anticipate that there could be development entitlements to the building for offsite renewables as a builder option, allowing community solar as a possibility.

But also making sure that this is administratively workable and cost effective. And that you think carefully about making this fit within the building department's enforcement responsibility and, you know, make it convenient for the building department.

So, the building department is making a decision on permitting particular buildings and enforcing code for those buildings as a point in time. And so, one of the things that would be important for allowing an alternative like this would be that the resource would exist at that

point in time. That, you know, it's not anticipating some future existence that might happen, that may be on paper, but trying to fit into the building department's job to physically look at projects.

The next point would be that it would offset energy use of the building that it's assigned to. So, basically, that the building that's under consideration for a permit is receiving the benefit of this option.

And also, that the output is not already spoken for, for some other reason.

The next slide. So, in thinking about this, we've kind of come up with how would we think about what should be the expectations for a community-shared solar alternative if it was a compliance option?

And the first thing you'd kind of think about is this is akin to an offset and people that conduct offset programs, administer offset programs are very concerned about the characteristics of those offsets. That they must be additional. That they must be dedicated. That they must be quantifiable. That they must be verifiable. And that they be -- sometimes the

word "permitted" is used, you know, at least durable.

So, those are the kind of things that in establishing this kind of a program that is akin to an offset, we think we should think about what do offsets normally have to ensure.

But it's also a compliance option. So, we want to think about what do we want this alternative to deliver in order to establish a compliance option.

And so, basically, we want to provide equivalent energy performance to what the standards would otherwise require. So, if this is going to be a one-for-one exchange with onsite PVs, then it should have energy performance that's comparable to those PVs that would have been there instead, for example.

Also that it provide energy benefits to the home that last as long as the standards requirement that would have been installed.

So, this is kind of a tougher situation than maybe you might think about in terms of establishing a community solar option for some social reason, or environmental reason.

The Warren-Alquist Act requires the

Commission to deliver energy bill savings to the home that is being permitted, and that those savings be real, and achieved, and so forth.

So, we think that if we create an option here we should be ensuring that there are energy benefits going to that home that is participating in the community solar program. And that home, those benefits in terms of the people that receive those benefits, they're all the occupants of the home over the useful life of the home. And so, they're basically the original occupant or original home served, and they are also the subsequent people that live in that home.

And so, it's a long-term delivery. It's not necessarily to that first customer that lives in that home, it's to the home that you're trying to deliver the benefits.

And then, also, coming back to the point of being easily verified and enforced by building departments, the resource needs to exist when the building department is considering whether to accept it as an alternative or not, and it needs to be dedicated to the home at that time.

A consideration that maybe could be worked through, but it's pretty important, is

that the resources that the building department is looking at for a normal permit is within their jurisdiction and is pretty easily accessible to them. And they're able to go out and visit, and physically verify compliance, and so forth.

And so, you know, maybe this is not an absolute requirement, but shouldn't an alternative community resource be also conveniently located perhaps in the jurisdiction of the building department and be available for some physical verification by the building department. So they can be satisfied that what they've allowed as an alternative to the code that they're responsible for is legitimate, valid, fully accurate information, that sort of thing.

The next slide, please. So, what we did is we came up with a series of criteria that are based on what I was just describing as expectations that you may want. And thought about, well, what are some alternatives, some community solar-like alternatives that perhaps exist or perhaps we could imagine existing. And then, try to match those up against the attributes and how a PV system, an onsite PV

system would accomplish those attributes. And trying to see to what extent these options would match up.

And, you know, we used these silly, these funny faces as a way of thinking about the matchup as dead on. Maybe the matchup is acceptable, maybe it's close enough to be acceptable and in a situation where maybe the matchup just fails to match the attribute of the onsite PVs.

The next slide. So, these are the criteria that we looked at. First off, we kind of thought about how do onsite PVs fit against these criteria for each one of them.

In terms of the additionality criteria, the onsite PV is a new resource and it's not meeting other obligations. You know, that's what you would normally expect.

The onsite PV is dedicated to the home. It does provide benefits specifically to the home that's being permitted.

Durability or permanent to the -- the onsite PV system, in general, will generate for a long life, maybe a 20-plus year with inverter changes that we've assumed in our cost

effectiveness analysis.

The onsite PV system, it takes into account the temporal expectation for the Building Code requirement. And so, it can be assessed in the same metric that's used for the Building Standards, the TDV energy. And the PV generates in a pattern that is easily determinable through our modeling and can be assigned a TDV value. And it is, you know, as Mazi was explaining earlier.

It's quantifiable. The energy performance is able to be modeled through CalRES, and we can come up with, you know, a reliable way of quantifying that energy performance.

MR. BOZORGCHAMI: Excuse me, Bill, you meant CBECC.

MR. PENNINGTON: What did I say?

MR. BOZORGCHAMI: CalRES.

MR. PENNINGTON: CalRES. My gosh, I remember that.

MR. SHIRAKH: He's showing his age. CalRES was from 20 years ago.

(Laughter)

MR. PENNINGTON: There's no come back for that, so I'll keep going.

So, verifiability, the onsite PV is there at the site that the building department will go to, to demonstrate that the quantification of this performance exists and is accurate, it can be subject to HERS field verification to verify installation quality, and that it's characteristics that impact performance can be field verified.

The onsite system will definitely provide benefits in terms of reducing the energy bill of the home and it's there for the life of the home. And so, those benefits accrue to whoever are the occupants over the useful life of the home.

It's enforceable. The building department goes there and can demonstrate compliance, and so forth.

It's administratively feasible. It's kind of, clearly, legally allowable once we get this in place, and the processes needed to administer are reasonable to all parties.

So, this is kind of, you know, how we see onsite PVs. These are kind of the things that you'll be trying to match or come close to matching.

The next slide. So, we looked at some

alternatives. These were the sort of ones that jumped out as being quite interesting. I must say that our initial review of these, you have to say is just that, it's just an initial pass at it, and in some respects is preliminary. And perhaps you might imagine the option being improved in some way against the criteria, and maybe that's possible in some cases.

So, I could see this review and our conclusions being adjusted in the future, perhaps as things change. So, view them as preliminary.

But we did look at a few interesting alternatives. The first one is the notion that the PVs would be directly connected to the home, but would be at another location in the subdivision. Perhaps there's a shading problem on the lots where the homes are. Or, perhaps there's some desire not to have PVs from an aesthetic vantage point on the homes, or something.

But there could be another location in the subdivision where it would be possible to direct connect. And so, this idea would have the panels being dedicated to the home. So, you would imagine a one-for-one dedication of the

panels without a sharing of the same panel with other homes. And you would have a DC connection to an inverter that was installed at the home. And so, that's what this idea is.

The second thing we looked at is looking at the Green Tariff Shared Renewables Program, which is the only community-shared solar program that's currently authorized by the Legislature for IOUs to conduct.

The third thing we looked at was having the builder get PVs installed at another location, where they would be getting energy bill savings at that other location, and that the builder administers a process to allocate those savings back to the homes. So that the homes would actually get the benefit that's coming from the system.

And so, this would be setting up a situation where this would be an ongoing administrative responsibility of the builder throughout the life of the property, so that those savings could be allocated back to those homes and benefit the original homeowner and subsequent occupants of the home.

And the last option is a local government

community facilities district idea, which is a Mello-Roos kind of situation where a local government sets up a bond that pays for the community resource. And the homeowners are responsible for paying back that bond through property tax assessments.

And that would be sort of how the structure would be, for how the sharing would be established.

You would need to also allocate the savings back to the home and that would be very tricky under the GTSR program for an IOU to do. But, potentially, it could be done by a POU, or by a CCA, who decides to support this and perhaps works in conjunction with the local government that establishes the bonding authority. So that you have both the shared payment and the mechanism for sharing the energy bills back to the property.

So, the next slide. So, this is our -- it's kind of hard to see, sorry. So, this is the table of attributes in the columns and the four programs that we just described -- thank you for that -- in the rows.

And you'll see, first off, starting out

with online -- the onsite PV, kind of showing the green happy faces that we associated with that on the previous slide.

Looking at the first option, the PV that's DC connected to the home from another subdivision location, you really should be able to match the attributes of the onsite PV one for one, but there's a catch.

It's quite possible that this kind of direct connection is not allowable under NEM rules that the resource must be on the same side as the customer. Or, in an aggregation situation, adjacent to the customer.

And so, you can imagine that that is maybe impossible to get approval by the PUC or is quite challenging to do. I mean, this is a really outside-the-box kind of idea.

So, the next row is the GTSR program, sort of our initial pass at what that looks like. The issue that kind of gets you into reds here is that the GTSR program is customer-centric, rather than home-centric. And so, the customer can choose to unsubscribe at any point. Can move and take the subscription with them. And that could end the benefit that the building department

approved to allow the home to go without onsite solar and to this, instead, very prematurely in the life of the building.

And so, that's the most significant issue. It doesn't deliver savings to the home, per say. There are some other issues. The resource could be quite distant from the home and maybe it's outside the building department's jurisdiction, or maybe the building department has difficulty accessing to verify.

And you might say, well, maybe this could be a paper verification and you can trust what came through the process. But building officials, in general, are skeptical about things that they're told. And in order to live up to their responsibility for implementing code, they want to be able to verify. So, I mean that could become an issue.

It's possible that the GTSR program, maybe a new variant on the program could be approved by the PUC that would remedy some of this stuff. So, I wouldn't say that's impossible.

In fact, when we discussed these things with E3, who's our contractor, Stella Price

(phonetic) thought that might be a feasible thing that the GTSR could be modified in some way to be okay.

The third option is the builder has PVs installed in another location and establishes a long-term mechanism to allocate the bill savings that they received on that other property back to the home.

And we give this -- the greens are a real optimistic, hmmmm that would work. You know, if the builder would be willing to take that on that actually could work. It's not against the law, as far as we know.

But on the other hand it could be quite complicated to do and requires a long-term commitment of the builder. And the costs for administering that would have to be somehow allocated back to the home, as well.

So, that's why the yellows are there, you know, it's kind of an in between.

The local government community facilities district, with the bonds for funding the resource and the POU, or the CCA administering a process to ensure the energy bill benefits go back to the home, we also think that could work. It could be

sweet. It could work very well.

The yellows are this is a heck of a lot of work for the local government to invent this. So, those are the reasons for the greens and yellow there.

The next slide. So, what we're imagining is in a -- we can't, the Energy Commission can't necessarily invent a program here that will kind of cover all these bases and will work. And, you know, up front people will want to do and, you know, we just call it out and just do X. We don't think we're in that situation.

But we think that it is possible for a community-shared solar alternative to be developed. Perhaps by a local government or by some other entity, perhaps by a very active builder who's motivated to build it.

And so, we want to try to establish opportunities for local governments or others to create an alternative that kind of meets these criterion.

We're imagining that we would establish an application process in the standards, perhaps put something in Part 1 that could be used for accepting applications, and maybe even having a

public process to review applications. And be open to people who might want to come forward, local governments.

Probably, we should have asterisks on this stuff. We probably should have the local government that's going to be responsible for being the building official on this to demonstrate their support for that kind of proposal, and taking on maybe that sort of a little bit of outside-the-box responsibility.

And then, so we would see a review process for applications at the Commission and the potential for the Commission to be able to approve community solar projects that meet these criteria.

So, I think that's the last slide.

MR. BOZORGCHAMI: So, we'll open it up right now for any questions/comments.

MR. NESBITT: George Nesbitt, HERS Rater. So, Bill, will HERS Raters get to verify 100 percent of these systems that get installed on the new houses?

MR. PENNINGTON: So, the staff has not developed field verification requirements, yet, but that's certainly in the offing.

MR. NESBITT: Yeah, we certainly fail systems that don't work, but pass the building inspection.

So, some of us have been around long enough that you'll remember nine years ago we were in this room, on the development of the Title 20 HERS regulations and the whole house rating system. And many of us talked about recognizing something beyond the building.

So, the idea of not having to uninstall a system on your building, on your property is not a new idea, but it certainly has its challenges.

And I think you have to think about you have one exception that's an out for a system. So, what do they do instead? I mean, because their house is shaded they don't have to make this investment, they also don't get the benefit.

Other people have to make the investment and they get the benefit. So, what do they do, instead?

A couple other things to think about is I can go out and buy 100 percent renewable energy right now, for a little bit of money. And I think what we -- in the big picture, do we just want all new houses to be 100 percent renewable

energy or would we rather have all houses be 100 percent renewable energy? So, I think that's really our ultimate goal.

So, obviously, some of these things are more complicated. But I think having some ability to go to a system outside of your building -- it also opens up something because all we're talking about is photovoltaic cells. No wind, no hydro, no biomass. You know, other things that would be renewable. So, this could open up other diversified resources.

So, I guess the question is, really, if you don't do it yourself what investment do you make? And, honestly, that investment should stay with the house and probably should last the life of a mortgage, maybe. I mean, not that a PV system and all its components necessarily last the life of a house, but there is certainly an expectation that panels will. You'll probably have to change inverters.

But if you've made that investment hopefully you're likely to keep it going. So, it shouldn't just be a one house makes the investment and the other doesn't. There needs to be some level of equivalency.

And, yes, verifiable in the sense that it is a real resource. And I don't think the solution of, oh, yeah, buy 100 percent electricity from the utility that seems like too easy of an out, perhaps.

MR. PENNINGTON: Thanks.

MR. STONE: Nehemiah Stone, Stone Energy.

Bill, can you pull up slide 5? Very good, well done. Well done, I'm impressed.

So, on that fourth bullet, why not have verified resources online? I mean, it's not that different from building departments looking at HERS reports online, in the registry. So, they wouldn't necessarily have to go out and look at it themselves, if it was verified.

On slide -- on bullets 2 and 3, are you meaning only as permanent as the site solar would be, or are you talking about permanent as wall insulation would be?

MR. PENNINGTON: Comparable to what it's replacing.

MR. STONE: So, the site solar, okay.

The other thing I wanted to say is in a way multi-family is community solar. You might look to what's been done with multi-family over

time. I mean, virtual net metering, it seems like a solution to an awful lot of this. All that would have to change is that property line boundary for the allowance.

So, if the PUC made a decision that for a compliance option like this it doesn't have to be on the same property or contiguous property, then an awful lot of the stuff kind of goes away. You know, you have a PPA that says, all right, everybody that signed up for this they get this share and the get it for the duration.

MR. PENNINGTON: So, the NEM program is largely spelled out in statute in terms of that expecting to be generation resource serving an individual customer.

So, the PUC doesn't have a lot of wiggle room there. So, it could be a statutory change.

MR. STONE: Well, all right, so the Legislature first and then the PUC.

But I mean ten years ago the PUC did not know what virtual net metering was. They had no idea. You know, I had to explain it over and over and finally gave up. And then, six months later I was invited to a meeting or a hearing where they directed the utilities to do virtual

net metering.

At that point, you know, changes had to be made because initially, the way the tariff was written is it had to be attached to the building. Well, that meant that for most affordable housing tax credit projects it couldn't be used because there were multiple buildings. And you cannot, by IRS law, give people in these apartments a different rent than the people in these apartments over here that are exactly the same, just happen to be in a different building.

So, it got changed at that point to define it at the property line.

It doesn't seem like it's that hard of a lift to get it redefined for this kind of a thing. Anyway.

MR. PENNINGTON: Thanks.

MR. STONE: I should have started with this. I really want to thank you for taking this seriously. This is very much needed and I really appreciate that you guys have focused on this.

MR. PENNINGTON: Thanks.

Other comments or questions?

MR. SMITHWOOD: Brandon Smithwood with the Solar Energy Industries Association, again.

I also appreciate that -- we also appreciate that you are looking at this. We think it's really important, not only in making sure that we can continue to achieve an increasingly aggressive code even if there are buildings that due to shading or other challenges can't host the solar on the building. But also because California lacks a viable offsite or community solar option for customers.

I was looking at your graph and a red, frowny face is often how I feel when I think about the Green Tariff Shared Renewables Program.

(Laughter)

MR. SMITHWOOD: Well, I laugh but it -- yeah. Anyway, there are a few things I want to point out about GTSR which I think really make it an unviable option for this use case.

The first, which is not a kind of procedural issue, but which is one of giving fair compensation to distribution generation is that the way that ratepayer indifference was achieved did not actually examine costs and benefits. And both what was written in statute and how the program was implemented through two rulemakings really ended up with customers only getting

credited for a limited set of short-run benefits.

So, unavoided generation costs and, well at least in Edison's case, a resource adequacy credit.

If a system is, you know, distribution sided, which presumably a lot of these -- which presumably these systems, for these new housing developments would be distribution side, you really have to capture all of those benefits of being downstream. Particularly, the avoided transmission and distribution.

Developing a project, I mean if -- actually, I am glad you raised all the issues with the AHJs, and the kind of the verification piece of the Building Code, which I think is something for us all to grapple with in our comments.

But there's a layer of cumbersomeness about the Enhanced Community Renewables Program that is pretty profound. There are limitations on the project size, which are likely to be too large for new housing developers. The customers need to be enrolled prior to the project going online. The developer needs to demonstrate that a certain amount of customers have expressed an

interest in the project within the certain geographic area. There's a solicitation process so that the developer and the utility develop a non-financeable power purchase agreement. The idea being that the utility can take any unsubscribed power.

I could go on, but it's an extremely cumbersome program and it undervalues distributed generation. And the results are that the participation has been pretty meager.

So, there's two components of the Green Tariff Shared Renewables Program. There's a Green Tariff Program, where the utility goes and procures mostly, you know, larger generation and customers just sign up on their bill.

And then, there's an Enhanced Community Renewables Program where the developer takes the lead and goes and gets the customers.

That Enhanced Community Renewables Program, which is presumably what you would use, the first solicitation that was held last August, when the results came out early this year, there were only 15 bidders, and there were zero -- there were 15 bidders. I think there were 8 conforming bids. And there were zero projects

that actually won contracts.

So, the part of the GTSR Program that would presumably support Title 24 is moribund at this point.

And on the Green Tariff side, that program has had a rough start. It's been going for about a year and a half, now, and less than 4 percent of the program's capacity has been used. In fact, Edison's program now has less subscribed capacity than it did six months ago, early in the year.

So, we really are thrilled that the Energy Commission is looking at this. We think it's good that you're looking outside of the kind of standard options.

And to the earlier gentleman's comment, you know, we -- we don't have any decision makers in here, right? Yeah, right, speak now.

We've been proposing a number of expansions of the VNEM tariff and that could be -- you really need a tariff, we think, to actually make this work. And we believe that it's within the Commission's, the bounds of what the Commission can do within existing statute to make that happen.

So, anyway, thanks for taking the time and thanks again for your work on this.

MR. PENNINGTON: Thank you.

MR. MCHUGH: Jon McHugh, McHugh Energy.

This is probably some of the most problematic parts of zero net energy is always what do we do about the building that's in the shade of a 300-year-old tree in the urban canyon, et cetera?

And it's my take that probably any of the solutions are probably going to be less than optimal as compared to that building that actually asks solar access.

And as a committee member of the ASHRAE 189.1 Standard for Green Buildings, we have a -- the standard is specifically designed for having renewables as part of the energy portion of that standard.

In that standard, they've got the same issues. And, you know, all of the solutions were less than ideal. But the thing that I think everyone agreed on, or most of the members agreed on was the idea that these alternatives were alternatives. They weren't -- they were actually an alternative of last resort. You actually had

to show in advance that the renewable energy option was not feasible, whether you're in the shade or -- of course, this is a nationwide standard, so there's certain parts of the country that also don't have much renewable resource for the whole state or whatever.

We don't have that problem here, in California.

I think one of the big issues, too, is that we ended up with something that was really sort of undesirable, which is the use of RECS. The cost of RECS is so low that it's essentially a non-requirement. You know, there's some issues about the additionality, some of the issues that you brought up, Bill.

But I actually see one of the benefits, in addition to the renewable resources provided, is that the renewable resource is actually present valuing the cost of efficiency options not chosen. So, when you buy a renewable energy system, you've got to first cost. And, you know, you can of course purchase a mortgage, you can finance it different ways.

But there is a first cost that's essentially offsetting that 20 years of

inefficiency that you're now trading back and forth, ideally, between renewables. And also, further levels of efficiency.

And, you know, one of the things that -- you know, we're also part of the United States and we have those regulations around preemption that prevent California from actually requiring the highest, the maximum energy efficiency option that's cost effective.

And this whole issue of present valuing inefficiency really creates a market drive for higher efficiency equipment that is actually preempted.

So, I guess my point here is that whatever options you look at, ideally it's an option that is not something where you're purchasing on a month-by-month basis, but there's actually this first cost investment that is comparable to -- you know, whether -- I'm not trying to make it more expensive, but that you're making that first cost investment over that -- you know, you're looking at the same time period that you would for either your efficiency investment or your investment in renewables. Thank you.

MR. MEYER: Thank you very much, Jon. Just really quick, before Pierre steps up, is one thing that you'll sort of notice is sort of a common theme in a lot of our standards is we're trying to sort of send the right market signals.

And when it comes to whether it's exceptions or alternatives, here what we're trying to do is sort of show everyone, oh, here's the pathway that works. You know, that you can put renewables on your roof. There's some benefits to the homeowner, there's some benefits to the grid, there's things we can mitigate.

It's that, along with the market transformation that's happened from the builders who are building sort of ZNE communities, or near ZNE communities. Local ordinances where local jurisdictions are requiring beyond-code and adding additional to get closer to the ZNE. But, basically, adding more PV.

What our hope is by us moving forward with PV in Part 6, with all of these other actors sort of moving the market forward, that without us having to say there are no exceptions at all that the market will move in a point where the builders realize if they want to sell their

house, you know, for a good profit,, if they want to be able to move their inventory quickly, if their house doesn't have PV because they've found a way to use an exception their house may not sell, or it may sit on the market longer.

If people look at the house next door that has PV, they may end up buying that one.

So, we're sort of hoping that part of the market transformation encourages builders to design their communities that limits the exceptions. That limits the use of exceptions.

We're not talking about having people find ways around old-growth protection and, you know, tree ordinances where they're cutting down trees to put this stuff on there.

But we're talking about when you're siting your houses, since we're mainly talking about new houses, that you're thinking about it smartly. That you're not putting, you know, your huge community center or your big, two-story that's shading a bunch of the other houses.

So, we're hoping that the market and the future moves in the direction where people are designing their communities better. They're designing the houses better so that instead of us

having to rely on, you know, solar-ready portions of houses and all those rules that the people who are trying to sell these houses realize we have to design these communities. We have to design them to have these features in there just to sell the house.

And those happen to be the features that a lot of us are passionate about as far as moving our GHG goals forward. So, that's just -- yes, we don't want to put exceptions that drive a house through size, so we're trying to keep them small.

But we're also, on a different track, trying to discourage people from looking towards those as a viable option because it could have an adverse impact on them.

Okay, sorry for keeping you waiting, Pierre. Please.

MR. DELFORGE: I'm Pierre Delforge, from NRDC. I think you've addressed partly one of my comments, which is good. Pre-proactively or preemptively, maybe.

Just a couple of high-level comments and questions. First, I want to reiterate what other speakers have mentioned that we really appreciate

the Commission looking at this and taking this seriously. We think it's important and we obviously support this and encourage you to continue looking into it.

And we think it's important because it provides flexibility. It provides a flexibility on cost and to be able to deploy renewables, you know, PV in particular at a lower cost. And also in terms of design, community design, to be able to put it where it works the best for the community, which may be a parking lot. If there's shading in the parking lot, then on the roof, or whatever makes sense. You know, on the pool, or whatever makes sense for the community.

I do have a question. I think you mentioned, if I understood well at the beginning, that you're looking at this as Part 11, or in Part 6? Could you clarify what you meant there?

MR. PENNINGTON: Yeah, so this would be an alternative in Part 6. You know, we would build it that way. It also, potentially, could be an alternative that local governments could do in their Part 11 stuff.

I guess it feels a little bit like a Reach activity, if you will, because there isn't

an approach that exists right now that you can just say, bingo that works. This has to be built. And so, it feels sort of like a Reach kind of activity.

Also, it's pretty important, I think, for a local government that's going to view this as an acceptable option for code enforcement in their area, for that local government to be behind these approaches.

And so, I think that the idea of trying to get a local government sort of endorsement of an application, you know, that they're willing to take this on also feels kind of like a Reach activity, or a local government-originated activity.

MR. DELFORGE: No, I hear you and I agree largely with you. But I also think that in that necessary -- require local governments to -- you know, they have other priorities and, you know, orientations and constraints. And I think it would be good, and I think if you're planning to put it into Part 6 as an alternative, it sounds like it wouldn't require that.

So, it would be good to set a framework and leave it pretty flexible in terms of who can

carry out the development of such programs. So that, you know, there is that flexibility there available if market actors are really motivated to use it.

I heard what you said, Christopher, about the exempt/exceptions and trying to make sure that these are all counting on the fact that the market, itself, is going to find -- you know, take advantage of them.

I would still encourage the Commission to make this part of an alternate requirement and not to provide straight exceptions, but provide alternative requirements when PV's not suitable. Just as I mentioned this morning to ensure that there isn't a strong incentive to find or to get, really, exceptions. And just from a fairness perspective to make sure that, you know, every builder and customer does its fair share for achieving clean energy, and carbon reductions, and contributing to the State's goals.

And lastly, I don't think it was mentioned, Bill, in your analysis, which it was excellent and thank you for doing it. But I think what about the aspects of maintenance of shared systems? And when you have your own

system, you have less interest in making sure it's working, the inverter's still working, and the panels may be clean or not.

But when it becomes shared then, you know, how does that work? And it may be something to think about.

But again, thank you for looking into this.

MR. MEYER: We've actually had a lot of discussions on the maintenance issues, the pluses and minuses of a group with funding versus an individual, and who's more likely? And there's a lot of pros and cons to both of them. But, yes, we're talking about that.

We're also talking about we had first looked at like, okay, what can we do as an alternative to say, okay, you either do this or you have -- instead of going right to exceptions, you have to do these things.

As you can imagine, we've ratcheted the building efficiency measures down so tight we're getting to the point where it's hard to do another one where it doesn't look like a penalty. Because if someone puts a PV system on they have a benefit back.

If I say, okay, well, instead of spending $10,000 on that, you spend $10,000 on this efficiency measure, but it may be cost effective but, you know, not nearly to the extent of a PV system. So, it ends up as sort of a penalty.

So, that's the kind of stuff we're -- we are still talking about that, but we're trying to make sure that it doesn't look like a tax, or a penalty, or something like that. But it is actually a true alternative.

But we haven't given up yet, but it's not an easy one to do when in 2016 they did such a good job on the single-family of getting the efficiencies in such good shape.

MR. DELFORGE: No, I appreciate that. And, you know, we shouldn't look at it as a penalty. It doesn't necessarily have to match the cost, it doesn't have to match the benefit.

But at least with you seeing that difference between, you know, having PV or not having PV, by providing or requiring some level of efficiency or other things like, you know, grid flexibility, re-harmonization measures, I think it would help reduce the incentive for seeking exceptions.

MR. PENNINGTON: So, Pierre, maybe you could think about this a little bit. That additional requirement would need to be cost effective. And, you know, we've gone to a lot of effort here to identify the things for this round of standards that are potentially cost effective, and that we've found to be cost effective.

And that magic thing that's sort of outside of our view, that still we might be able to require that's cost effective, and doesn't come with a bunch of other issues that makes it, you know -- that's the reason why it's borderline. If we're not proposing it, you know, we don't know of any just, yes, do this thing.

So, if you want to think about some ideas there, where maybe there is something like that, that's not preempted, and that is potentially cost effective and doesn't come with a bunch of issues, those would be okay.

MR. DELFORGE: Okay. Well, thank you for the offer. We'll think about it and comment on it, thanks.

MR. PENNINGTON: Sure, thanks.

MR. MEYER: This is what we call, too, as throwing NRDC a hot potato.

(Laughter)

MR. NESBITT: George Nesbitt, HERS Rater. So, back to that exception one, at the moment I guess it just says, well, if it's not feasible. So, I guess thinking about what is not feasible, would that mean if you have to put in a 1 kilowatt system, if it was facing the south it would produce X?

But if the 1 kilowatt system, as you would put it in your orientation, with your conditions, your shading primarily, if it produces less than 75 percent of the ideal, that's not feasible?

So, I guess that's a big question.

And then, the question of what do you do if you don't have to put in the system? And my first, my gut --

MR. PENNINGTON: So, George, let me see if I understanding. So, you're suggesting requiring a sub-optimal PV system in that situation that has a shading problem or something?

MR. NESBITT: I'm suggesting defining what is -- what's the criteria for that exception.

MR. SHIRAKH: Maybe I can explain.

MR. NESBITT: At what point is it not feasible? I mean, I would take that as being you're investing money in something you're not getting much out of, but at what point is that?

MR. SHIRAKH: You're talking about the exception one?

MR. NESBITT: Exception one.

MR. SHIRAKH: So, the way it's currently written is if there is a solar-ready area that's greater than 80 square feet, and you can accommodate a PV system, then you'll put that PV system up to the amount that it can accommodate.

But if you have solar-ready areas that are not 80 square feet contiguous, then there's no requirement. So, it depends on the -- you know, you could have a situation where you've got an adjacent building or tree that shades part of the roof, but all of it. In the part that it's not shading, you could have 100 square foot of, you know, good solar access.

MR. NESBITT: Right.

MR. SHIRAKH: Then you're required to put a PV system in.

MR. NESBITT: Well, what we don't want is

the architect designing that choppy roof that doesn't even have 80 square feet.

MR. SHIRAKH: You know, I mean it's a possibility.

MR. NESBITT: I mean, that's an extreme but --

MR. SHIRAKH: But I doubt if most architects will do that.

MR. NESBITT: Well, they do that anyway, that's just how they do it. So, I mean --

MR. SHIRAKH: And then, again --

MR. NESBITT: We're not asking them to do something they don't already do.

MR. SHIRAKH: -- this is external shading. It's not a roof self-shading is covered by that exception, for exactly that reason. So, you know, they need to think about their solar access of the roof.

But, so these are for structures and objects that are outside of builder's control.

MR. NESBITT: Right. But just at the moment you just haven't necessarily presented enough that's sort of, okay, that is not feasible versus -- and as far as something to do instead of putting in the system, I'd say the number one

thing would be QII. If it's the prescriptive requirement, you can trade it off in performance. Make it mandatory. But we'll make Bruce work harder because we'll make it not part of your actual compliance, so it has above compliance. And we all know there's no matches with QII.

(Laughter)

MR. SHIRAKH: Joe?

MR. CAIN: Joe Cain, with SEIA. I usually try to avoid me-too testimony. But I want to express that I agree with several others that I'm really, very thankful that you're taking on this topic because it is a very challenging topic and it's an important one and timely one.

A couple points that I would like to make is that -- one of them is that this is kind of -- well, in other codes, you know, of course I'm on the national stage, but we had this definition of onsite renewables. And that's tough enough, by itself, to define onsite renewables and get more acceptance of that.

The question of offsite just kind of -- this is the first version, the kind of the small, and close, and tight version of offsite which I think will be useful not only in California, but

in the rest of the nation.

And because, you know, with the California 2030 commercial goals, we're going to have to talk with it. So, this is why I'm extra-super pleased to see the Commission dealing with it because it sort of sets the stage for some of those same conversations we'll have as we move into commercial ZNE.

One of the arguments, and I just wanted to touch on one of the other things that I hear in terms of opposition points is, well, the building official doesn't want to be responsible for -- here's my building here and there's something else there.

But my experience, early in my career I worked as a building department plan checker for seven years. And my experience is that there is a precedent for that sort of thing. And that was where we had townhomes and there were property lines, and they were individual owners, I own this, you own that, we did require foundation/roof maintenance agreements.

And even though they are different and distinct owners, we needed to make sure that because, you know, fire separation happens at the

roof and foundations are important, that should something go -- you know, need maintenance, that the parties already have a legally binding contractual agreement.

And so I would say -- and from the building department perspective, we didn't need to get into the legal. We just needed to say here's the -- we need you to give us the agreement. Here's the parties, here's what it says, it's executed. Throw it in our file and that was the extent of it.

So, I think that some of these same questions may come up in terms of building department acceptance. Thanks.

MR. MEYER: Thank you.

MR. STONE: Nehemiah Stone, Stone Energy.

I have a clarifying question and then a suggestion. Bill, when Pierre suggested that if somebody is going to use the exception, then there should be other measures they have to put in use, and you mentioned preemption. But as a compliance option, does preemption even -- I mean, couldn't you, for example say you've got to have a 3.5 COP heat pump water? I mean, couldn't you do things like that, outside of --

MR. PENNINGTON: So, what you just described is not a compliance option. You basically are required to do that. You know, it's not -- if, for some reason, it's outside of your control that you can't comply with the standard, and we want you to do like something else --

MR. STONE: I got it, right.

MR. PENNINGTON: -- that's a requirement that needs to be meeting all of the --

MR. STONE: Right. As I said, it was a clarifying question, thank you.

The suggestion, it's already against State law to build something that impedes somebody else's solar access, at least in the residential arena.

One of the questions that came up earlier was about a subdivision. How do you make sure that somebody doesn't decide to build a one-story with solar on here, and somebody builds a two-story next door?

You could cite that same thing and say that the subdivision has to be laid out to preserve solar access for all residential buildings.

MR. PENNINGTON: Thanks.

MR. SHIRAKH: So, Brandon just used that example, correct? Brandon DeYoung, from DeYoung. You know, he just made that very same case that they do have subdivisions that --

WEBEX COORDINATOR: We have a question online. Barry, I'm going to go to you, now. Go ahead and state your name and affiliation.

MR. HOOPER: Hi, this is Barry Hooper with the San Francisco Department of the Environment. I really appreciated this presentation. And I disagree with most of the commenters and some of the content of the presentation, itself. From the point of the view of the research we had to do to prepare San Francisco's PV and Living Roof requirement for most new construction.

You know, I think that if we step back, as George in one of his comments came very close to doing, the basis -- a core basis for the ZNE goals was aiming for greenhouse gas-free building operations. And another way of putting that is 100 percent renewable energy, which we're kind of dialing back to interpreting as 100 percent renewable electricity.

And then as a goal in the 2019 Standards, in general, you want to communicate to the design community as a priority. And then we're adding, collectively, a new goal of coincidence of load with generation or at least maximizing consumption on site.

And so, you know, given those two things, the PV requirement isn't being envisioned in the first place as a penalty but that, therefore, should have a certain ante that we should all collectively pay into.

But, rather, a necessary way to ensure that you could get to, reliably get to the 100 percent renewable electricity.

And so, therefore, you know, I think the research kind of goes into some detail about how complicated it could be to try to directly mimic all of the attributes of the onsite PV.

But I think the one attribute that's giving the greatest trouble is that those resources be absolutely dedicated to the specific unit or home. And that's likely to be a bigger problem as you scale up to look at high-rise multi-family and nonresidential, ultimately.

And so, I'd actually encourage and

stepping back and asking, you know, if the -- yes, PV, onsite PV has an upfront cost, but it also has a long-term lower cost of power, so that there's net benefit, as we're all aware, and you have a similar cost signal of higher, ongoing power costs if you purchased all of your electricity, particularly if it's 100 percent renewable electricity.

And so, I'd suggest you add an additional compliance option where you set a set of criteria for the local government to administer, but leave them the flexibility to verify those criteria were met.

And, you know, I think that a criteria including onsite storage, efficient electric appliances, and a durable restriction placed by local governments, such as the entitlement process as a condition of approval. To purchase either 100 percent renewable electricity and attaching that to the parcel, or attaching the greatest level of renewable electricity that's available would be a means to get back to the same underlying goal.

And given that the CCAs, the IOUs, and potentially equivalent tariffs and programs could

all contribute to those goals, in different cases you'd have a pretty flexible approach.

And then, just as a comment to comments, the State's solar access laws limit shading from vegetation after the property, a given building is constructed and not necessarily new structures or buildings that end up obstructing that solar access.

And that becomes important because otherwise your right to add solar to your home would be a taking of property rights to people to your south, east or west, who currently had a height limitation on their property that currently allows them to build a taller building than the level that would cause shading on your site.

So that there is a risk borne by the property owner for investing in solar and installing that on a rooftop that's potentially lower than what would be built by their neighbors. Thanks.

MR. PENNINGTON: So, sir, thank you very much for those comments. Can you put those in writing to the Commission?

MR. HOPPER: Sure.

MR. PENNINGTON: Thank you.

MR. BOZORGCHAMI: So, it seems like that's all the questions on this topic.

I'm going to open it up for any other topics for today's discussions. Anything online?

If not, thank you for participating today. Did a hand go up? No.

So, thank you for participating today. And the presentations that you saw today will be posted on our website soon. Thank you.

(Thereupon, the Workshop was adjourned at 3:29 p.m.)

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**REPORTER'S CERTIFICATE**

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

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