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CALIFORNIA ENERGY COMMISSION

In the matter of:

Senate Bill 49 Flexible Demand) Docket No. 20-FDAS-01
Appliance Standards)
_____)

LEAD COMMISSIONER WORKSHOP

REMOTE VIA ZOOM

MONDAY, DECEMBER 14, 2020

9:00 A.M.

Reported by:

Martha Nelson

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AGENDA

P R O C E E D I N G S

8:58 A.M.

MONDAY, DECEMBER 14, 2020

MR. FERRIS: Good morning everyone and welcome. I would like to thank you on behalf of the Energy Commission for participating in today's Senate Bill 49 Flexible Appliance Demand Lead Commissioner Workshop.

Before we get started I would like to take a moment to introduce myself. I am Todd Ferris, the new Supervisor of the Flexible Demand Unit. I have worked for the Energy Commission almost nine years. And I transferred to the Appliance Office from the Building Standards where I was Supervisor of the Software Tools Unit.

Before we get to opening speakers, I have some reasons for the virtual workshop, and the policies on the meeting operation.

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With the COVID pandemic infections still increasing, we want to encourage everyone to please continue to wear face masks when you're in

public, frequently wash your hands, and keep physical distancing, according to the Governor's directives.

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Today's workshop is being held remotely without a physical location for the participants, consistent with Executive Orders N-25-20 and N-29-20, and the recommendations from the California Department of Public Health. This is being done to support social distancing to slow the spread of COVID-19.

The public may participate or observe the workshop, consistent with the direction in these executive orders. Instruction for remote participation were provided in the meeting notice for this workshop which is available on the proceeding website shown above. The Public Advisor can facilitate your participation and is available at the email and phone number shown in the above slide.

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Before we get started I need to cover a few housekeeping rules.

This is a public hearing and is being recorded by the Court Reporter. All statements

communicated today become part of the public record.

All attendees will be muted during the presentation. Following each panel there will be a 30-minute question and answer session where we will take questions and public comments.

If you have questions during the presentation, you may type them into the question and answer function on Zoom and they will be forwarded to the moderator.

If on the phone, raise your hand by pushing star nine and the host will give you the ability to speak during the question and answer session. When it is your turn you can push star six to mute and un-mute. Please state your name and affiliation when speaking.

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This slide presents our morning agenda for today. First, Commissioner Andrew McAllister is going to provide the opening remarks. Next we will hear from Michael Sokol, the Efficiency Division's Deputy Director, about flexible demands connection to the California State Energy Policy. Then we will have several keynote speakers to talk about the value of flexible

demand standards to the consumer grid, flexible demand shift resources through the year 2030, and supporting flexible resources.

The following keynote speakers -- following the keynote speakers we will take a short break and then we will start our series of three panels. The first panel will talk about the criteria for the selection of candidate appliances. We will have a comment period and then we will break for lunch.

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After lunch we will continue our panel discussions starting with the second panel to talk about communication technology and cyber security. Following the second panel we will take a short break and then we will have our third panel to talk about consumer perspectives and equity. After this we will have our final comment period before the concluding remarks.

The Lead Commissioner for this workshop is Andrew McAllister, who will make some opening remarks to start us off. Please welcome Andrew McAllister.

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COMMISSIONER MCALLISTER: Hey there

everyone. Really happy that -- can you hear me okay, Todd and everybody? There we go.

MR. FERRIS: Yeah. I can hear you just fine.

COMMISSIONER MCALLISTER: Okay. Great. I keep raising and lowering my stand up desk and it creates trouble. Okay. Great.

Well, thanks. Thanks a lot and really, really happy to be here. Thanks, everyone, for attending. It looks like we have 136 and counting right now. I won't take 15 minutes to make comments but I did want to just put this in context.

But first, I want to just thank Staff, certainly Todd and Pierre and Nich and all the different staff that's been working on this issue and related issues.

It's very clear that a relatively new resource that we have at our disposal, and it has multiple benefits, is load flexibility. And I think it sort of still remains to be seen where its highest and best value will end up landing but it's likely to be in the realms of reliability enhancement for the grid and cost reduction, overall cost reduction for our

electricity system. And there's also a significant decarbonization benefit from load flexibility. And so all of these needs of our grid are becoming apparent as we transition towards ever higher percentages of renewables and, in particular, non dispatchable or intermittent renewables.

So we have a lot of tools in our toolbox, a growing number, including storage and others. But the digital economy and digitization in general, the ability to cheaply communicate and manage different end-use technologies in real time to customer benefit and to the benefit of the grid, is something that is coming into its own. And we're really at the cutting edge of this in California in terms of having multiple fronts in this discussion, the Building Code, load management standards, and this topic, SB 49, the load flexibility in our appliances.

And so this suite of various innovations that we're developing in California, I think, will reap massive benefits going forward. And it's not something that just happens overnight. We're on the front end of this particular SB 49 push. And you all who are in attendance, and

anyone who can -- who brings some expertise and some viewpoint to this that's grounded in your experience and your analytical viewpoint, and have been working in this field, and we have a lot of great speakers here today to get us started, can have an impact on building this ecosystem that will help us in these ways I'm describing.

So I'm really happy that Staff has gotten this initial paper out and that we are convening this workshop to help us inform the path forward and really appreciating everyone being here.

In particular, I wanted to thank Severin for being here, as well, and as well as Mary Ann Piette, both good friends, and all the Staff that will present today. From the PUC, we have Nate Kinsey, we have Sean Steffensen from our Staff, Appliances Office, Pierre du Vair, the leader of that office, Nich Stuven, whose done -- all of them have done lots of yeomen's work on this topic to bring it to us.

So very interested in everyone's ideas about how we prioritize, what basis we kind of lay, what groundwork we need to do in terms of test procedures and prioritization of different

appliance categories going forward, where the people think the most value will be, and how we can get going sooner, rather than later, in harvesting that value, and all the questions that Staff has lined up in the paper that you have seen and will be working through going forward.

So lots of big, interesting stuff happening here in this docket, and looking forward to everyone's best inputs. And with that, I'm really looking forward to the rest of the day. And I believe Mike Sokol is going to follow me.

So, Mike, I see you're all teed up.

So thanks for the opportunity to open this up. And I really appreciate Todd's intro and everyone's participation.

So, Mike, thanks and take it away.

MR. SOKOL: All right. Well, let me just say good morning to everyone. And let's see, who -- I have a few slides I'm going to share here, if we can get those posted up?

I just wanted to say quickly, thank you to everyone, and echo Commissioner's thanks for everyone attending today. And really wanting to underscore the incredible amount of Staff work

and prep and coordination that's gone into pulling together a very good workshop agenda today.

I'm Michael Sokol. I'm the Deputy Director of the Efficiency Division here at the Commission. And I'm going to speak just a little bit and add a little more to what Commissioner stated in terms of the overarching kind of policy framework where SB 49 is going to help plug in and lay some groundwork for us on the load flexibility as a resource here in California.

So next slide please.

So, again, welcome. And we're really excited to have this workshop today. Staff's been working diligently to prepare for some background materials, do some literature review, and talk with a broad range of stakeholders related to load flexibility. And it really points to that there's a lot of interesting material out there and there's a lot to get started with. But there, also, are a lot of questions that we have and some knowledge gaps. And so that's where we're really looking forward to the conversation today and, specifically, the written comments to follow over the coming weeks.

We have some good sort of framework and starting point and some criteria for how we're going to begin to tackle Flexible Demand Appliance Standards. But, again, there's a broad range of ongoing activities and some very good research and other lessons learned that we want to make sure are implemented here as we get started with this process here at the Commission.

Next slide please.

So importantly, as a starting point, you know, we've got to keep in mind that we are in a crisis here, not just in California but, really, as a world. But California is at the forefront of leading the fight against climate change. And here you see a quote from Governor Newsom, given some of the complications in the past year or two, really doubling down on accelerating any activities to support climate change mitigation.

And if you layer on top of that, beyond just climate change, of course, we're in a number of different crises sort of stacked -- crises stacked on top of each other at the moment and so there's a lot of drivers here that are important to consider.

The good thing is that SB 49 has the

ability to support a number of those responses. So, of course, the support of our decarbonization goals, both from a building level and a system level, as we look towards a 100 percent clean energy future from the supply side. But at its core, SB 49 is focused on benefitting the consumer. And so making sure that there's, you know, bill savings generated and other investments that can be deferred or ultimately saving money for utility grid operations at the same time and benefitting the customer.

And perhaps most importantly, Commissioner mentioned this, but given, you know, the unexpected reliability issues that we faced this last summer and some, you know, keeping a close eye on in the next couple of years here, load flexibility is an important resource as we look to plan out how to respond, if there are reliability events and need, some quick capacity to support grid operations, so hitting on a number of fronts.

And then, as you'll see, as we get into to today's agenda, also considering knowing that we're getting started here and this is a new realm for the State of California, it's how

important it is that we take an equity lens and make sure that this is an inclusive set of standards that consider the unique needs of low-income and disadvantaged customers as well.

And so, really, you know, this is -- load flexibility is a key aspect of building out this 100 percent clean energy future that's clean, reliable, affordable, and inclusive. And we're just excited to get that conversation going today.

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So I already mentioned a range of some of these benefits. But just to add a little more depth, of course, as we're looking to decarbonize the state's economy, we need to look at a portfolio of strategies of which load flexibility is one of those key aspects that sort of cuts across the demand side and the supply side. So as we look at building decarbonization we're going to see load flexibility as one of the key strategies and, certainly, on the system side, as we look at SB 100, the ability to make use of existing resources on the grid, as opposed to building out new generation capacity, has to be something that's a strong consideration.

And so the Flexible Demand Appliance Standards are one piece of the puzzle to building out this ecosystem to realize load flexibility as a resource to support California. And you know, there's a few others that are going to be important to consider, as well, as we look at our Load Management Standards the Energy Commission is developing, certainly the building decarbonization activities which I'll talk a little bit more about in a moment, and a range of other activities that are ongoing, including extensive research into technologies that could interface and, eventually, become standards.

Consumer savings on electricity bills, really, at it's core, SB 49 is consumer-centric and includes a number of statutory criteria for cost effectiveness and user accessibility, open source standards, and we'll get into a lot more detail about those this afternoon or later today, but really a focus on the consumer benefits, but also supporting the electricity grid, and so working with the utilities, working with the Public Utilities Commission, and working with the California Independent System Operator to make sure we ultimately develop standards that are

beneficial and support grid reliability. And last but certainly not least, the benefits to improved air quality, we're, basically, we're reducing demand in a way that offsets the need for additional peaker plants for some frame of reference.

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So I mentioned it briefly and I won't spend a lot of time here, but we have a number of activities that are happening simultaneously here at the Energy Commission on the planning and analytical side, in addition to our standards setting process that we're kicking off here.

And so taking the lens of building decarbonization, you'll see, right in the middle there, in addition to the demand-side strategies on the left and the supply-side strategies on the right that we're taking a close look at, flexible demand and load management are right at the center and cut across both sides to really be a key aspect of our building decarbonization planning efforts.

Next slide.

I mentioned this but there really is a consumer-centric approach where it's pretty clear

in Senate Bill 49 that there is a fundamental consideration for the needs and the drivers that are important to consumers. And so we're really taking that to heart and putting that as a core piece of our implementation approach here for SB 49.

And so looking at ways that we can engage with locals and do outreach to communities across the state that have unique considerations, and knowing that California is such a diverse state with numerous climate zones, numerous cities, counties, and lots of unique groups of people, and so we want to make sure that we're inclusive and bring equity as a core principle in our implementation approach here. And that would involve collaborating with the Disadvantaged Communities Advisory Group that the Energy Commission has. We've already had some preliminary conversation with them. We intend to work closely with them.

But, also, working closely with local communities across the state to make sure that we're hearing what the concerns and interests are of local residents across the state. And, of course, you know, challenging, given the state of

the world at the moment, but we are very fortunate to have tools, like Zoom here, and Teams, and, of course, phone calls. So we're going to -- we've been on the phone very regularly but we'll, as we have the opportunity to consult a little more closely, we'll plan to sort of extend that approach, but make sure that we're working with locally-based organizations and making sure that we're representing all those viewpoints in the standards that are developed.

A key piece of this is making sure that we do have a good public process. And so we're getting that, again, started today with this workshop. We want to make sure we get a good conversation, not just verbally here but also in written comments that come in, and we really look forward to hearing those.

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So with that, I will go ahead and tie up my remarks and lead into the rest of today's agenda which I think, again, is really exciting.

And first up we have Severin Borenstein to talk through the value of flexible demand standards to consumers and to the grid.

MR. BORENSTEIN: Thank you, Michael.

MR. SOKOL: Thank you.

MR. BORENSTEIN: There we go. I am Severin Borenstein. Thanks for inviting me to participate. Thanks to Commissioner McAllister and all of the CEC Staff. I am a professor at UC Berkeley and, also, a member of the CAISO Board of Governors. I should clarify, though, anything I say here today is my opinions alone and not necessarily those of the CAISO or of UC Berkeley.

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So the last time I was here physically, actually at the CEC, was in January. It's been along year but it did make me remember back to the workshop that Karen Herder ran on implementing dynamic pricing. And I made a pitch at that time for getting prices right so that they reflect the true level and variation in society's cost of providing energy.

And of course that's an important piece but today we're back to talk about the other piece which is making sure that consumers can actually respond to those signals because the price variation alone doesn't get you anything if consumers aren't actually seeing that price variation and have a way, in practice, to

actually respond to that price variation.

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That, of course, is becoming more important every year. California is moving towards an ever greater level of renewables, most of which are intermittent and non-dispatchable, which means that we need to make sure the power is still there when we need it while, at the same time, continuing to use the lowest cost renewable resources we can. The great news is, of course, that renewables have gotten cheaper and cheaper and now on a levelized cost basis are competitive with even natural gas-fired power and cheaper in many cases.

The bad news is levelized cost isn't what we consume. We actually want electricity when we want it. And, of course, solar doesn't produce when the sun isn't shining and wind doesn't produce when the wind isn't blowing. And so we need to make sure we have a way to either move supply to the periods when demand is there or to move demand to the periods when supply is there, the latter of which we're going to be talking about today.

I think any realistic assessment of where

we are in California suggests that we really are going to need to do both, move demand and move supply, and that there is clearly some really low-hanging fruit in moving demand, and so that has to be part of the solution.

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Just to be clear, we can do this without flexible demand, and some people suggest we should. But the argument isn't that it will be impossible, it's just going to be a whole lot more expensive if we do it without taking advantage of demand participation. Storage is expensive still. It will get a lot cheaper but it's going to remain expensive, particularly for long-term storage, and we are going to have to make some of those big investments. But we have a way to avoid many of them through demand flexibility.

Also, we can trade power with other areas. And we're doing more and more of that as well. But trading power also has limitations. It has physical limitations through transmission constraints. And it also has institutional limitations through a number of complications of trading power with the rest of the west, both

financial and environmental complications, that are really pretty sticky to work out. It's definitely going to be part of the solution as well. But to the extent we can just move demand so that we don't need to import as much power on those peak times, that will be extremely helpful.

So on its own we do have other resources that are low carbon and are dispatchable. People talk about green hydrogen. That will probably be part of the solution in the future. It's not here yet. It's still very expensive. There are a lot of practical issues to work out. I am very bullish on it but I think, realistically, we have to recognize it is not going to be the major piece of the solution in the next decade.

And finally, I think it's really important to note that we're not talking about shutting off customers. We're talking about flexing demand a bit. And it's clear that there is a lot of demand that can moved at little or no cost. This is an opportunity that we really haven't taken advantage of and it's been there for decades. And when I, even back in the '90s, was talking to engineers about the technology side of doing this, many of them would just roll

their eyes and say, yeah, we know how to do this. The problem isn't on the technology side. The problem is on the institutional and regulatory side.

Well, the good news is the technology has gotten even better since then. And it is going to be even easier if we can actually take the steps forward to make that demand an integral part of the electricity system.

Next slide please.

Just a little bit of history. We have had demand flexibility for decades. We called it interruptible load back in the '70s and '80s. That's when we could actually shut off customers when power was tight. That's a pretty kludgy solution. It basically takes all of the demand from a customer offline, both the low-value demand at that time and the super high-value demand. And we know from our own use at home that we have -- demand a very different value.

And certainly the public safety power shutoffs have highlighted this for us. You want to keep your refrigerator cold, and your freezer, if it's cold out you want to make sure your furnace can operate, but you probably don't have

to have all the lights on. You certainly can change the way you use a lot of other resources, of other appliances, do the laundry at a different time, run the dishwasher at a different time, and so forth. And we can do that manually but now we can do it in an automated way that will just make it much, much easier to do.

We have gradually evolved other systems for demand flexibility. And probably the best known one is air conditioning cycling where the utility has the ability to turn off your air conditioning unit for 20 minutes or 30 minutes. And that was a fine 1990's solution to the problem. It always had problems, of course, the main one being that air conditioning is a single-power system that is either on or off. And so when you turn an air conditioner off for 20 minutes and there's no change in the setting of the thermostat, when it comes back on it comes back on full blast and runs for quite a long time to get the house back down to the temperature.

So we can think of that as demand flexibility 1.0. The great news is that we have made real progress since then.

All of this sort of fits in this idea

that I have been sort of ranting about for a long time, that the whole concept of the value of lost load is incredibly misleading. We talk about that often when we talk about electrical systems because it says there is a single number that captures how much people are losing, or companies are losing, when they consume less, and that's just not the case. There are very low-value uses and there are very high-value uses, so there's no single value of lost load.

The way we can get to actually sorting those out is letting customers sort it out themselves. Now they're not going to, probably, do much of that if they have to do it manually. As a Commissioner said to me during the California electricity crisis, when I was advocating for real-time pricing, consumers aren't going to run around shutting off lights when the power goes off, and there's some truth to that. But the great news is the technology has gotten so much better for automation to run around and shut off lights or shut off your air conditioning for a few minutes, or change your setting, more importantly, on your thermostat. And so those are the technologies we now have and

that we now need to think about implementing.

The key is to reduce the lowest value demand when the cost of incremental electricity rises. That, as I talked about back in January, requires good price signals, and it also requires the technology and the institutions to implement the ability for customers to efficiently respond to those signals.

Next slide please. Next slide please. There we go.

So the key to essential role of demands in smoothly and efficiently balancing high renewable system is that it will improve grid resiliency. It will allow us to respond to those super-peak demands which are likely to get more common with climate change. It will reduce the cost of integrating renewable electricity and reducing our GHG emissions. And it will reduce reliance on more expensive alternatives, such as storage and transmission.

Now if storage were free, if we get to a technology where storage is super cheap, then, obviously, demand flexibility becomes much less important. We can just use storage to move the power around. But we're not there and we're not

really, seriously likely to be there any time soon.

Likewise with transmission. Transmission is a great key or great piece of the puzzle. We should be building more transmission and integrating electricity markets across the country. But, again, that's not free. And it does require both direct costs and a lot of institutional change, and we're not there, and we're not likely to get there right away. So demand flexibility is, in many ways, the lowest cost way to keep the system balanced.

And that allows -- and the technology allows smart implementation of demand participation. What, as I said, what we don't want to do is shut off customers or eliminate high-value usage of electricity. We want to find the low-hanging fruit. And the technology s that we now have allow us to automatically respond to find that low-hanging fruit.

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So why do we need government participation in this? Why don't we just put the prices out there and the technology will be implemented? And the problem is largely a

chicken-and-egg problem that -- or what's called a network externality problem, that we do know how to put the prices out there but there's not much demand for it unless the technologies are out there.

Once -- the technologies have to be, obviously, studied closely for effectiveness and cost effectiveness, but once they're there, getting them out there in the appliances is what will trigger the changes in pricing and the changes in usage of those appliances, which is what we -- how we will get from here to there to a system where we have a lot of smart demand that can see the prices, respond to those prices, and help move demand away from the highest cost periods in order to keep the system in balance while supply is varying in ways that, frankly, as long we we're reliant on wind and solar, are not going to be entirely controllable. Storage will help but it's going to be limited and it's another alternative.

So there are a lot of pieces to the puzzle. We need to use all of them. We need to use demand flexibility, along with storage, along with trading with other parts of the west, and

along with dispatchable resources.

All of those have a role to play but we have an opportunity here to really reduce the cost and show the world how we can reduce the cost of lower implementation of intermittent renewables by implementing widespread demand flexibility. And I think that that is an opportunity that will not just benefit California but, since climate change is, obviously, a global problem, will benefit California indirectly when the rest of the world sees how we do this and follows along and implements the same sort of policies.

So the question is: How do we get from here to there? As the climate scientists keep telling us, the real question is: How do we get from here to there quickly. We don't have time to waste. We have, unfortunately, frittered away the last decade with very little progress on climate change, and the last four years in particular, and so we need to make changes fast.

California, in itself, will be able to reduce its greenhouse gases. But the biggest effect is not California's own reduction but California's leadership and demonstration of how

the rest of the world can use these opportunities to reduce their greenhouse gases.

So I'm looking forward to the rest of the day, to finding out how we can do this in a fast and efficient way, use the technologies, and implement demand flexibility in a way to get us to a lower cost and lower greenhouse gas system.

Thanks a lot.

MR. FERRIS: Thank you, Severin.

Next slide please.

So next up we have Mary Ann Piette, a Senior Scientists and Director of Building Technology and Urban System Divisions in the Energy Technologies Area at Lawrence Berkeley National Laboratory. She oversees LBNL's building energy research activities with the U.S. Department of Energy and is also the Director of the Demand Response Research Center. Today she's here to talk about flexible demand shift resource through the year 2030.

Welcome, Mary Ann.

Next slide.

MS. PIETTE: Good morning everybody. I hope everybody is doing okay on this Monday morning.

I want to start by thanking the California Energy Commission for organizing today's event. It's very exciting to be supporting the goals of the Senate Bill 49. And I'm going to talk with you about the California Demand Response Potential studies, which have been funded by the Public Utilities Commission, but I also want to reference some data that's going to be published soon from the Building Technologies Office at the U.S. Department of Energy.

It's an exciting time in this field. We've been working with DOE on something called the Grid Interactive Efficient Buildings Roadmap and that will be out early next year. So it's exciting to see both the national leadership, as well as the California leadership, on this activity.

Go ahead to the next slide.

I'm going to start by giving you an introduction into the Demand Response Potential studies. Those studies started about in 2014/2015 with the first publications in 2016. And it's been four phases of activity. These activities, I'll review with you the concepts of

shape, shift, shed, and shimmy, and the Phase 3 results which were published this year, and then I'll talk a little about Phase 4 because that activity is just starting and we're in the process of resampling the California loads. The purpose of these studies, and I'll talk about, as well, and I want to introduce you to the way we look at the cost for connected devices, and then I'll summarize and present a few future directions.

Go ahead to the next slide.

One of the challenges in California is that we have a growing amount of curtailment every year. And in 2019 the average in spring was about 5 gigawatt hours a day, so you see that increase over time, and that's the belly of the duck getting deeper and deeper. On Memorial Day of 2019, we actually reached 40 gigawatt hours of curtailment, so that we generated 40 gigawatt hours of solar electricity that we could not use.

One of the ways to use that is to use more demand-side loads, so we want to shift loads around during the day. And if we can use more loads during those curtailment hours, then we can have flexible demand and reduce these numbers and

have a cleaner electric system and support higher levels of renewables on the grid.

Go ahead to the next slide.

So let me introduce you to what we've been doing in the Demand Response Potential Study. The basic idea is to model the capability of loads and the characteristics of those loads, the size of them, and the cost of them. This originally was done to support an order institute rulemaking at the PUC on enhancing the role of demand response in meeting the state's needs for operational requirements. We have been supporting the utilities and the CEC, and I'll present some of these results, but the long-term goal is to understand how flexible demand can help meet the state's long-term energy goals?

And we've recently started modeling electrification. And as we model electrification, it's really important that we think about the participation and the adoption of these various devices, and I'll speak a little about that. And if we electrify space heat and water heat we need to make sure that it's flexible and can shift or we may have problems with those load shapes. We may become winter

peaking and have an early morning electricity peak from space heat and water heat.

Go ahead to the next slide.

So these are the concepts of shape, shift, shed, and shimmy that I want to share with you.

On the upper left is the concept of shape. And we use the word shape to describe the capability of a load to respond to a dynamic price. As we think about time-of-use rates the electricity load shape of an office building or a home or a school might change if they're responding to time-of-use rates, and peak demand charges but we're mostly interested in time-of-use rates, historically, the high price time has been 2:00 to 6:00, but now the high price time is from 5:00 to 9:00 which is, of course, the head of the duck. And so we want to understand what loads can use less at that time of day and shift that to the middle of the day to the belly of the duck?

The traditional shed demand response, I'm going to talk about as well, and Severin made a number of comments about that, about hot summer day demand response, that's our traditional loads

tend to be cooling loads, so we still have that need. And we, of course, saw this here, the blackouts that we saw, as a result of problems on the wholesale grid which might be related to emergencies or some price issues or a power plant being down. So we still want to have that capability to shed load on a hot summer day.

What is quite important is this new concept of shift. And the concept of shift is moving load from one hour to another. In comparison, shedding is often meaning that we're curtailing load and we're not catching it up again. So if we change the temperature in an office building, say from 70 up to 75, we often don't have a rebound, depending on what time of day that's happening. And you can make sure, with controls, that you don't hit a new rebound.

With shifting we're actually moving load to part of the day. And an electric battery can shift load. But we also want thermal loads to be able to shift, and even things like pool pumps, and I'll give an example of that.

So that is what shedding and shifting is.

Now shimmy is what we call fast-acting demand response that's receiving a signal

continuously and load following or ancillary services. My presentation is not talking much about shimmy. Shimmy requires more advanced telemetry often. And the advance meters that we have with
AMI are sufficient for shed and shift. We may or may not want them for shimmy.

So those are the concepts of shape, shift, shed, and shimmy. And we're continuing to model these different loads in the Demand Response Potential Study.

Go ahead to the next slide.

In this slide on the left I show you the average annual electric load shape with shiftable loads. And you'll see the top gray, you'll see process loads, pumping loads, refrigeration, pool pumps, EV charging, HVAC. The net load is, of course, the duck curve, and then others. So there's a lot of load that we're not modeling. I'll talk a little bit about how this model was derived.

In the Phases 1 through 3 we had 200,000 electric load shapes and 11 million demographic files to create a model of the IOU service territory where we model residential, commercial,

and industrial loads. And you'll see in the table there on end uses the different end uses that we model. So we basically create an 8716 (phonetic) hourly load. And that's a load that has different weather climate zones across the state. And we cluster these loads and we look at the capability of these different end uses to respond to some sort of demand response signal or event.

We have been modeling space heating and water heating in Phase 3, so that was not in Phase 1 and 2, and those are new electric loads. The majority of California uses gas for space heat and water heat. And when we try to model the electrification of space heat and water heat the numbers that we get and the value of that is going to depend on how quickly it's adopted and how quickly we can retrofit the stock. So we're actually trying to model the cost to implement those different systems. You'll see we don't have residential appliances in Phase 1 through 3 but we are adding that in Phase 4, and we're adding commercial space heat and commercial water heat.

So when we think about SB 49, it's

important to understand that it's oriented towards demand-flexible appliances, not built up systems, so we have some of both in this study. And I want to make sure you understand that the loads that we're modeling here include things beyond SB 49, as well as things that might be available in SB 49. And we'll work with the CEC to dig into the numbers from the study and to try to help them understand the magnitude of the shift potential, as well as the shed potential, from some of these emerging flexible appliances.

Go ahead to the next slide.

So we've been trying to model, how much does it cost to get a kilowatt of flexible load? And we have a few categories of different costs that we consider. A lot of the technologies that Severin mentioned, like the direct load control, the utilities pay for a switch at an air conditioner. They may pay for a switch at a pool pump. And that's one type of piece of equipment where the utility controls it.

Another piece of equipment would be a smart thermostat that a consumer may install in their house, but they may get a rebate from the utility, and the utility may then enable that

thermostat to be part of a demand response program. Most of the demand response programs in California at this time are shed programs. We're just beginning to think about shift. And the digital tariffs and load management standards are designed to help us move to this continuous price response that Severin mentioned as well.

So the cost that we think about here are both kinds of costs. There's a fixed cost for the communication and the hardware. And most of these communication systems are using the internet. And we consider a cost per site, so it's a cost to turn that automation on for a given building.

Then there's a variable cost for the type of controls. And when we think about those controls, it might be the controls for a heat pump, for a thermostat, or for a built up system, as I mentioned, and that would be the cost per kW. So in our accounting system we have both cost per site and cost per kW.

And then there's the end use control and communication which are per end use, for example, per HVAC system in a large commercial building.

So there's a variety of different costs.

And I'm going to show you a report that was published by a few folks at LBNL that has some of these data that you can refer to later.

Go ahead to the next slide.

Here's some examples of the cost for residential site enablement. And this is the report on the right that I mentioned. These numbers are from that report which was published in August 2017. And I'm going to show you a resource for newer cost data as well.

The three on the left under shed are HVAC, that's a direct local control thermostat or direct local control device that the utility controls, a pool pump. Now a room air conditioner, as well, some utilities are actually communicating with room air conditioners, whereas on the right I have the HVAC for a smart thermostat which can both shed and shift load. The historic demand -- the automated load control from utilities is shed only, whereas a smart thermostat might be able to respond to a price and pre-cool a building.

So as we move toward these technologies that Severin was describing, we have our traditional shed, and then we have our more

flexible shift that can respond continuously to some sort of price.

The report here is called Demand Response Automated Controls Framework and Assessment of Enabling Technology Costs. So that's a resource I wanted you to be aware of. And we've been using some of these costs in our modeling activities.

Go ahead to the next slide.

This is not published yet, even though it says September 2020, but this is a list of devices that Guidehouse has been evaluating for the Department of Energy. And here, DOE uses the concept of grid interactive efficient buildings. And you'll see a good list of technologies here, smart thermostats, heat pump controls, heat pump water heaters, dishwashers, residential window attachments, so these are both energy efficiency, as well as demand flexibility technologies. And there's been a lot of work in the last year looking at the relationship between energy efficiency and demand response technologies. A smart thermostat is a great example of a technology that can help people automate their schedule for their air conditioner, as well as do

this sort of pre-cooling and shedding for demand response and shifting events.

So as we think about devices for demand flexibility, many of the control systems also can provide energy efficiency. That's true in lighting. That's true in heat pumps. And it's very important, when we think about something like a heat pump water heater, that it is much more efficient than an electric resistance water heater. So we want to move towards devices that are both efficient and grid interactive. And the SB 49 program is going to help us identify those.

So this is a report that will be available soon. And I have one slide on the details to show you the kinds of information available from this report.

Go ahead to the next slide.

So this slide shows you 2020, 2030, 2040, and 2050, so it's a pretty aggressive outlook into the future about what is happening on air conditioning in homes, the seasonal energy efficiency ratios for the south and the north, the average life of the retail equipment, install costs, annual maintenance costs, and reported energy savings. And you'll see there a column

that says, "ENERGY STAR Connected Smart Thermostats," so we have smart thermostats in 2020, all the way out to 2050. And you'll see a little bit of reduction in costs over time. And they produced tables like this for all those devices that I showed you in the previous slide.

So this is a great resource to think about these ENERGY STAR connected device costs and, also, the energy efficiency associated with the end use. And we're moving into a time where our ability to understand the cost effectiveness of adopting these technologies is improving with studies like this.

Go ahead to the next slide.

Now here is some results from the Phase 2 Demand Response Potential Study where I'm showing you results for shed. And when I say that the cost is $200 per kilowatt, I'm showing you all of the demand response that's available at $200 a kilowatt. If I showed you a number at $300 a kilowatt, it would be a higher number. And if it was $100 per kilowatt, it would be much less. But here, at about $200 a kilowatt, we think that the state has about 6 gigawatts of demand response potential from the end uses shown here

for the year 2025 for a typical weather year.

And you can see the division by utility, about -- Edison and PG&E have a similar amount of about 3 gigawatts. San Diego Gas and Electric is a lot smaller. And you can see the different end uses we modeled here. This does not include water heating at this time, or space heating. The HVAC here, in this case, is cooling, and HVAC in large buildings. You can see there's a lot of industrial potential. And some of the industrial loads may be affected by SB 49. But this is -- these are using the levelized costs for the technology. And we estimate the size of the reduction for every end use and then we summit over the year.

So for each of these devices we estimate the lifetime of the control system in order to create a cost that is an annualized cost to install the technology and then to use it every year in the hours that it's available. And these are the top 200 to 250 hours where we need this kind of demand response.

Go ahead to the next slide.

Now shift. This slide shows you on the left a plot of the different end uses, which I'll

talk about in a moment, but there's three colors there. The blue is the participating resource that we think can be available in -- this one is 2030, which I don't show here but I know it's 2030. The orange is technically available -- technologically available, meaning that not all of the loads are going to participate. So the blue is what we think will participate. The orange could. And the green is the max.

So you'll see, for example, at the very top, pool pumps could shift about a gigawatt hour per year. Now when I say a gigawatt hour per year, that's a sizeable resource that we actually can use once a day. We tend to need it most in the spring. Sometimes we could use it twice a day.

So the picture on the right shows you a day, so that's 24 hours, and on the Y axis it's the shift for a particular dispatch. Now over the day, in the morning we want to take load and then shed load because of that morning blip in the duck curve. And then in the middle of the day, when there's plenty of solar, we want to take load and then we want to use less during the shed hours in the late evening. So that's the

inverse of the duck.

And those are why we may be able to use the resource twice a day. For example, some heat pump water heaters might be able to cycle twice a day. You might have a morning demand and you might have an evening demand. And then you're going to pre-charge it before your morning showers, and then charge it in the middle of the day before everybody comes home, but they're home all the time now, so it may be a different load shape. But those are examples of the kinds of things we do.

So the technology costs and the performance levels constrain how much shiftable load is accessible. And that's the key, is that we -- SB 49 will help reduce the cost of providing shift on the grid because the appliances of the future will have that embedded when you buy them, as opposed to the way we modeled them was that you had to pay for that capability to be added to a device. Now residential appliances turn over more quickly than, for example, a large HVAC system. So there's a lot of opportunities in different kinds of loads and the way we think about the adoption

cycle.

The demand response path model that we use considers the customer historical participation. So we look at the demand response programs that have been in practice for the last few years and then engagement models that are help in the future. So that's basically the concept here. And you'll notice, as I mentioned in the beginning of my talk, that in the spring we had about 5 gigawatt hours per day of curtailment, so we actually are able to soak up that much load with these kinds of devices. And we are able to use demand flexibility to reduce the curtailment significantly.

Go ahead to the next slide.

These are the new residential appliances that we're going to be including in Phase 4. We're going to be modeling, for the first time, refrigerators, freezers, washer and dryers, dishwashers, and domestic hot water, both residential resistance heat, as well as heat pumps. And we're using the CEC's 2019 Load Shape Study from ADM Associates, and we'll be modeling across numerous climate zones, so we're really excited to be doing that work. Right now we have

300,000 load shapes from the utilities for Phase 4. And, again, we have this 11 million demographic file, so creating this model of the capability.

And I think I have one more slide. Head to the next one.

So I just want to say that I'm excited to share with you some thinking about how flexible loads are critical for California's clean energy policies, and the magnitude of that capability, compared with some of the over-generation problems and the kinds of resources we need. We need to -- we are in the process of modeling these new appliances and quantifying the value of the load shedding. We can model the influence of SB 49 on making those loads more cost-effectively available for the shift potential. And a lot of new resources are becoming available for that cost data that I wanted to share with you.

I have two links here, the different link to the potential study, and also the Electricity Markets and Policy Group's controls framework of enabling costs.

So I'll stop there. And thank you so much for the opportunity to present this work.

MR. FERRIS: Thank you, Mary Ann.

Up next is Nate Kinsey representing our sister agency from the California Public Utilities Commission. Nate is the Senior Regulatory Analyst on the Building Decarbonization and Renewable Natural Gas Section at the California Public Utilities Commission. Today he's here to speak about supporting flexible resources at the California Public Utilities Commission.

Welcome, Nate.

MR. KINSEY: Thank you, Todd.

Morning everyone and thank you for the opportunity to present on what the CPUC is doing and to coordinate on the implementation of SB 49 moving forward.

I think the ordering of this conversation was fantastic with Severin kicking off and Mary Ann touching on a lot of the topics and technologies that I'm going to be covering, so I'm excited to be here.

And before moving to the next slide, I just want to highlight the language that's in SB 49 for coordination between the two agencies, and that is to better align the flexible demand

appliance standards with the demand response programs administered by the state and load-serving entities, and to incentivize flexible demand appliances. So when I was developing my slides, I really tried to frame it in that context, specifically in alignment with the language in the legislation.

So let's go to the next slide please.

So first, I just want to start off by acknowledging, I'm not on the Demand Response Team at the CPUC. I am on the Building Decarbonization and Renewable Gas Team and really, exclusively, focus on the electrification of buildings. And so I spent a lot of time thinking about how buildings already account for a large load on the grid in California and how increasingly they will be serving additional load moving forward as more buildings are electrified due to the installation of heat pump technologies, such as space and water heating.

That brings up a really interesting point -- next slide please -- that Mary Ann already touched on which is as the grid takes on more and more of electrified building stock a lot of that building load occurs during times of really high

or higher GHG emissions on the grid. As we look forward in studies you see as a building gets electrified, especially at space and water heating, you get these morning loads and these evening loads, especially during the winter, that really align with times of really high GHG emissions.

So as I'm thinking about not only electrifying the building, removing barriers, providing incentives, I spend a lot of time thinking about how do I truly make a building decarbonized by ensuring that its operational load is in alignment with the greenhouse gas emissions of the grid? And one way to do that is to shift around load as much as possible.

Next slide please.

And there's been really great research done by folks, like Rocky Mountain Institute, that show on a residential application, where I spend a lot of my time, there is a great ability once you include the right controls, the energy storage, the right price signals, that you can really nicely fit a lot of a residential load into those middle day -- or the middle hours of the day when renewables are high, solar

generation is high, and avoid some reliability issues and greenhouse gas issues in the evening.

So that's my framing coming into this conversation. I just wanted to be up front and honest that I'm not the demand response guy but I do spend a lot of time thinking about how demand response, how shifting of these types of resources, will be critical for California to achieve its greenhouse gas and reliability goals moving forward.

Next slide please.

So just taking a second to talk about where we are today. I think Severin did a great job of keying up the examples of past demand response programs and where we were, really, at the turn of the millennia, and in response to the energy crisis and the situation that has developed out of that, or the framework for demand response and flexible resources that has developed out of that over time.

Next slide please.

And I came up with this catchy little reminder which, if you work in energy efficiency or in any public purpose program, I look at these, the CPUC's enabling flexible resources,

through programs, pricing, and products. The programs are your traditional energy efficiency market transformation programs and we'll highlight a few of those next. But, really, the goal of those programs are to lower costs, some of which Mary Ann touched on, increase adoption, remove barriers for adoption, and to provide that marketing, education, and outreach to not only the, you know, the broader California community, but also communities that have been impacted over time, disadvantaged communities, communities that will be impacted largely by climate change more than others have been, and those are our programs.

Our pricing is our, you know, time-of-use rates which are slowly rolling out statewide now. EV rates, the Self-Generation Incentive Program's Greenhouse Gas Signal. Future programs -- or future pricing examples could be real-time rates or the pricing provided through the load management standard that's being worked at here at the Energy Commission. And then our products. And these are our products that go into the marketplace at the CAISO and really provide those services there.

And if you click one more time, those two, the pricing and the products, are what is enabling the flexible resources and the framework in which we're operating under today. I will say that, as we've highlighted a few times throughout the conversation, this structure is really focused on shedding of demand response. It is not necessarily set up for shifting. Some of the time-of-use rates, we will highlight later on and get to that, but this structure is historically, kind of in its current form, focused on the ability to shed of resources.

Next slide please.

So when we think about the programs and the programmatic side, there are a range of programs that are offering appliances or incentivizing the adoption of appliances. And a couple key things I want to hit on here is, first, each one of these programs currently lives kind of in its own bucket and its own silo. They have their own goals, they have their own rules, and that changes what types of appliances are incentivized going out the door.

For example, energy efficiency will incentivize a heat pump water heater. Now that

heat pump water heater might not have the capabilities to provide the shift resources that we're talking about here today because energy efficiencies really focus on, today, on capturing energy savings. It doesn't take into consideration any of that shift that's possible, whereas the AB 2868 Energy Storage Programs, which we'll again talk about later, really are focused on energy storage applications, thermal energy storage, and are trying to get appliances out there that can serve that function.

So when you're thinking about programs and when we're thinking about SB 49 implementation, and one of the big benefits of it will be that kind of peanut buttering effect across the California marketplace. Appliances across the board, no matter which program they're going to be incentivized through, will have that ability to respond to a signal, shift load, shed load. And I think it's going to be a really key barrier to -- or key benefit to the California marketplace in lowering cost, which Severin and Mary Ann both touched on.

Next slide please.

So here is our demand response framework.

And I want to point out, we want to ignore C for right now. This is a copy/paste from another presentation that was given a little bit earlier on. But our current demand response framework falls into these two buckets of load-modifying resources and event-based resources. And I've highlighted a few of the different types under here. And that goes, again, back up to those pricing and products that we already touched on.

So these load-modifying resources, Permanent Load Shift Program was a program that operated from kind of the mid-2000s until about 2017 and really focused on how can we get thermal energy resources to shift load on a constant basis? If you take that example and kind of play it down to a smaller appliance level, maybe that's what we're going to be asking some of our appliances to do, like heat pump water heaters, and we'll talk about that. Time of use is another great one. Events, like critical peak pricing. And then this, you know, future of hourly or real-time pricing signals that are going to go out. So those are the load-modifying resources.

Supply-side resources, I've touched on

already, these are the ones that go play out into the CAISO and into the marketplace. And there are DRAM programs, Demand Response Auction Mechanism, as well as our resource adequacy contracts and broader kind of DR IOU contracts that they might operate. But, again, this is the framework that we're working on today. Is this the best framework for incorporating SB 49? Maybe. Maybe not.

I think there's a lot of areas where you're going to have devices that could fall into both of these categories and how do you deal with those? How do those get accounted for is a key question that, I think, all of us need to answer as more of the technologies that are identified by the CEC roll off the lot.

Next slide please.

And I was also asked by Energy Commission Staff to touch on how do we actually account for the benefits of these resources? So the main function of -- or the main way that the Public Utility Commission values and benefits or avoided costs that a DER and, really, behind-the-meter resource provides is through the avoided cost calculator. And, hopefully, many of you are

familiar with the avoided cost calculator. But in the simplest terms it is a forward-looking projection, 30 years on the 8716, the annual basis, that looks at the different costs that are being imposed onto the system or generated onto the system. And we take those costs and considerations, you take the technology and their ability to avoid those costs, and that provides your output for your benefits.

Now when you're looking at shed, that's a little bit easier of a calculation to do. You say you're avoiding one hour of costs or one hour -- you're providing one hour of benefits to the California grid. When you start thinking about shedding -- or shifting, excuse me, you really are doing two things. One, you're creating benefits across multiple hours, which is a great thing, but you're also increasing costs at a different time of the day. Now those increased costs might be coming during the middle of the day when renewables are high, costs are low, and we want to encourage that. But, again, it is a different framework in which the programs that have been developed and operated by the CPUC are going to be moving forward in.

So it's just -- it's a tweak in the mindset that we need to employ, not only as Energy Division Staff but as all of us, that we are not just generating a benefit, we are also generating benefits and costs.

Another thing that I wanted to highlight the difference between the shed and the shift is, in the past, it was my understanding that purely shed resources, and some of the big interruptible programs, the Commission came up with, you know, you're a cost metric for the loss of operations that your factory might be providing or the avoided revenue that you might be providing. Well, in a shifting resource, such as a heat pump water heater, and we'll talk about next, you're really not losing any value. You're moving the value around. You're ensuring that your hot water is still there but providing a reliability and greenhouse gas reduction or a benefit at a different time of the day.

So again, the structure and the frameworks at the Public Utility Commission are going to need to update as we move forward with these new appliances coming on and with the technologies that will enable this to happen.

Next slide.

So again, I spend a lot of my time thinking about the electrification of buildings. And in 2020, I've spent a lot of time thinking about deployment of heat pump water heaters across a variety of different programs and their ability to shift load, their ability to shed load. I've included shimmy in here because there are resource studies out that show electric resistance have the ability to shimmy, as well, so I wanted to walk through an example of just taking one appliance and/or one category of appliances and how the Commission is going through those three Ps of programs, pricing, and products.

Next slide please. So -- and we'll click one more time please. Let's get the boxes up. And one more. Great. Thank you.

So from a program standpoint there is, actually, a lot of programmatic support for the adoption of heat pump water heaters from the Commission. And these, I believe, are roughly in order of chronological time from when the Commission approved them, but starting with the San Joaquin Valley Clean Energy Pilots, which is

approximately about 2,000 homes in the San Joaquin Valley. The Commission sent the signal that, you know, through the electrification of those homes, single-family, mobile homes, manufactured homes, we wanted to encourage the adoption of not electric resistance technologies but heat pump water heater technologies. And we wanted to ensure that those technologies had the ability to shift load, to shed load, and we're kind of under this term of grid-enabled or grid-connected heat pump water heaters.

So Cal Edison has taken this as an opportunity to explore the actual real-world analysis or potential of these resources to provide different kind of demand flexibility, whether it's shedding or shifting. And we have kind of grown from there where we've had this small group of about 2,000 who are supported, where we went to PG&E's WatterSaver Pilot Program, which is on the Commission voting meeting this week, but would approve 6,400 heat pump water heaters. And, approximately, 6,400 heat pump water heaters would be enabled in PG&E's service territory to provide shifting resources. So Cal Edison also has a secondary

application which is a bigger kind of WatterSaver Pilot Program to operate in their service territory to shift resources.

So we have this category, again, of programs that are working on the enablement of the shift technology or the shed technology in heat pump water heaters. And each one is providing a little bit different resource.

The two boxes below that, the Tech and Energy Efficiency Pilots, are really focused on getting the technology out there. Those don't have the requirement that they be grid enabled, grid connected. The Tech Program might be enabling or -- excuse me, providing a kicker incentive for that technology to be determined. But, again, we've already talked about energy efficiency as getting the technology out there.

And as Mary Ann mentioned, we have this kind of chicken or egg scenario where we're going to have to go back to some of these heat pump water heaters and enable them to become the demand flexible resources we want, whereas in an SB 49 implemented world, we're going to actually avoid that whole kind of go-back scenario at a lower cost and provide the benefits that we're

looking for on the grid.

Finally, I just want to highlight that the end to Self-Generation Incentive Program, about $45 million that we've -- the actual number is $44.6 million, has been set aside to explore the implementation of heat pump water heaters in that program as thermal energy storage. And so Staff is going to be issuing a Staff proposal on that shortly. But you can just tell, across the board, the Commission has sent the signal that we want to, one, provide support for the adoption of heat pump water heaters for their efficiency purposes and, two, we want to make sure that in some areas we are studying their ability to shed, shift, and be a flexible resource on the grid.

Next slide please.

So on to pricing. So what do we look at for pricing for heat pump water heater? So in the time-of-use category, we actually have one time-of-use rate available in So Cal Edison's territory that is not exclusive to heat pump water heaters but is exclusive to kind of -- in trying the resources that could be shifted and/or shedded for reliability purposes. And so you can see the TOU prime rate has a pretty high-peak to

off-peak differential during those peak tier periods of 4:00 to 9:00. It's broken by summer and winter. And that is a great (indiscernible) that is sending that signal to the homeowners and to their devices, if they're properly enrolled, to move off those times of high cost, high GHG, and to do -- you know, provide those resources or benefits at another time.

Additional pricing signals that are coming for heat pump water heaters, PG&E and SDG&E have both been ordered by the Commission to develop similar beneficial electrification rates. PG&E has filed theirs in an application which is their e-elect (phonetic) proposal. And SDG&E, I believe, is the following fall they will be submitting their beneficial electrification rate as well.

Energy Division, also in support of the adoption of water heating, has proposed a baseline credit in the Phase 2 Staff proposal in the building decarbonization proceeding to kind of bring cost parity for these resources. As we electrify and move away from natural gas for water heating to heat pump water heaters there's an adjustment factor that is made for space

conditioning but not for water heating. And so Staff had proposed to support it.

There are also multiple kind of, you know, explorations of real-time energy rates ongoing at the Commission. Those could, you know, be sent signals with the proper communication technology and telemetry to a heat pump water heater. And we've been active in supporting ongoing conversations at the Energy Commission for the load management standard.

Next slide.

So products. And I will admit that there is very few exclusive water heating products operating out there in the CAISO markets today. I do know for a fact that there are programs where it's kind of bundled with another set of appliances where heat pump water heaters are shedding load. I'm sure there's some electric resistance tanks out there that are shedding load. But, again, these products are focused pretty much exclusively on their ability to shed and on that kind of key consideration of reliability during peak demand times.

I also will note that, you know, electric water heaters in the state of California are a

pretty small percentage of the appliance base. This is the 2009 RASS number, which is the Residential Appliance Saturation Survey, it's less than ten percent. And a majority of that, if not all that ten percent at the time of the 2009 study, was electric resistance water heating technologies. Now ten percent in California, especially in the residential space, is a still pretty big number.

We have about 13.5 million residential homes or, you know, units in the state. And so ten percent of that is 1.3 million. So if we're looking at a million electric resistance water heaters that could be enabled with some go-back technology and appliance standard adopted through SB 49, that if it's for, whatever reason, impossible to replace that electric resistance water heater with a heat pump water heater, capture that benefit and that potential at a later time, that's a lot of, you know, a lot of ability to shed or shift. And that could be helpful to the California grid.

And, finally, I'll just note that there's a ton of ongoing research and testing. And we've noted the programs up above on where best these

water heaters are going to serve. Is it going to be addressing the spring issue that Mary Ann touched on of we want to soak up as much of that renewable energy and avoid curtailment in the spring? Are we going to want to use these resources for shedding purposes? Are we going to want to shift them on a daily basis, regardless, really, of the conditions out there on the grid and the GHGs because that's the best thing from a participant cost benefit?

So I think there's a lot of really unique opportunities to continue this ongoing research. I'm thrilled to see that in Phase 4 of the LBNL research the space heating and water heating will be considered. But there's still this big outstanding question of where and how, and how do you design a program that, if it does all these things, provides these benefits to the grid?

Next slide please.

So I just pulled together a couple of barriers and key questions here. I'm not going to read these off. This is something that will be considered ongoing with our sister agency and Staff at the Energy Commission.

I do think highlighting one of the key

considerations here around telemetry is super important for equity reasons. There are heat pump water heaters on the marketplace today that come Wi-Fi enabled and really are set up with the ability to do the shedding and shifting that we want with maybe a couple of tweaks here and there.

Now Wi-Fi works great. It is, you know, a fantastic way to communicate back and forth between a utility or a third-party aggregator. But in some parts of the state, as we've noted with COVID, some of our fellow Californians don't have access to Wi-Fi. So how can we ensure that any standard that does move forward, and especially around the topic of telemetry, takes into consideration and centralizes equity at the heart of that? Should these devices be standard with a cell phone signal? So no matter what, really, in the state of California, they're going to operate and be able to connect it. Do we want cell phone and Wi-Fi? Do we want one-way or two-way? I think just that topic alone is a really interesting one to continue to explore as these standards are being developed.

So next slide please.

And then the final thing I wanted to touch on was the Commission recently adopted an energy reliability new rulemaking. And that rulemaking is focused on how do we ensure, if we have an extreme heat weather event, like we did this last summer which, really, we had probably three if you consider August, September, and end of October, how do we, you know, ensure that the grid is reliable and stays up to -- stays able to provide the resources and electricity that we need?

And one of the key questions asked in there is really on this topic of demand flexibility and on what rules, modifications, opportunities there exist to further reduce demand and enable demand response or demand flexible resources to provide that reliability?

So I bring this up, really, as an FYI to the audience and as an opportunity for engagement around what should the Commission consider doing? It was just -- reply comments on the OIR itself just closed and so it's just something to keep your eye on. And it will be a quick-moving rulemaking, especially in the context of anything that happens at the Public Utility Commission as

we prepare for next summer.

So next slide.

And here's my contact information. I thank you for the time and really hope that it was a useful kind of background on the programs that are offering incentives for appliances, the demand response framework that is up and running at the Commission, as well as some thoughts and, potentially, how we might need to tweak in response to rules or regulations adopted by the Energy Commission with SB 49.

Thank you.

MR. FERRIS: Thank you, Nate.

So we're finished with our morning keynote speakers. And I wanted to give Commissioner McAllister a chance to comment, if he was interested?

COMMISSIONER MCALLISTER: Yeah. Absolutely. Hey, Todd, thanks for the opportunity. I really appreciate that, really, three of the, really, best speakers I could imagine to kick off the proceedings and really highlight the key pieces of this puzzle.

There, you know, really are a lot of considerations that overlap and intermingle. And

they all are very exciting. So, you know, the idea that we can really use these both in real time to respond in a real life actual events that happen, you know, and perhaps over in the CAISO market, and minus one (phonetic) kind of response back to situations that will come up with climate change evermore intense, such as we had in August and September, and so building on that kind of approach to leverage communication and controls of aggregated appliance flexibility capacity throughout our state

But then, also, implicitly and somewhat in a stated way, you know, through the morning we heard that load shaping, kind of permanent load shaping, is also been an obvious and core pathway forward for these flexible resources.

There was a lot of talk about water heating, which I completely agree with, but I think we have to learn a lot more about that, about water heating and the duty cycles and, you know, how big the actual loads are and when they tend to operate. Obviously, there's a lot of potential synergy there but, also, we have to go and, you know, roll with eyes wide open and a fair amount of data about how these are actually

being used across the state.

So if we are going to depend on them for capacity resources during specific parts of the day, in the belly of the duck say, can we do that at scale with a meaningful impact and still get people the hot water that they need without any interruption? So I think we can but I think we need to know, you know, the details about how to make sure that we operate that way.

Really excited to continue collaboration with the public on the Build Program and all the different initiatives that we have across both of our agencies in terms of how to kind of wake up this marketplace and make sure that the consumer has the benefit that they deserve if they make the outlay for purchasing these.

And as we move through the Building Code and we make it more explicitly beneficial to peat heat pump technologies into the Building Code in new construction, at the same time we build a replacement market through the various programs, you know, I think that's the -- there was acknowledgment throughout this morning that this marketplace is a nascent one and that, you know, we have a lot of -- 90 percent of the state has

gas service, and most of the water heaters out there are gas. And so as we shift to heat pumps and we figure out ways to do that sustainably through the Building Code and through programs and really scale that marketplace up, that we have alongside it the market kind of platform through this and, you know, SB 49 and the load management standards alongside those other efforts to really build things in an integrated way.

So very excited about how all these pieces work together. And I think those were my comments.

I want to, again, thanks Nich and Mary Ann and Severin for being with us this morning to set the stage. And really looking forward to looking at all the issues, the technical and the security issues, that we'll be talking about in the afternoon.

So thanks.

MR. FERRIS: All right. Great. So we are going to -- we're going to time check. We're basically going to shift in a break here. I'm sorry for the odd start time. We actually have to do some slide maintenance, so we're going to take

the full ten minutes. So you can run and get a cup of coffee and a snack or use the restroom and we'll start back here at, basically, 10:37. We'll see you then.

(Off the record at 10:25 a.m.)

(On the record at 10:36 a.m.)

MR. FERRIS: Hello everyone and welcome back.

Up next we have Sean Steffensen, who is a Mechanical Engineer from the California Energy Commission, here to speak about the criteria for the selection of candidate appliances.

Sean?

MR. STEFFENSEN: Good morning. I am Sean Steffensen, a Mechanical Engineer in the Flexible Demand Standards at the CEC. I will talk about Senate Bill 49 and provide a Staff perspective as we gather information to select appliances for Flexible Demand Appliance Standards. After my ten-minute talk, I will lead a panel discussion on approaches to flexible demand in appliances, followed by a discussion with the panel and audience.

Next slide.

What is the objective of Senate Bill 49?

The bill's author, Senator Nancy Skinner, said,

> "Senate Bill 49 will help bring California's electrical grid into the 21st century and allow us to use clean, renewable power more effectively. Senate Bill 49 will also save ratepayers money because smart appliances can be programmed to use electricity when it is cheapest. Senate Bill 49 is just the tool we need to help us get there. Senate Bill 49 is the intersection of a win for climate and a win for consumers."

Next slide.

The threats posed by climate change, whether extreme weather, drought, fire, flood, drive us to use more clean renewable energy to reduce our greenhouse gas emissions. Advances in appliance automation and the significant increases in wind and solar power in California will make this possible. Senate Bill 49 fits these trends together to bring about changes for the public good.

The Flexible Demand Appliance Standards will evoke appliances to match their electrical load to the clean power of the sun and wind and to reduce our dependence on fossil fuels. Senate

Bill 49 does not start this innovation but accelerates existing trends by creating guaranteed markets for innovation.

Next slide.

In what way does appliance load need to be moved to enable more clean energy in California? This figure shows the changing state of carbon emissions from the California electricity grid. Green means low emissions that typically occur when the sun is shining and demand from appliances is low. Red or high emissions typically occur when load is high or in the night. Two challenges emerge from California's new renewable power supplies, an oversupply of generation in the middle of the day which contributes to the curtailment of renewable generation, and significant ramps in the morning and evening which are demands on non-solar resources to respond to the beginning and end-of-day lead solar production cycle. Adding to the complexity, the impacts of oversupply and ramping varies season to season, day to day, and location to location.

The blue arrows I have placed are on a hot summer day to show how load may be shifted

from night into day and from evening into afternoon to better align appliance load with low-carbon emissions from the electrical grid. Demand flexible technologies are key to reducing emissions from the homes and businesses.

Senate Bill 49 provides three options to change an appliances load, schedule, shift, or curtail. A standard could require appliances to have the capability to delay their energy use through a timer, to move load from evening into morning, say. A standard could require the appliances to have the ability to run ahead of time when renewables are plentiful and load is low. Or the standard may temporarily request an appliance turn down or curtail use during the time of extreme demand. Staff feel that a standard could embrace any combination of these approaches to meet our climate and energy goals.

Next slide.

What should Staff consider to understand how a proposal could contribute to achieving our climate goals? The calculation provides a list of the key factors Staff considers as they begin to identify proposals. The first factor is load size. How much power does the appliance draw

when it is on? How often does it run? Appliances that use more energy have the potential to shift more energy. Appliances with large load include HVAC, heating, ventilation and air conditioning, water heating, and car charging, the load near the emission peak.

Staff considered the load shape or how the use of the appliances varies by the time of day and by season. Appliances that are run more often during the peak emission times will lead to a larger potential to shift load. And example is a dishwasher where, on average, dishwashers seem to be on during the early to late evening when emissions are high and not on so much during the middle of the day when emissions are low.

The third item is load reduction of shift, meaning how does the proposal effect the energy usage to move it to times of lower emissions? A simple example of load reduction would be to temporarily shut off the appliance. In this case load reduction would be 100 percent. But in the spirit of flexibility, perhaps our proposal would delay the load by minutes or hours, or in ways that would not be perceptible to the customer. Understanding how much and how

often the proposed standard is key to the load shift potential.

The customer participation rate is another important consideration. Although it will be mandatory that the appliance be sold to meet the standard, the consumer will retain the control of the appliance. We will seek proposals that consider the consumer. What incentives does the consumer receive in turn for flexing their load? The more consumers that participate statewide the more potential to shift load.

The final item Staff has identified is the quantity of appliances statewide. The more appliances participating statewide the more potential they will be to -- there will be to shift load.

What other factors should Staff consider as they evaluate the load shift potential and the Flexible Demand Appliance Standards proposals? What sources of information should Staff consider?

Next slide.

What requirements will lead to flexible demand appliances that shift load to meet our climate goals? Will the standards be a minimum

list of features, like a checklist? We call this a design standard. An example of a design standard would be the recent Washington State Electric Water Heater Standard requiring a communication port. Design standards may be verified by inspection.

Or will the standard provide requirements that are based upon an appliance achieving a minimum level of performance? An example is an appliance that receives a command to cause it to shift its load in a certain way.

Performance requirements require test procedures to verify the appliance meets the standard. An example of this framework can be found in the proposed USEPA ENERGY STAR Residential Water Heater Specification. Our preference is performance standards that identify the key functions to enable appliances to provide flexible demand.

Next slide.

I will now turn our attention to the other side of SB 49, the win for the consumer. The CEC in setting standards must meet the criteria to put the consumer first. The standards will be cost effective, meaning the

benefits to the consumer will not exceed any costs. Staff will consider cyber security and reliability. The standards need to care and protect for the consumer without adding uncertainty to the operation of the device. Staff will consider how a standard may affect the ease of use to the consumer. The consumer will also maintain control of their appliances. And the appliance will need their consent for flexible demand operations.

Finally, labeling will be the tool Staff will examine to help guide consumers in their pursuing decisions. Labels will indicate compliance to the standards.

Next slide.

We will work with the California Public Utilities Commission, load-serving entities, such as the California Investor-Owned Utilities, public owned utilities, and California Independent System Operator to develop a consistent statewide foundation for the design of the Flexible Demand Appliance Standards. We recognize the strength in aligning the Flexible Demand Appliance Standards with existing incentive and equity programs.

Next slide.

Senate Bill 49 grants the CEC the authority to establish regulations to describe the process to promote compliance, protect consumers, and level the playing field for appliance manufacturers, distributors, and retailers. The authority by the statute is the same authority as the Appliance Efficiency Regulations. Staff seeks comments to establish enforcement regulations for the Flexible Demand Appliance Standards.

Next slide.

Where will the solutions come from? Staff seeks proposals information from the stakeholders and the public. These could be complete proposals, descriptions of problems, or information that could better inform our deliberative process. We are committed to working with stakeholders.

A key next step is to identify those appliances ready for standards.

To recap my presentation, what appliances would you identify for mandatory standards to be sold of offered for sale in California? What would these standards require? Would they be

design or performance standards? What change would the way the -- what change would lead to the way the appliance flexes its load? What benefits or costs would the standards create? And to highlight, we ask that you -- why do you recommend this approach? And the why can increase the persuasiveness of your idea.

We look forward to your comments today during our public comment period and via written comment period that will end on January 4th. Information on written comments will occur at the end of today and can be found in the workshop notice on the CEC website.

Next slide.

So that's the end of my presentation. And I'd like to welcome our panelists to the first panel for today.

First I have Abigail Daken from the U.S. Environmental Protection Agency and, for the past decade, has managed the ENERGY STAR's investigations for heating, cooling, and water heating products. Abigail will speak about ENERGY STAR connected appliances.

Second I have Jacob Cassady, the Director of Government Relations as the Association of

Home Appliance Manufacturers. Jacob will speak about AHAM's capabilities of appliances to flex demand.

Third I have Ashley Armstrong, a Director for Regulatory and Technology Policy at AO Smith Corporation. Ashley will speak about appliances that can be used as a form of energy storage.

All panelists will provide a ten-minute presentation, followed by a short opportunity to ask clarifying questions from stakeholders. At the conclusion of all three panels, we'll have a 30-minute discussion, including questions from stakeholders, those that are attending today.

So with that, I will welcome Abigail.

MS. DAKEN: Thank you. So I appreciate being asked here to talk about the work that we've done at EPA on connected products.

Next slide.

So connected, for us, includes grid flexibility and, also, consumer amenities that come from connected. And one of the questions is: Why is this part of ENERGY STAR at all? And there are two reasons.

That bottom arrow has been amply covered by the -- plenty of speakers today. So I'll also

mention that ENERGY STAR is, fundamentally, a consumer information program. And so the developments in the consumer space are also very important to us and very relevant to this as the internet of things has -- and smart technology have grown, it presents both opportunities and potential problems in terms of energy efficiency. The opportunity is for insight into and control of energy use. And then, of course, it also means that, as we've been seeing for many years, baseload grows.

Next slide.

So ENERGY STAR has been involved in this for years. I'm not going to go through this in detail but I do want to mention that in 2018 we took a step back and we restrategized, we reviewed our strategy for internet of things products, smart products, and grid strategy overall. And a lot of the information that I'm -- the overview information I'll be presenting to you comes from that. This is a workstream that we've been very busy with in the last two years and we expect to be moving for.

Next slide.

So this is a quick rundown of the product

categories for which we have connected criteria and I'll just point out a couple of things here.

The first is that there are two products for which it is not optionably -- option to be connected, where we only recognize the connected version of these products. The first is thermostats. And the second is smart home energy management systems. And for both of those, these are control technologies. And savings come from an intricate interplay between the technical -- the product features and consumer behaviors. And we felt there was no way real way to get an insight into energy savings without having data about how the products are used in people's homes. And so for those two product categories, we only recognize connected versions.

For the rest of these product categories the connected criteria are optional, which means that a product which meets all of the other ENERGY STAR criteria, in addition to using the ENERGY STAR certification mark, may also be recognized on our list of certified products as connected.

Some of these -- why don't you go to the next slide, because I'll be talking about it more

there?

So there's a bunch of this work going on right now and in the near future, which I was asked to highlight. So we have been working on connected criteria for what we're calling large loads. These are four products which represent a significant grid resource which EPA has ENERGY STAR criteria for. Those are central AC and air source heat pumps, pool pumps, residential water heaters, and electric vehicle charging equipment. So for all of -- actually, all four of those are now in the process of having connected criteria added or revised for those products.

For central air conditioning and heat pump, we are approaching the finalizing of Version 6 which will include optional connected criteria, and we expect to finalize that in the next month.

For residential water heaters, Version 4 includes optional connected criteria and a demand response shift test to demonstrate load shifting, and that should finalize in the first quarter of 2021, along with its test method.

Electric vehicle chargers, Version 1.1 includes an updated connected criteria, also

optional. And the idea there is it was updated specifically to become more useful as a tool for utilities to identify chargers that give them the tools they need to control vehicle charging.

The pool pumps, Version 3.1, with fairly modest updates to the connected criteria, actually was released last week.

In addition, we're working on a way to ease the test burden for demand responsiveness for room air conditioners. And smart thermostats will also launch a revision in 2021.

Next slide.

So this is probably the most useful piece for this particular purpose. When we, in 2018, rethought how we were approaching connected what we realized is that for some ENERGY STAR products connected looks different than for others. It's always been a combination of user amenity and grid services. But what kind of combination depends on the type of product. And in this table what we have essentially divided by is what is driving connectivity into the market?

So for some products, lightbulbs are a great example, consumers want connected product. In fact, we got our 14-year-old a color-changing

LED lightbulb for the fixture in her room for her birthday. This is fun. That's why people want it. It doesn't really provide on its own much that's interesting for demand response. So for those products, in addition to controlling standby loss, the ENERGY STAR approach is to look at the integration of them into a smart home as a whole that can, in aggregate, potentially provide a demand response resource.

Some of those products, in addition to being, perhaps, useful in an aggregated way may provide occupancy information, which is interesting for energy savings. I'm starting at the bottom of the table, of course.

We actually started with our connected criteria in that center line with appliances. And there's a broad jungle of advantages that connectivity can provide. Manufacturers like selling it. Consumers have some interest in it but not like for the color-changing lightbulbs. For some products (indiscernible) is a great example. Electric dryers are another example. There may be some grid service, some sufficiently ripe opportunities that it's worth trying to address the product itself rather than as part of

the complete connected home.

Then we have the large load products. And for these products, for a couple of them, user service may be somewhat affected by load shifting, so that's true for electric vehicle chargers, that's true for room air conditioners, as has been discussed before. But they still have a significant potential, either because of peak coincidence or because, you know, electric vehicles are an energy storage technology. And in these cases we think that connected, while it may be pulled into those products by consumer demand to some extent, it should not be without an element of grid service.

And then for pool pumps and water heaters, these are products for which not only do they provide a significant resource but, in addition to that, users are very unlikely to notice any load shifting. So for these products the primary driver is the interest of organizations, like the CEC, the CPUC, and across the country, jurisdictions and utilities that are interested in controlling costs, particularly as we electrify for a lower-carbon world. So for these products the criteria focused on grid

service.

Next slide.

So as we are considering our considering our approach we're looking for -- we're looking at a bunch of considerations. We prefer -- we are looking for interoperability, both for consumers and for creating value in the market broadly, that favors both common standards and finding how those standards are implemented. We'd like to future-proof as much as possible. It's not really possible but we can help. We see to lower the transaction costs for implementing load flexibility has been amply heard earlier in the keynote speakers.

And then we look at what is driving connectivity. So can the demand response capabilities use a connectivity path that is already there for some other reason? Now that may or may not be the best way to do it. But ,if it can, there may be a cost advantage to implementing that way.

So one example that's already been brought up there is smart thermostats. People are purchasing smart thermostats because they want them but, obviously, they present quite a

significant resource using the same path that is giving consumers what they want and give utilities what they want also.

And then the next question, of course, is: How valuable is the DR resource? Is it worth investing a little bit more to get this product connected?

All right. Next slide.

So I'm just going to close by talking about a couple of the things we're doing now. And I see I'm over time.

So for room air conditioners, we have a demand response test. But one of the things it tests is how often the product responds in a 24-hour period, which makes it a long and fairly expensive test.

So we've just introduced, as a proposal structure, to let those products rely on test results from one product model to speak to whether another product model will be able to test. And manufacturers felt strongly that they would be able to use -- that test results from one model were applicable to another. This is a structure we use for energy efficiency, as well, for a wide variety of products, so -- and is

similar to the Department of Energy's alternative energy determination method. And so there are reasons why this is particularly relevant to room air conditioners. But we may, also, use a similar approach for other product cats.

And next slide.

So for water heaters and central AC heat pumps, we are coordinating with the criteria in other places, for instances, for central AC and heat pumps the AHRI came up with a technical standard for demand response for two-stage and variable capacity products, so we're referring to that. For water heaters, we closely followed the Joint Appendix 13 criteria and other similar standards.

We've specified two specific protocols and included tables of how the various messaging is implemented using those protocols for maximum interoperability.

I will mention that price response in these -- all of these criteria is optional. And the reason is because the way programs are being run now relies more on the signals, load up now, curtail now, and less on price response. But we do define, if price response is there, how it

would be -- how it's implemented in the messaging.

And I think I'll stop there. I have more to say but I'm out of time.

MR. STEFFENSEN: Hi. This is Sean Steffensen again. I'll pause right now and look to Bruce for -- to see if any participants have asked any clarifying questions or have their hands raised?

MR. HELFT: None at this time, Sean. Thank you.

MR. STEFFENSEN: Okay. Okay. Next up is Jacob Cassady from the Association of Home Appliance Manufacturers.

Jacob?

MR. CASSADY: All right. Let's just skip to the next slide. You know, hello and thank you for the opportunity to participate in today's workshop. Again, my name is Jacob Cassady. I'm the Director of Government Relations at the Association for Home Appliance Manufacturers.

To get things started, I really wanted to provide folks a roadmap for kind of where we're going and what we're going to talk about today. So I'll tell you some information on AHAM. We'll

talk about the partnerships that industry has had with energy efficiency organizations. And then we'll really talk about the connected home and considerations that go into which appliances and how they should be, how demand response should work.

So we'll go to the next slide.

So quickly about AHAM, AHAM's roots stretch back to 1915 when manufacturers of clothes washers formed the American Washing Association. Fifty-two years later, in 1967, they determined that a single unified organization would be stronger. So today, AHAM represents manufacturers of major portable and floor care home appliances, as well as their suppliers. Membership at AHAM includes over 150 companies throughout the world. And in the U.S., AHAM members support more than 1 million jobs, have a $198 billion economic impact, and produce more than 95 percent of household appliances shipped for sale.

The home appliance industry, through its products and innovation, is essential to U.S. consumer lifestyle, health, safety, and convenience. And through its technology,

employees, and productivity the industry contributes significantly to U.S. jobs and economic security.

Home appliance are also a success story in terms of energy efficiency and environmental protection. New appliances often represent the most effective choice for a consumer to make to reduce home energy use and cost.

Next slide please.

So I want to highlight the energy efficient and smart appliances management of 2010. This is an agreement that included a petition to the USEPA, Environmental Protection Agency, and the Department of Energy for a five percent ENERGY STAR credit for connected appliances, which was approved. The cover letter of that petition is on the right side of your screen.

So next slide please.

So the home appliance industry remains committed to demand response capable appliances and welcomes continued collaboration and partnership with CEC and others to achieve a greater deployment of these appliances. Stakeholder engagement is vital to that goal. A

consumer who sets a delay or a timer on the appliance does so without knowing if or when energy costs will be lowest. Consumers are in the dark as to if the delay of the timer leaves the appliance operating with lower energy costs. And utility companies play a major role with demand response and the consumer's application of the technology.

For that demand response market to grow, consumer use of it should be incentivized or otherwise promoted by all stakeholders of this value chain. Ultimately, all stakeholders hold the key to successful implementation of demand response technologies.

So we'll move to the next slide and we'll talk about the connected home. One more over please.

The connected home is consumer-focused. User experience is the key. A product's functions must actually be functional. If a demand response capable appliance does not operate efficiently consumers will ignore or bypass it. Connecting the technologies should also be simple, and that goes beyond the consumer to appliance, but the appliance to the

electricity source.

Innovative solutions should be ongoing and not restricted. Software updates improve functionality. They fix glitches and take little effort to install.

Next slide please.

The connected home is secure. A Cloud-based interconnection enabled through Wi-Fi is the safest and most secure solution for manufacturers, utilities, and most importantly for our shared consumers. Protecting consumers, their data and information, and their homes from potential hackers is of utmost importance. This empowers consumers to decide how much security they want to build into their home's network where multiple layers of security exist. And these multiple layers of security produce the likelihood of a single hacker or hack. These layers of security include the appliance itself which has a secure app to control the connected appliance, the Cloud which has security. Utilities would, we expect, offer an additional layer of security between their utility network in the Cloud. The utility would securely interconnect the appliance. And this, again,

helps to ensure that one hack or security breach does not expose all stakeholders.

Next slide please.

Harmonization of a variety of options make the connected home possible. Flexible demand meters and consumer needs are not one-size-fits-all. And regulations are mandates for specific technologies over others should reflect this through enabling utilities to incentivize and promote demand response appliances that already exist on the market today and have the ability to easily connect consumers with utility companies.

We understand how, for some products, the CTA-2045 port is a workable solution. However, this would not work for the appliances AHAM represents. Mandating a specific port technology risks consumers removing the module that's plugged into the port and difficult to install on appliances where aesthetics are important, so locations can be problematic. And that's sort of an example, a couple examples there, of fitting it in behind a refrigerator or a stove.

Also, mandating a port, a physical port, would take years to fully implement for

manufacturers and consumers as they go to replace their appliances.

Next slide please.

Ultimately, we all want the connected home to be cost efficient. And cost efficiency is a key driver of this as it leads to savings from the use of demand and the use of demand response should reflect this. A mandatory CTA-2045 port would require significant product changes, as I've mentioned, which would increase manufacturing costs and would impact consumers. Lower-income people would feel this the hardest. And for many consumers it would increase the likelihood to repair older, less efficient products that are not connected.

Existing products and infrastructure provide cost efficiency and allow manufacturers to innovate. And a key thing to think about here is, you know, these products are made for a nationwide national market, if not, to some degree, international. And we want these products to be used throughout the country and have the utilities work with the local utilities to establish the demand response.

Next slide please. I'll quickly

conclude.

So there is currently market alignment on a Wi-Fi and Cloud-based solution for appliances. Again, the CTA-2045 port may work for some but would stifle appliance innovations and a step back for cyber security. Also, the appliance industry supports CEC's promotion of demand response capable appliances but think that CEC should support adoption of a broad API standards that allow for manufacturers in appliance innovations and ensure security can be prioritized for the consumer. The best path to encourage this growth is not through regulation and mandating these specific demand response communication technologies.

And that is -- thank you. Thank you for the opportunity.

MR. STEFFENSEN: Thank you, Jacob. We'll pause now to ask Bruce if there were any clarifying questions from --

MR. HELFT: We've got a hand raised, Sean. I'm going to un-mute Tristan.

Please, Tristan, when I un-mute you, state your affiliation.

MR. DE FRONDEVILLE: Hello. This is

Tristan de Frondeville. I'm with SkyCentrics, so representing the CTA-2045 side of things.

So, Jacob, a question for you. You mentioned -- it's true that on a refrigerator or a stove, certainly on the front of the device, we wouldn't want to put a CTA-2045 module, so that's a reasonable point. However, you're making a strong case for Wi-Fi and Cloud.

So are you aware that there was an investor-owned utility that controls 800,000 water heaters? And they tried to shift to Wi-Fi control for 70,000 and ten percent of those water heaters were going offline every month, so that's 7,000 a month. And remember, it's critical, when we have these appliance loads -- you know, all these pilots have been small. But when you're talking a million of 13 million water heaters that are critical to preventing gas peaker plants from coming on it's critical to have a bomb-proof connection that's reliable over many months, if not years, especially after the investment which would be somewhat equivalent to a peaker power plant.

So I'm just concerned that you have such a strong resistance and promotion of Wi-Fi. And

then similar on the cyber security side.

So my question was: Were you aware of, you know, water heaters, it's not that sexy for them to be kept online because there's not much real sex appeal to controlling your water heater. You get it at the right temperature and you don't think about it for 10 to 15 years.

So I guess, Jacob, to summarize, would you be open to being equally promoting of CTA-2045 and Wi-Fi, given that sometimes CTA-2045 is actually much better than Wi-Fi?

MR. CASSADY: Well, first, thank you for the question. And let me clarify that the key takeaway that I would hope that anyone would get is that it's not a one-side-fits-all solution. I know the next speaker is going to speak to water heaters, so I will just leave that product there.

But the key is, is what might work for some does not, necessarily, work for all. And if we want consumers to use it we should have a marketplace of ideas and technologies.

MR. STEFFENSEN: Great. Thank you, Jacob. And I think that is an important point. We are searching for what may drive a lot of these initial requirements. What's the function

behind a particular requirement or embodiment?

So I think, Tristan, as you mentioned, it's vital that the connection remain reliable. And so we're looking for stakeholders to provide those types of solutions and the reasons why certain iterations or interpretations may be better than others. We'll drop more of that into the discussion after Ashley Armstrong is up.

And so I'll turn our attention now to Ashley Armstrong and introduce here. She is up next from AO Smith Corporation.

MS. ARMSTRONG: There we go. Can everyone hear me? I assume that's a yes.

So with that, good morning everyone. My name is Ashley Armstrong and I'm the Director of Regulatory and Technology Policy for AO Smith Corporation. AO Smith is one of the world's leading manufacturers of residential and commercial water heating and hydronic heating equipment, as well as a manufacturer of water treatment and air purification products.

I'd like to thank the Energy Commission for organizing this proceeding as I'm excited to be here today to talk about flexible demand appliances, especially water heaters.

Can you guys go to the next slide please? Thank you.

So buildings are the nation's primary users of electricity. About 74 percent of all U.S. electricity is consumed within buildings. As such, building owners and operators are seeking various ways, both to reduce their utility bills but also take advantage of times when pricing is low and/or renewable generation is abundant.

Smart water heaters can be one way -- can be a grid flexibility asset for building owners to utilize. Smart water heaters are conventional electric or heat pump water heaters that have additional controls. Smart water heaters simply allow the utility or the third-party aggregator to control their energy use during the course of the day. Within a given local territory a fleet of water heaters can be controlled to be a flexible energy storage system that can adjust the load on the grid.

So a lot of people ask, why water heaters? Well, the simplest answer is everyone has one. Smart water heaters can play a key role in load management within the built environments.

Most consumers and commercial customers install their water heaters and they really never turn back unless an issue arises. Even with the implementation of load management functionality within the water heater, it is very unlikely that a consumer would notice their water heater programming is being altered as long as their cold water events are minimized.

Smart water heaters can be programed to adjust the times when they are using power. For example, a water heater can reheat to recover from usage during off-peak times. And smart water heaters must have a balanced load.

So can you go to the next slide?

So this slide is simply showing a couple different ways to connect the water heater at the point of the water heater. So one of the things on there is a CTA-2045 port, which we've kind of heard about already. As mentioned, it's now required by the State of Washington and will be required by the State of Oregon in the coming years. You can also see our water heaters offer open ADR via Wi-Fi. And as of late, our latest generation offers time-of-use pricing, so it can download a local pricing schedule and then

execute that TOU schedule when no connectivity is reqd.

Next slide please.

So one of the things we've heard a lot about is the CTA-2045 Standard. It's a basic standard that governs energy management for various appliances. Currently, AO Smith participates in the development of this standard. And we've implemented the CTA-2045 ports on our DR water heaters. The CTA-2045 port, as I mentioned, is now required in Washington. It will be required, coming the first of the year, for heat pump water heaters and a year later for electric storage water heaters in residences.

The CTA-2045 Standard incorporates basic commands like DR commands, such as shedding, loading up, grid emergency signals. And it -- also, the CTA-2045 Standard is in the process of being revised and in its final stages of adoption to incorporate a way to address time-of-use pricing.

Next standard -- next slide please.

So one of the things we participated in a while back was a large water heater demonstration project with the Bonneville Power Administration.

And I mention this because the BPA really had two primary objectives. One was to DR events, so install a fleet of water heaters with CTA-2045 capabilities. These were electric water heaters and heat pumps. Then they were going to run a set of demand response events throughout the winter and summer season and see what the results looked like. And they really wanted to take this demonstration product and then try to create a market transformation plan and a business case to be able to justify the cost.

So I'm not going to go into detail of the results but I do have the reference demonstration project on the slide in case anybody would like more information.

So I want to go to the next slide.

And I think this is going to be one of the key ones and the key issues for the AO Smith and, perhaps, the broader water heating industry, which is we have a lot of movement in this space. And there's a real need for harmonization. So we're seeing states adopt demand response requirements for water heaters. I've already mentioned Washington and Oregon. We also have an alternative compliance measure which is called

JA13 for the State of California for new construction. We're seeing ENERGY STAR, as Abby mentioned, enter into this space with their development of the voluntary connector criteria. We have NEEA, the advanced water heating specification, which requires for a Tier 3 and above a CTA-2045 port for listing.

And the one thing I want to mention is AHRI has kicked off kind of a new development effort. And this is Standard AHRI 1430. And this is going to be a demand response standard for electric and heat pump water heaters. And it's in development.

One of the reasons it was really kicked off is because there's so many different moving pieces. And manufacturers really want to come out with a national SKU or a national product offering. And so harmonization is key across all the different programs and the state and regulatory policies.

So that's one of the goals of AHRI 1430, which has a large amount of stakeholders, a broad base, including the CEC, in its development. And it's looking at all the different programs in an effort to come up with a one-stop shop for a

standardized DR electric and heat pump water heater standard.

Next slide please.

So this is our new heat pump water heater with smart connectively. It has Wi-Fi and Bluetooth, as well as it's California JA13 compliant, so that just means it can easily load up time-of-use rates.

Next slide please.

So this is one of the things that shows how to connect the water through the local Wi-Fi, or you can connect directly to Bluetooth on your phone, or a tablet. So, basically, you can set your set point, you can do notifications that you can get on your phone or through your app on your tablet.

Next slide please.

So this is kind of what the interface looks like to choose your TOU rates. You can search by your utility, name, or zip code. And then we would download the schedules and accept them. From there, we have software in the water heater that will be able to execute the TOU schedules for your specific zip code and your utility territory from there when your water

heater is not connected.

Next slide.

And then for the other one, we can use the CTA-2045 port route, connected to a third-party module, to execute DR commands, or we can do it through open ADR Wi-Fi.

Next slide.

So we've kind of already heard today what's needed with regards to some of the load management. But for water heaters specifically, we need to move beyond these pilots to large, sustained, scaled deployments. This will help us get scale.

For water heaters specifically, AO Smith hopes that California will stick to uniform national standards, especially for residential water heaters. CTA-2045 would be preferred, mainly because we're already in that route with regards to Washington and Oregon, and we don't want to have a California-specific product.

We want to avoid custom one-off DR integrations. They can add cost and burden.

And then, somehow, we have to find out, how to we make it worth the customer's effort to participate in a program? It needs properly

structured incentives and rate tiers, which we heard a lot about at opening keynote speakers.

And then, obviously, customers have to be happy, so we need to minimize the hot water events and show that the savings really can be realized from these programs.

Next slide.

So with that, I just thank everyone for taking the time to listen. And thanks to the CEC Staff for having me speak today.

MR. STEFFENSEN: Thank you, Ashley.

We'll turn now and ask if Commissioner McAllister, if he had any comments or questions for the panel? Then after the panel, we'll ask a couple questions including those from the stakeholders.

COMMISSIONER MCALLISTER: Thank you, Sean.

And I want to thank Abigail and Jacob and Ashley for presenting really good stuff. And it's great to have this partnership, really, between federal industry and Commission. So it shows that there's a real can-do kind of attitude. And there's just a lot of volunteerism to here to make this work.

We all know that aggregating load flexibility in water heating but, really, in many device categories across the Board is going to help us solve multiple potential problems and really provide benefit to consumers, and to the grid, and to the environment.

So it's really heartening to see the stuff that's happening at EPA. And I really want to just put that at top level of partnership going forward because I think being able to have a broad platform for standardization and discussion and just terminology really helps tremendous. When California tries to do something, and then other states are doing it, it really helps to have the lexicon be something that we don't have to argue about but that, actually, we can leverage, so really appreciate that.

And certainly want to acknowledge the industry groups, AHAM and AO Smith and others, that we all know this coming. And they're developing a lot of innovative technologies to figure out how to do it best at least cost and with highest benefit.

So I don't have -- I don't want to -- I

know there a lot of people on the call here and I want to give people in attendance, many of them very knowledge, an opportunity to ask questions and poke and prod a little bit, because that's really the lifeblood of our process here, whether it's today or whether it's with written comments following up, interactions with Staff. You know, certainly, all of our doors are open for this conversation and we want to get it right, create a real robust platform for scaling.

And several people said, we have technology, we've got a lot of experience. Pilots aren't going to do it. We really need to scale. And I absolutely want to endorse that idea.

And that's what SB 49 is all about. And I want to just thank Senator Skinner, actually, for her foresight. Working with her on this has been great because I know she gets it. And the time has come for this effort, so really glad we're getting on it here.

So thanks everyone for being here. And I'll pass it back to Sean and, hopefully, we do have some public comment.

MR. STEFFENSEN: Great. Thank you,

Commissioner.

Now we'll turn to the panel. We'll, for the next half hour, provide an opportunity for stakeholders to ask questions of the panel and provide each panelist, if they wish, about one minute to respond. We ask the questions are short.

And just to lay out, then after this current panel discussion there will be an opportunity for more general public comment for those that want to provide statements of what is on their mind to this proceeding.

So to start out with, maybe I'll get the conversation going. I think of central interest to me, as someone who may likely be the one to write the regulation for an appliance's -- which appliance has the most potential to positively impact the climate and benefit consumers in California? And with that appliance, what should that appliance do?

And, you know, this may be an opportunity for some of the panelists to recap their presentations, but let's really kind of pull that to the front and center. What appliances should the CEC look at and what should the standard --

what sort of capabilities should that appliance have?

I'll look to Abigail first.

MS. DAKEN: So nationally, I would probably hold up water heaters as the highest potential. But because California has such a high penetration of gas water heaters, I might look to electric vehicle chargers. That's new infrastructure that's rolling out, and that's substantial new load on the grid. And it's, also, load that, when it's on, it's on pretty hard so, you know, it's a high draw at the time that it's on. So I might look there first.

As to what should be in it, I hope that the criteria that we're proposed with Version 1.1 of ENERGY STAR is helpful. It includes specific commands, such as delay charging, charge now, curtail charge, and all of these can be used to do a signal-based process. There's also price response defined but not required as for other large loads.

And then, you know, it's interesting, connected thermostats have the potential to address, really, for incumbent fixed-capacity and dual-capacity equipment. They exercise, pretty

much, all the capability for demand response that's available from that equipment, and so you don't need a connected central AC or heat pump for that.

MR. STEFFENSEN: Thank you.

Jacob, would you like to comment on the question?

MR. CASSADY: Yeah. I think we can just, maybe, provide a couple appliances that, during their runtimes, they could be -- that intermittent load could be, you know, curtailed, like heat for a dryer for five to ten minutes. Or, say, the refrigerators defrost mode, you know, someone could schedule that to happen when it's least expensive, and overnight, for example.

MR. STEFFENSEN: Okay. Okay. Great.

Ashley?

MS. ARMSTRONG: Yeah. I think everyone can guess my answer. I mean, certainly we think water heaters have a role to play in demand response and TOU-type scheduling, especially residential water heaters.

There's probably some additional work that's investigative-type research work that needs to be done in the commercial space,

although there's probably certain appliances that also could play a key role.

As far as what requirements might look like, I mean, harmonizing with those that are out there is going to be important as manufacturers have already invested in complying with those regulations, whether that be those for Washington and Oregon, those coming forward in a voluntary space with regards to the ENERGY STAR Program, and those commands that are already part of the CTA-2045 feature, as well as the alternative compliance pathway in JA13.

So I would urge CEC to look at those first. And to the extent they're not already addressed by the existing regulations, we would welcome a further conversation.

MR. STEFFENSEN: Great.

MS. ARMSTRONG: Thank you.

MR. STEFFENSEN: Thank you.

So I'll turn to Bruce and see what hands may be raised or questions that may have come in through the Q&A section?

MR. HELFT: A couple of questions that have been written.

John Bade, B-A-D-E, writes, for Ashley,

"I have been told that at least some hot water heater manufacturers are concerned about requiring the capability to heat water to higher temperatures, for example, over 140 degrees Fahrenheit, due to safety concerns, even a tempering device is already required. What is AO Smith's view on this?"

And then there are two other written questions at the moment as well.

MS. ARMSTRONG: Okay. Thanks Bruce.

So I would say, I mean, one of the functionalities that is required by CEC's JA13 is an advanced load up functionality with requires that the water heater, once the customer has opted into the program, go above the consumer set point to, for lack of a better term, further heat the tank. We would, in that case, strongly recommend that a mixing valve must be installed, and that's reflected in the language, that's in JA13. And then it needs to be installed in accordance with the manufacturers instructions. Safety is, obviously, of the utmost importance when we're working through this.

MR. HELFT: And another question. Christopher Danforth asks,

"In assessing the cost effectiveness of various demand response technologies, what is the cost per kilowatt hour per year being assumed for batteries or batteries/storage? At the CPUC, in the PG&E GRC, various parties," and he puts in parens, "(PG&E, TURN, Cal Advocates (phonetic) in turn) have presented estimates below $200 kilowatt hour per year for lithium ion batteries which is lower cost than the six gigawatts of potential presented by the speaker from LBNL, Mary Piette.

"Also, is the assumption being made that if these demand response technologies are built into appliances through Title 24 the cost will come way down relative to the costs presented by the speaker from LBNL?

"I ask all these questions because Severin Bornstein stated that these technologies are cheaper than batteries."

MR. STEFFENSEN: Yeah. I would -- some of these might -- these questions may -- I mean, I'll let the panelists respond, you know, but some of these may have been directed at some of the previous speakers.

So I guess I would call upon Abigail first.

MS. DAKEN: I'll pass.

MR. STEFFENSEN: Okay. And Jacob?

MR. CASSADY: The same. Yeah.

MR. STEFFENSEN: Okay.

MR. CASSADY: I think they were for -- I'd seen the dialogue exchange before. I think that --

MR. STEFFENSEN: Okay.

MR. CASSADY: -- yeah. Thank you.

MR. STEFFENSEN: Yeah. I mean, we encourage these kinds of questions, just some of these may be somewhat -- I'm sorry, I didn't mean to skip Ashley.

Do you want to respond?

MS. ARMSTRONG: Skip on. You did great.

MR. STEFFENSEN: Okay. Yeah. We do appreciate these comments, and we will take a look at them, but it may be difficult for some of the panelists to respond.

And I think just one -- another question that I have is the concept of interoperability. That's central to the statutes as the Legislature provided them to the Energy Commission.

Interoperability means, to me, that I, as the consumer, could use the appliance to participate in flexible demand in the way in which I would prefer to use. And I've seen various business models out there, whether it's a utility rates program, signals being provided, clouds from manufacturers or others, third-party aggregators. And the consumer may have a preference as to which program they may choose to participate in.

I guess in some of the existing models out there, I'm just wondering, this concept of interoperability, I mean, do I have that concept correct? I mean, please comment on what you think interoperability means but, as well as like what are the requirements that will bring about interoperability to foster consumer choice?

I'll call on Abigail first.

MS. DAKEN: You want me to do this in one minimum?

MR. STEFFENSEN: Yeah. I mean, that's kind of -- I know. It's hard for me to even ask the question in a minute.

MS. DAKEN: So I'll start by saying, that's an interesting definition of interoperability and just a piece of what we

think about. We think about, from the utility perspective, that devices from different manufacturers or different models of devices should be able to provide predictable responses when called upon with the same commands by the same D-R-M-S or DRMS.

We also, from the consumer point of view, and this is more relevant to the smaller loads, look at interoperability from the perspective of a consumer who has a beautiful, beautiful General Electric refrigerator and what's that to be part of the same home, smart home, for instance, as their Lennox air conditioner. Can those two easily be integrated into a single smart home? And I will say, we are not there yet.

From EPA's point of view, we've concentrated for interoperability. There's a two-pronged approach. One is for the large loads to, obviously, provide technical criteria that provide for interoperability between models, and to the extent that it's practical, also, between product types, by choosing the same protocols for a variety of product types for the large loads, which we expect to be addressed on a device-by-device basis, whether that's by an aggregator or

a utility directly or whatever.

For the smaller loads we are more concentrating on providing pressure for them to be integrated easily into a smart home and which would -- can provide some energy management. And I didn't talk about that but that's through out Smart Home Energy Management System Specification, as well as the connected specifications for each of the smaller load devices.

MR. STEFFENSEN: Thank you.

Jacob, topic of interoperability?

MR. CASSADY: I think it comes back to the focus on the consumer and making sure that these things work and that they can talk to each other. And so I think that that's a real key to this, the interoperability.

MR. STEFFENSEN: Ashley?

MS. ARMSTRONG: Well, last but not least.

So I would say, I think, there's two parts to this, one is hardware and one is software. I want to make sure that water heaters that I ship tomorrow with whatever hardware is on them that's required or supporting DR programs isn't obsoleted in a year or two, so I want to

make sure of that. And that's one of the main advantages of the CTA-2045 standardized port. So I want to make sure that that issue is addressed.

But, also, I think there's a software point, which we're heard from Abby and Jacob and yourself, which is to make sure everyone's speaking the same language, that the water heaters, in this case, water heaters respond or the appliances respond and in the manner that we expect them to, but also that we understand the signal in the same way, that when the appliance gets it, that it understands what it's being asked to do and then can execute accordingly. So standardized commands, et cetera, and making sure that as iterations of standards or regulatory requirements or voluntary standards move forward that it's not leaving a fleet of stranded assets behind it.

MR. STEFFENSEN: Great. Thank you for the responses. Yeah, I think interoperability is, I think, one of the key items that we need to examine as we come up with concepts.

Are there questions coming in, Bruce, from the chat, or are hands raised that, if possible --

MR. HELFT: No hands but here are two. They're directed to Abigail from David Springer. The first one -- I'm going to read two of them, one from David Springer, the other from Pierre Delforge, for Abigail.

"Opportunities for load shifting using house pre-cooling, and even residential thermal energy storage, have been demonstrated. Is there any work going on to enable these strategies and smart thermostats or other controls?"

And then Pierre asks,

"Thank you for your work on connected heat pump water heaters. One of the main challenges for more rapid market adoption of heat pump water heater and connected heat pump water heater is competition from gas water heaters which have much lower efficiency requirements in ENERGY STAR and utility programs that leverage ENERGY STAR sub-1 UEF for gas competing with greater than two and proposed 3.3 UEF for electric. Accelerating adoption of heat pump water heater and connected heat pump water heater requires a level playing field.

"Question: Can ENERGY STAR require heat pump technology in gas water heaters and pause ENERGY STAR for gas water heaters until there are heat pump versions for gas water heaters?"

And if that's not clear, I could un-mute Pierre and he could ask it directly.

MS. DAKEN: It's clear.

MR. HELFT: Okay. And remember David's question.

MS. DAKEN: Yes. So I'm going to address Pierre's question first.

Now is the time to give us that feedback, Pierre, so I hope that that was included in comments to the Version 4 Draft 1 Specification. And I think it probably makes more sense to answer that question within the context of that specification and we'll be happy to talk about it.

To the first question, yes, we are. So for connected thermostats, we were in this, when we established that specification in 2016, we were in this very interesting spot where there were already a variety of business models it the smart thermostat space, including vendors how act

as demand response aggregators. And so rather than doing a very specific set of criteria for connected thermostats, we simply required that they provide demand response.

And we will be -- I have not done a careful examination of the connected thermostat market to see whether there's anything better that we could be doing with it. But that will, naturally, be part of the Version 2 Specific revision which will launch in 2021. So anybody with information about that, I'd love to talk to you, maybe the second quarter of 2021 would be a better time for that conversation. There's a lot I'm trying to finish in the first quarter. But ping me and we'll set something up.

For central AC and air source heat pumps, specifically, there are criteria. And this was following AHRI's ground-blazing work for AHRI 1380. There are criteria specifically referencing the ability of a product to pre-cool. So the three types -- or four types of DR requests that are included in that specification include load up, return to normal, general curtailment, and a deep curtailment. So for those products, obviously, those signals could be

used for that.

And then lastly, any product that chooses to implement the optional price response, obviously, the algorithms that the vendor puts in place to respond to whatever those prices are, that's an excellent time, at least for scheduled price changes, to address it.

I will say that we don't currently have anything that looks like the JA13 static time-of-use rate, except in the Smart Home Energy Management System Specification, and so that's one thing we do not have. But mostly, I think, it's pretty thoroughly addressed in our specifications.

I'll make one other comment. I'm sorry I'm taking so much time.

Our criteria mostly require that the product be able to respond. Only in specific cases do we -- we were cautious about putting criteria on exactly how it responded because that's exactly the way that manufacturers will be able to differentiate their products from each other for balancing consumer needs and grid needs.

MR. HELFT: Sean, here's one from Henry

Richardson of WattTime.

"Do the panelists see a substantial difference between event-based demand response and continuous load optimization? Do the current standards support continuous load management?"

MR. STEFFENSEN: Great. Well, I'll pass it along to the panelists. Abigail will walk through.

MS. DAKEN: Actually, can Ashley start with this one because --

MR. STEFFENSEN: Okay. Okay. Sure.

Ashley, would you? Would you?

MS. ARMSTRONG: I'm not sure that we see a substantial difference between event-based DR and continuous load optimization. I think it might be too early to know yet for water heaters. The current standards do support it but I don't think we know a substantial difference among the two yet.

Back to Abigail. I went first.

MS. DAKEN: Yeah, I would agree with that, that the big discussion, really, is whether the load is being continuously managed by the device itself or its vendor or service provider

through a time-of-use type response, or whether the utility or an aggregator is managing it directly using signal-based DR, like load up and shed.

MS. ARMSTRONG: Yeah. And just to follow on, I think we're just seeing those types of water heaters come onto the market. And it's really going to depend in part of how closely those TOU schedules are going to match the DR events and how active those signals are going to be sent. So I still think we're in the early, early stages of this to do a comparison.

MR. STEFFENSEN: Great. Jacob, do you have a comment on this question?

MR. CASSADY: Nothing to add. Thank you.

MR. STEFFENSEN: Okay. I did see that there was a comment from Phillip Escobedo from Fluidra. And he is asking, "What pool pump types are being considered for requiring DR technology?"

So I'll just pass that to the panel. Although, something close to my heart is I had participated via the U.S. DOE efforts to set requirements for pool pumps for efficiency.

MS. DAKEN: So from my perspective at

EPA, first of all, ENERGY STAR is voluntary and the connected criteria are voluntary within that, so nothing is being required. However, we do have criteria defined for -- the criteria that are there are defined for both self-priming and non self-priming pumps. Any pump that's within the size class is covered by the ENERGY STAR specification, which is intended to cover most residential pool pumps, except for those that are integrated into the pool itself when it's sold.

MR. STEFFENSEN: And I'll ask the remaining panel, do you want to comment on pool pumps? No? Okay. And I guess the question was: Which types of pool pumps? I mean, we've heard from Mary Ann this morning. I think that the emphasis would be more on the filtering pool pumps as they tend to have a cycle that makes it perform daily. And there could also be opportunities for the -- there's a booster pump that's used to help run the robot. I mean, again, that could be scheduled to run it at various times.

So I mean, I think the CEC is looking for comments from stakeholders as to how pool pumps does -- do fit into solutions to beat this

climate goal.

Bruce, are there additional questions or hands raised?

MR. HELFT: One for Jacob from Tristan from SkyCentrics. What -- this is to Jacob.

"What happens when the Wi-Fi goes down versus a cellular CTA-2045 module or an AMI smart meter mesh module which are expected to be a lot more reliable as communication paths for grid-critical infrastructure?"

And then he comments after that question, "This is what a low-cost port offers, future-proofing and communication path flexibility, whereas with Wi-Fi and no port, we are stuck with Wi-Fi forever."

So he's asking for Jacob's comment on that.

MR. CASSADY: All right. There we go. No, I think he's answering his question. You know, the answer, as he sees it, is there. You know, this is just, the Wi-Fi enabled, it really provides the most consumer focused, it provides layers of security. We're using Zoom to teach our kids these days and having family events that way. We're using Wi-Fi. If it goes down a lot,

goes down and maybe your power is out so you can't run your appliance anyway, and we're all saving energy at that point, so --

MR. STEFFENSEN: I think one thing that we'll want to look to as the comments come in is to understand that the issue of future-proof that some of the panelists have presented, how do we identify requirements that speak to the functions that we hope the appliances segue as technology innovates, that the regulations keep up.

So I think an essential part of the comments that I'll be looking forward to seeing is how do we structure the regulation, the very short list of requirements, around requirements that really don't need to change as technology evolves because we've identified the essential function that the appliance needs to provide.

And now if the -- any of the panelists want to add on to that kind of thought, how do we future-proof regulations where technology is evolving, or for that case, business models?

We'll turn it to Abigail.

MS. DAKEN: I don't know that future-proofing is really possible. The main focus of future-proofing from EPA's point of view is to be

careful about balancing standardization against innovation. And as much as we can, without throwing out the baby with the bath water, encourage innovation and concentrate on performance, rather than have performances achieved.

Now, obviously, for our large load specifications, we have been much more prescriptive than usual around demand response. And I can imagine a future where we are able to be more flexible about that. But all of these products, once they're connected, including firmware updatability, so that's very helpful.

And I guess the other thing is take into account not just what the future of demand response is but what the future of connectivity in general is. What communications' pathways are going to be there, we think, for other purposes and might be usable for demand response? That's one way to think about allowing for what the future might hold.

MR. STEFFENSEN: Thank you.

Jacob, did you -- I think you had talked a bit about future-proofing but did you have anything to add?

MR. CASSADY: I think that balance is what we're hoping to achieve.

MR. STEFFENSEN: Ashley?

MS. ARMSTRONG: No. I think Abby pretty much summarized it. I will just say, you know, this is an evolving market quickly. It's still pretty nascent, so it's still kind of hard to fully future-proof but, certainly, we should try to do that as much as possible while balancing the idea of complicated performance standards that may be very costly or expensive to test with the over-prescriptive design requirements. Putting my old hat on, it's certainly going to be a challenge.

MR. STEFFENSEN: Great.

Bruce, are there additional questions?

MR. HELFT: We're good, Sean. The rest are comments. But, of course, stakeholders are welcome to submit comments after this to the docket or at our other time for submitting questions later on today.

MR. STEFFENSEN: Okay. Well, I think we're coming up, I guess, at the end of the half-hour discussion. I would like to thank our panelists for their time today.

I think next up we will turn our attention to an open comment period, public comment period, where we'll ask that stakeholders raise their hand or present comments in the Q&A. This will be a half-hour opportunity, the first of two today.

And so I'll again look to Bruce and Nich to lead this conversation. And so just -- so, yeah, we're about at noon today, so I was thinking we could just move into the public comment period.

So moving on to the next slide please, so the next slide, public comments.

This public hearing is being recorded by a Court Reporter and all statements today become part of the public record.

If you have any questions, you may type them into the question and answer function and they'll be forwarded to the moderator.

If you are on the phone, raise your hand to speak by pushing star nine and the host will give you the ability to speak. Then you can push star six to mute and un-mute.

So if you'd like to make a public comment at this point, please raise your hand or press

star nine on the phone. Comments may be limited to three minutes per person and one person per organization. Please state your name and affiliation when speaking. And we'll look to Bruce to identify the first participant that would like to make a public comment.

MR. HELFT: Yes. I'm going to give those that have not yet commented the chance to make those comments first. So I do see a hand up from someone who spoke before but I'm going to pass.

I'll come back to you, Tristan.

I'm going to read this one from Chris Granada for the panel.

"Some products with relatively low ability to shed or shift load, is it better to use simpler control approaches? For example, would it make sense for all freezer defrost cycles to be set to operate during daylight hours during solar production?"

MR. STEFFENSEN: Okay. Great. So are the panelists still with us?

MS. DAKEN: I am.

MR. STEFFENSEN: Okay.

MS. ARMSTRONG: Me too.

MR. STEFFENSEN: Okay. Well, great.

Well, let's start with Abigail and we'll address this question.

MS. DAKEN: So we started in 2011 or '12 with exactly that criteria for the first connected product criteria we were considering, which is refrigerators and freezers. And the problem we came across is that, speaking of future-proofing, it's difficult to predict whether that is going to be the right time.

I mean, in general, the answer to your question is, yes. I once heard a Commissioner -- I can't remember whom, which state, I'm sorry -- recommend the simplest possible method which is to us FM, or even AM radios to -- for the ISOs or RSOs to transmit price, real-time price data, and just have the product respond as it sees fit. But -- which would be admirably cheap except you have to put that processing in the product, which may not be as cheap as it sounds at first.

So I mean, yes, but you have to account for the fact that what the grid needs is very likely to change in the next five to ten years.

MR. STEFFENSEN: Jacob?

MR. CASSADY: Nothing more to add.

MR. STEFFENSEN: Okay.

MR. CASSADY: Thank you.

MR. STEFFENSEN: Ashley?

MS. ARMSTRONG: Nothing on fridges.

MR. STEFFENSEN: Okay. Well, thank you.

Bruce, do we want to -- again, we'll move on to the public comment.

MR. HELFT: There's a question --

MR. STEFFENSEN: Do we have --

MR. HELFT: -- a question. Well, it's directed for Jacob. Do you want to take that question now?

MR. STEFFENSEN: Okay. Okay. Sure.

MR. HELFT: "Does AHAM recommend an open standard in the Cloud or does AHAM suggest the utilities integrate with 150 different member-company Cloud system? If the latter? What performance and design testing standards are suggested to evaluate each of the 150 different member-company Cloud systems?"

This was a question from Dan Nephin, N-E-P-H-I-N, for the Court Reporter, from e-Radio.

MR. CASSADY: No, I get the question, I'm just trying to give it a little bit to kind of consider it. It's -- we're not talking about 150

different, or over, systems and apps or programs, so I just -- so there's no real -- there's no real answer to that. And I understand the direction the question is going, so I'll just leave it at that. I just -- it's not answerable. We're not there. You're talking about a whole, you know, the entire product industry. We're not talking that the entire industry would need to have this type of technology.

MR. HELFT: Okay. Thank you, Jacob.

A question coming in the phone from Laura Groh from AHRI.

Laura, I'm un-muting you.

MS. PETRILLO-GROH: All right. Hello. This is Laura Petrillo-Groh. Hello. This is Laura Petrillo-Groh with the Air Conditioning, Heating, and Refrigeration Institute. AHRI represents 332 air conditioning, heating, and refrigeration equipment manufacturers in North America, including the majority of the North American water heater, central air conditioner, and heat pump manufacturers, all of which have been discussed or, at least, mentioned today.

Thank you very much for holding this workshop. AHRI originally identified the need to

discuss our smart or connected products in 2011. The first work product outcome was, as Abigail Daken mentioned, a consensus standard targeting standardized responses and dual-capacity and variable-capacity residential and light commercial air conditioners and heat pumps, or AHRI 1380. Stakeholders included utilities, EPRI, EPA, and others. The certification program to ensure that equipment using 1380 as the basis for developing those responses is anticipated to launch in this coming year.

Now, as was mentioned, AHRI is working with water heater manufacturers on AHRI 1430. And we hope that the progress on that standard will move much more quickly now that there are established base and other programs for that.

So these test procedures have and will standardize demand response performance and characteristics on the equipment side for air conditioners and heat pumps and water heaters, respectively. But manufacturers require flexibility to innovate and address market needs. There is a lack of a common communication protocol from electric utilities which complicate the benefit and slow the adoption of demand

response technologies. These manufacturers sell products nationwide and, as Ashley Armstrong mentioned, a California-specific product is not desirable.

All have acknowledged this is a complicated problem. A December 9th Staff report lists a page of questions that require a thoughtful response. AHRI has submitted a request for an extension of the 30-day January 4th deadline and hopes that CEC will approve that request in order for industry to provide a reasonable and helpful response to this issue.

Thank you.

MR. STEFFENSEN: Thank you, Laura. Staff has received your request to extend the comment deadline and we are currently evaluating it.

MS. PETRILLO-GROH: Thank you.

MR. HELFT: Tristan, you are un-muted now, if you want to make your comment?

MR. DE FRONDEVILLE: Thank you. This is Tristan de Frondeville at SkyCentrics. I want to make comments about competition and cyber security.

So on the cyber security, when you have an alternative communication path capability that

is available if you have a CTA-2045 port, you can actually avoid the public internet entirely. And as we know, once you're on the public internet, that is much easier to hack than when you're off it. So by going VPN between cellular and, for example, a modular Cloud, and then over -- and then through cellular, you're avoiding the public internet entirely.

On the competition side, first, there are smaller OEMs that don't have Clouds. By putting a port in they can actually provide internet-of-things functionality through a CTA-2045 module vendor, so that allowed smaller OEMs to participate.

If there's -- the API integration fees that I've seen charged so far by the people who do demand response are $20,000 to $50,000 per API. Now once somebody like Enbala has integrated with Ecobee thermostats, then they can brag to utilities that they've already done the integration and so, typically, they don't need to charge that $20,000 to $50,000.

So that speaks to Dan Nephin's point that was made earlier at e-Radio that I think is valid. And, certainly, that's why open ADR

exists, although the open ADR items, integrations can sometimes take some money as well.

And finally, I want to let the Commission know that there's going to be a CTA-2045 test harness. And that testing tool will allow manufacturers to practice sending demand response signals to all -- anything that's a CTA-2045 product.

And then the last thing, on the competition, if an OEM, such as Nest, which has been out in the field for a long time -- and you should speak to utilities about their frustrations, having to go through a single-vendor Wi-Fi solution -- but imagine that an OEM, such as a water heater manufacturer, has 10 million water heaters with Wi-Fi only and no CTA port, and they're now preventing a $25 million peaker power plant from being turned on. Don't you think that over time they're going to start charging a lot more for access to those 10 million water heaters because they know the value to the grid and they'll have an effective monopoly?

So we all know that the CEC is all about regulating monopolies. And I'm concerned about

introducing one more monopoly. So the CTA-2045 port allows that flexibility. And once you have a brain on an appliance that can do Wi-Fi, it's very inexpensive to use that same brain, add the plastics for the port, adds very little cost as some people have mentioned.

Thank you for your time. I cede my 20 seconds.

MR. STEFFENSEN: Thank you, Tristan.

MR. HELFT: Dean Taylor is asking or making a comment with a question.

"Transportation electrification seems to be different as both EV and EVSE are possible points of regulation. How to be tech neutral?"

Then he goes on,

"EVs are analogous to smart thermostats that can work on existing loads rather than regulating the other point, for example, the AC or the EVSE. EV OEMs are working on being able to do demand response and other grid services direct to the grid."

MR. STEFFENSEN: Thank you.

MR. HELFT: His question is how to be tech neutral with these kinds of devices?

MR. STEFFENSEN: Well, we're up to, I think, the public comment period, so let's just continue through seeing if there are other comments coming in from the public at this time.

MR. HELFT: There's a hand raised from Bob Wolfer.

I'm un-muting you. You can speak.

MR. WOLFER: Terrific. Can you hear me?

MR. STEFFENSEN: Sorry, there's a bit of feedback (indiscernible). Turn down your other devices.

MR. WOLFER: Okay. How is this?

MR. STEFFENSEN: Somewhat better.

MR. WOLFER: Okay. So good afternoon. Thank you for the opportunity to speak today. My name is Tom Wolfer. I am the Manager of Government Relations for Bradford White Corporation. Our company is an American-owned major manufacturer of water heaters, boilers, and unfired hot water storage tanks. In the state of California, a significant number of individuals, families, and job providers are buying our products that are hot water and space heating needs.

We appreciate today's discussion, as well

as the overarching goal advanced by the passage of Senate Bill 49. Our company believes this action is pivotal to achieving more energy efficiency in the state, while also having the added benefit of promoting our shared goal of increasing the market for electric heat pump water heaters throughout California.

As CEC continues to consider this matter, Bradford White urges the Commission and Staff to allow product manufacturers as much intellectual flexibility as possible when designing and developing demand response products. This market is still in its infancy, as was mentioned today. This means that manufacturers and utilities alike will be constantly learning about and adapting to new challenges and opportunities as this market matures.

For this reason it will be important for manufacturers, utilities, and regulatory bodies to have a full arsenal of options at their disposable when troubleshooting various consumer concerns that will arise as adoption and use of flexible demand response products increases.

Additionally, we would ask that the Commission continue their consideration of

hosting conversations between utilities and manufacturers. If their own utility demand response programs will be affected, it must include clearly defined responsibilities between these two groups of stakeholders. This will help to clarify the expectations of home and building owners who choose to participate in these programs and will assist in directing them to the appropriate body when they have any questions or concerns.

Bradford White encourages the Commission to consider actions that have been taken by other regulatory bodies related to connected water heaters while examining the best path for California's own utility demand response program. These include actions by the Washington Department of Commerce, the Oregon Department of Energy, AHRI Standard 1430, ENERGY STAR, and the Commission's own Joint Appendix 13 to the 2019 Building Energy Efficiency Standards, all of which previous speakers have touched on today.

In designing a program for California, we urge the Commission to maintain as much consistency as possible with aspects of these existing measures as many manufacturers have

already made significant investments to achieve the goals and requirements that are included in them.

Thank you, again, for the opportunity to address you on this matter. Bradford White Corporation looks forward to being a partner with the Commission as this important work continues.

MR. HELFT: We have a comment next from Orly of Universal Devices, for the Court Reporter, O-R-L-Y.

You're un-muted.

MS. HASIDIM: Thank you very much for giving --

MR. STEFFENSEN: Sorry. We've lost your audio.

MS. HASIDIM: Can you hear me now?

MR. STEFFENSEN: Yes.

MS. HASIDIM: Okay. So I'm Orly. I'm part of Universal Devices. We manufacturer energy efficiency hubs and devices.

I would like to ask the Commission to consider requesting manufacturers to make their APIs, the interface to their devices, public so things are not custom and private, just so energy management systems, such as ours and others, can

communicate with multiple devices. At least in our organization, we believe that the solution is just not one per device. Every home, every location has their preferences, maybe the water heater more than the EV or vice versa. And we'd like to give the homeowner the opportunity to make these choices. It will be much easier when devices have public APIs and we can all communicate with each other.

Thank you very much.

MR. STEFFENSEN: Thank you.

MR. HELFT: A comment from Brian Pickett. "This is Brian Pickett with Ariston Thermal USA, a global manufacturer of water heaters and more.

"It seems to me that one of the stickiest issues affecting demand response implementation for water heaters is scalding risk liability related with advanced load-up. I suggest that protections from manufacturers be included in any regulation that is implemented, specifically manufacturers will not be held responsible in scalding incidents where a required mixing valve was not present, a mixing valve malfunctioned, et

cetera."

MR. STEFFENSEN: Thank you for the comment.

MR. HELFT: A comment from Peter Mustacich, M-U-S-T-A-C-I-C-H.

"Could the federal precedence that connected devices fall outside of simply being a feature support California to regulate these products?"

That's a -- I'm sorry, that is a question.

MR. STEFFENSEN: Thank you for the question.

MR. HELFT: Deepak Sivaraman.

"How easy is it to retrofit existing residential water heaters with flexible demand capabilities, as opposed to adding such capabilities to newly manufactured water heaters?"

From Dean Taylor --

MR. STEFFENSEN: Sorry, Bruce. I'll just interject, I mean, that is a key question we want to understand. And to phrase it another way, we want to understand the difference between a water heater that has the demand flexible capability

versus a water heater that does not, what the cost difference may be at the point of sale. I think that's a key way that we'll look to see the readiness of various proposals that we will evaluate, as Staff, as well as, hopefully, receive from stakeholders.

Bruce, you may be on mute. I'm not sure.

MR. HELFT: No, I'm not, but Christopher Danforth wants to know if he could -- if this is an appropriate time to bring up his comments? Did you want to read that in the Q&A box or would you like me to restate that?

MR. STEFFENSEN: This is Christopher Danforth's comment?

MR. HELFT: Yes. It's at the top.

MR. STEFFENSEN: Yeah, we may. Yeah, we may read that for the record. I think that would be okay.

MR. HELFT: Christopher Danforth.

"In assessing the cost effectiveness of various demand response technologies, what is the cost per kilowatt hour -- per kilowatt year being assumed for batteries?

"At the CPUC, in the PG&E GRC, various parties, PG&E, TURN, Cal Advocates, have

presented estimates below $200 a kilowatt hour per year for lithium ion batteries, which is lower -- a lower cost than the six gigawatts of potential presented by the speaker from LBNL.

"Also, is the assumption being made that if these demand response technologies are built into appliances through Title 24 the cost will come way down relative to the cost presented by the speaker from LBNL?

"Finally, I ask all these questions because Severin Bornstein stated that these technologies are cheaper than batteries."

Christopher, if you wanted to raise your hand and speak further on this as a comment, you can be un-muted. This would be the time to do that.

From Mitsubishi Electric, Bruce Severence writes,

"Does the CEC have research already on the cost benefit of demand response in space heat pump applications, specifically average cost of demand response features across manufacturers relative to Southern California Edison, PG&E, and SDG&E time-of-use rates,

and whether the return on investment over energy savings will actually pay for the demand response feature over ten years?"

Christopher, you are able to speak. Ah, I see. I'm un-muting you but --

MR. DANFORTH: Okay.

MR. HELFT: -- there you go.

MR. DANFORTH: Okay. Well, it's just a question. I presume that in the course of this proceeding the cost effectiveness question will be looked into further. But I just wanted to alert people that it appears that the cost of batteries at the utility scale is coming down significantly. And the capital cost is around $1,200 per kilowatt. And when you apply real economic carrying charge amortization factor, it comes down to around $120 per kilowatt year.

And you know, the calculations done in the CPUC proceeding also incorporated offsets to those capital costs from energy arbitrage and participation in the ancillary services market by the utilities that own those batteries. So it's something to consider in determining what's the most cost effective way for society to deal with the duck curve issues that we've talked about

this morning.

I think that's all I have to say at this point.

MR. HELFT: Would you like to share your affiliation please for the Court Reporter?

MR. DANFORTH: Oh, I'm sorry. I thought it was already indicated in the comments. I'm with the Public Utilities Commission, Public Advocates Office.

MR. HELFT: Deepok Sivaraman asks,

> "In terms of the avoided cost model by CPUC, my understanding is that we should treat it as marginal cost and not prices. Is that consistent with your understanding?"

So, Sean, that wraps up what we have open for the moment at this period.

MR. STEFFENSEN: Okay. Well, I think, yeah, we'll be performing the last call for this comment period.

I would remind everyone that we'll have two panels after lunch with opportunities to ask those panelists questions. So there's, by far, more opportunities to participate and provide what's your mind, as well as a final comment period coming up at the conclusion of Panel 3, I

believe around 3:30 today.

So at this point, seeing that -- or just to conclude, we're up against about the scheduled break for lunch. Lunch is scheduled for one hour today. And just looking for confirmation that would -- I do have confirmation that we will, seeing that there are no additional comments at this time, we will begin the lunch break. We will resume at 1:30 p.m., Pacific Standard Time, and proceed into the Panel 2 discussion on Communications and Cyber Security at that time. Again, we will break for lunch now and resume at 1:30 p.m.

Thank you.

(Off the record at 12:21 p.m.)

(On the record at 1:28 p.m.)

MR. FERRIS: Okay, everybody, welcome back to the afternoon portion of our Senate Bill 49 Flexible Demand Lead Commissioner Workshop. I hope you all had a nice break.

As we move to the second panel, I'm going to turn our workshop over to Nicholaus Struven. He is the Senior Mechanical Engineer for the Appliance Office.

Nich?

MR. STRUVEN: All right. Thank you. Let's look at our agenda. It's approximately 1:30 p.m. We'll now continue on to the afternoon panels and discussion.

Good afternoon and welcome to Panel 2, Communication Technologies and Cyber Security. My name is Nich Struven and I am the Moderator for this panel. I am the Flexible Demand Appliances Project Lead at the Appliances Office at the CEC.

The concept of connecting appliances, objects and devices of all types over the internet is called the internet of things, or IOT. Today, consumers can purchase all kinds of products with an internet connection, everything from vehicles to refrigerators. Expanding network capabilities to all corners of our lives can make us more efficient, help save time and money, and helps put our digital lives at our fingertips whenever we need it.

The best way to ensure strong cyber security in the internet of things devices is to ensure that security is built into that device from the start. That means working with people who recognize the risk and have taken steps to

protect their products. The panel I have for you today has been carefully selected to address these risks and steps that could be taken to reduce these risks.

First, I have Professor Zubair Shafiq from University of California, Davis to speak about cyber security for flexible demand appliances. Second, I have Rolf Bienert from the OpenADR Alliance to speak to us about open ADR for communications and standards that promote flexible demand capabilities in appliances. And third, I have Dr. Walt Johnson, who is a retired technical executive at the Electric Power Research Institute and will speak to us today about technologies and communications and standards that promote flexible demand capabilities in appliances.

The subject matter experts will provide a ten-minute presentation, followed by a short opportunity to ask clarification questions, and a 20-minute panel discussion on stakeholder questions after the last presentation.

Welcome Professor Zubair.

MR. SHAFIQ: Thanks. Thank you. I really appreciate (indiscernible) cyber security

considerations and Flexible Demand Appliance Standards.

So I'm hoping to, today, present the academic point of view. Basically, what are some of the lessons that we have learned in more than two decades of academic research on security and privacy issues in the broader IOT ecosystem, as Nich laid out?

I organized my remarks around three key questions. One is, why? What? And then how cyber security and privacy considerations should be taken into account in developing flexible demand appliance standards?

So let me jump right in. First, I will try to briefly motivate why we should care about cyber security and privacy considerations? And, really, what we have learned from the past two decades of research on security and IOT is that most IOT devices, unfortunately, have like little or no built-in security or privacy built in. And this not only has an impact on their own security and privacy, but it also has a downstream impact on the broader critical infrastructure, not just the smart home but the broader internet, for example. And, hopefully, I will be able to

convince you that the standards threat model should not only consider this like immediate impact on flexible demand appliances, but also the holistic view of the critical in fact, such as the smart grid and beyond.

And just to illustrate these two points, let me first talk about some of the cyber security issues that have been observed in the last few years.

So the most notable cyber security incident that recently happened was a large-scale denial-of-service attack that was carried out using hundreds of thousands of small, innocuous internet-of-thing devices, like home routers, censors, like air quality monitors, and personal surveillance cameras. And at its peak this botnet, which is also -- which was called the Mirai botnet, consisted of more than 600,000 one-able internet-of-things devices. And this botnet was used to conduct a series of attacks over the last few years.

For example, in 2016, the infamous Mirai attack happened where the botnet was used to attack the domain name service infrastructure which underpins most of the internet. And this

attack resulted in outage of many popular websites on the internet, including sites like Amazon, GitHub, Airbnd, Netflix, Twitter, and so on.

And after that there were multiple, additional denial-of-service attacks launched through this botnet, which primarily consisted of compromised IOT devices. For example, it was used later that year to take down the network entire country. And then further, later that year, the same botnet was actually used to significantly undermine the connectivity provided by one of the largest telecom providers in Germany by compromising its more than 1 million routers.

So this shows that compromised IOT devices in a home, including flexibility monitored appliances, once they are compromised they can be, potentially, recognized to launch broader-scale attacks.

Then I will talk a little bit about some of the privacy considerations. And what we have seen in research is many of these, like IOT devices, unfortunately send and receive information in the field. And this often can

contain sensitive information. So even appliances, such as water heaters, might actually sometimes communicate some sensitive information that might reveal information about people in a household. And sometimes, even when you encrypt this communication, depending upon the coupling of the device activity with the users of that device, there are these so-called side channel attacks which can be launched, which can reveal the information which is being sent, even if it is encrypted.

So, for example, in the diagrams here I am showing a couple of examples where, for example, a sleep monitor or a Nest camera, even just by looking at encrypted communication, you can actually tell when there was someone inside a home, or whether certain activities were taking place. So this shows that, in addition to cyber security, privacy considerations should also be taken into account.

So I will briefly talk about what are some of the major privacy considerations that we should take into account? And some of my remarks here are inspired by some of the recent regulations which have been put forward in the EU

and UK, and specifically, actually, recently released standardization of the recommendations for cyber security for consumer internet-of-things devices. And there are three main things that stood out which I think should be -- should constitute the minimum baseline that should be advised in the CEC Flexible Demand Appliance Cyber Security Standards.

The first one is there should be authentication. So these appliances, they should have -- they should -- you know, the access should be authenticated using passwords. And there should be regulations which make sure that these devices don't use default passwords. And, if possible, these devices should also support two-factor authentication to mitigate large-scale denial-of-service attacks which are possible when attackers can predict the passwords used by users.

The second key requirement that should -- is absolutely critical, and I think some of my colleagues who are speaking afterwards will talk about, the need for secure communications. So standards, such as a Open ADR, already support some of this but it is very important that they

use best practices, like TLS, and use public infrastructure to ensure secure communications.

And lastly, we know that vulnerabilities and exploits are inevitable, so there should be mechanisms to report these vulnerabilities. And all of these appliances or devices should be patchable. So once we figure out that there are exploits there should be a safe way to do firmware updates.

And lastly, I want to, very briefly, talk about a recommendation in basically discussing, how should be convey these cyber security and privacy considerations, not just to manufacturers, but how should manufacturers convey these considerations to users?

And one of the things which has gained like a lot of popularity over the last few years are, after a lot of research, academics and researchers have converged onto this simple idea of something like a nutrition label which is, conceptually, very similar to an ENERGY STAR label which is used to convey energy efficiency of different appliances. So I think a similar kind of nutrition label can be designed or added to existing labels which can help consumers

understand the security practices implemented in that appliance and, also, list off different data collection and privacy considerations that the appliance adheres to.

So with this, I will conclude my remarks, and happy to take any clarification questions or, maybe, at the end of the panel.

MR. STRUVEN: Thank you, Professor.

Let's just first check in with the Commissioner if there's any additional comments? Okay.

Hearing none, Bruce, are there any additional clarifying questions?

MR. HELFT: No hands raised. And no questions submitted to the Q&A. Oh, just a second, one just came in from James Frey, F-R-E-Y, of 2050 Partners. "Zubair, do you support bricking devices that remain disconnected and create a security issues?"

MR. SHAFIQ: So I just want to make sure I understand the concept of bricking completely. But if I understand it correctly, the idea is that these devices should be kind of like separated or kind of like bricked so that they cannot communicate, so they become non-usable,

essentially. So I think this definitely is an extreme last resort. So if these devices are not patchable and they are -- if they don't get admitted to the latest firmware, so, yeah, so this could be another definition for those devices.

At a certain point I think this should be a consideration that they should be forcefully removed from the network so they cannot be compromised, so I do support this.

MR. STRUVEN: So --

MR. HELFT: Okay to move on.

MR. STRUVEN: Okay. All right. Now I have Rolf Bienert from OpenADR Alliance to speak with us about OpenADR for communications standards that promote flexible demand capabilities in appliances.

MR. BIENERT: Excellent. Thank you. And thank you to the Commissioner and the CEC for having me here today. It's great to be able to present.

So we've heard already OpenADR mentioned a few times today, so for those of you who don't really know much about it yet, I'm going to just give a really quick intro here and a very high-

level use case on how this works.

So if you'd go to the next slide?

Essentially, OpenADR is an open communications protocol between a demand response service provider, most of them, of course, at the utility level, and the resources outside in the customer demand. This connection can be established straight through existing internet, or it could go through a facilitator or an aggregator, as shown here on the right side of this image. We have heard talk about thermostats earlier, from Nest to Ecobee and so on, but this is, for example, a way to communicate OpenADR, as well, by driving the signals through the internet to the Cloud-based controller. And then the companies would then independently control the thermostats, for instance, that sit on the consumer end of things.

So OpenADR is not new.

If you'd go to the next slide?

Just a brief history here. I'm not going to go into details but the idea of OpenADR was conceived after the energy crisis of 2001. And it became a CEC grant opportunity with a few companies, as well as the Lawrence Berkeley

National Lab, participating in the creation of OpenADR 1.0. And then as the smart grid efforts seriously kicked into gear in the last 2002s, it became clear pretty quickly that we wanted to make this an interoperable and implementable standard.

So starting in 2010 and '11, we created the two OpenADR 2.0A and B specifications, tested them, ran them through all kinds of schemes out there, until they were ready for publication. And in 2018, it also became and IEC standards, also known as IEC 62-746-10-1.

If you go that next slide, we will see where are right now in the Alliance. The OpenADR Alliance, we, ourselves, we do not make products. As you can imagine, we are a nonprofit industry alliance that manages the standard and the certification. We have, currently, eight test houses locally. And, in fact, I think I have three more products here on my desk, so we have about 218 certified systems, and 165 member companies.

So if you go to the next slide, just a real quick overview again because this will come up a lot in the discussions, we are talking about

two different actors here, the virtual top node for VTN, which is, essentially, the server or the demand response, or DER, management system, again, typically located at the utility level or some aggregator. And that server manages all the resources that are connected. That doesn't mean that the server or the utility will need to know each and every lightbulb at the end of this chain, but they will need to know the endpoints in a sense. So the VENs, the virtual end nodes, which are the clients that receive the OpenADR events and will react to them, are coordinated.

One important thing with the cyber security in mind that we just heard about from Zubair is that each of these green OpenADR links here is a peer-to-peer connection, so we are not doing networking here. If you look on the left side of this sketch here the utility would not talk, necessarily, to that residential unit directly but, rather, the aggregator would receive the OpenADR signal, would apply it there under their mechanisms, their intelligence, and then control other resources underneath them, so, generally, a fairly detached system here.

So if you go to the next slide, just a

really quick overview here. And I'm only going to touch on the one service, the so-called event service in OpenADR, which you can imagine like a calendar notice. It has a start time and there's an end time. And it can have, if you will, an agenda. We call these time periods intervals within the event. And within these intervals you can have a number of different signal types from just simple price communications to more complicated energy up and down regulations, and so on and so forth. We have a large table of different signal types that can embedded in this, so calendar notice, if you will here.

And earlier this morning there was a discussion about this more event-based versus kind of real-time control. And, really, it doesn't make any difference for us because the event could start, of course, in a week from now, in a month from now, in a year from now, or it could start at this very moment. So any kind of control window here is possible. So from a communications perspective it makes no difference.

We're using XML payloads. And as I mentioned before, typically, the communication

goes through existing broadband. And, in some instances, it could be a dedicated interconnection, like a cellular modem, for instance. We use TLS 1.2.

And if you go to the next slide, Nich?

And I've outlined this a little more here. In OpenADR, we are using server and client certificates, which I fully understand that this can give someone, effectually, some grief because not everybody is used to having client certificates on the client side here. And it adds cost, of course, because, you know, certificates have to be validated, have to be generated by a certain route. And we have, in fact, contracted with a company that manages this for us, so we have dedicated OpenADR ECC and RSA certificates that are being generated by a certificate authority.

So this has gone through a number of reviews over the years, initially, Nest and SGIP laid out the IEC. And while we tried our hardest to keep this as simple as possible we also wanted to make it secure. And the only way for us to do that was, of course, to have these server and client certificates in place.

The application of all of this -- and I want to emphasize, that is, of course, really up to the user of the utilities. So I would encourage them to really look carefully at security and what to use. Just like with a Wi-Fi router that you buy for your home, if somebody sets the password for 1234 or turns off security, not much the manufacturer of this router can do.

One thing to also keep in mind, based on what we just saw in the previous presentation, OpenADR does allow for a fairly solid demarcation point between the utility network and the customer-owned equipment, simply because the server really is the gateway for these downstream clients and there's only that single connection there, so there's no extension of the utility-controlled network all the way into the customer building.

So we go to the next slide.

Just a real quick overview of how this typically looks like. And originally, of course, in 2002, '03, '04, and so on we were only talking about the peak load management, the one aspect that you have seen in Mary Ann's presentation this morning, really, simply, to cut off the

peaks. But now, of course, we are seeing a much greater variety of resources out there, both just consuming resources or both generating and consuming resources, storage, renewables, EV chargers, bit topic for demand response, demand-side management. And there's, of course, also microgrids and smart communities.

So all of this can be controlled through an architecture, like you see here. And you know, you could you this DR controller that is right in that mix and use them, either proprietary technologies to the resources or, of course, the OpenADR could also go directly to that resource, per se.

That being said, another standard -- if you go to the next slides? -- that we talked about this morning is the CTA-2045. And we will hear a little more about that from Walt here in a minute. But, essentially, the CTA-2045 module provides another way of connecting that sort of last, you know, typically we say, the last mile; right? In this case, it's more like the last few yards here in the building.

So as I've shown here, some of the

potential architectures for the local connectively have either a router there, or a building control system here at the top, that controls the individual units, or you have, of course, OpenADR built into a unit, whether this is a water heater, or this here is an air conditioning unit, it doesn't really matter. But if a company really wants to do that, then they can absolutely do that. I believe we heard from AO Smith earlier that they have that. And they're also a different product.

And then you can also terminate OpenADR in the CTA-2045 module which makes the communication here to the appliance, or potentially easier, I should say, because there's certainly other aspects here. But we'll hear more about that from Walt.

So if you'll go to the next slide?

I just wanted to briefly mention to folks, we sometimes hear that people are not quite clear on the certification process. So, really, it is very simple in OpenADR. And it will be the same for CTA-2045 since the OpenADR Alliance will be managing that certification process as well.

The vendors need to review the standards, of course, build the products according to their requirements. And then you can go directly to one of the test houses that are enabled for the testing. They will need a conformance statement from you to understand what they need to test. And then after the tests are done the conformance documents will be sent to the certification body, in this case the OpenADR Alliance, and we'll review and create the certification and the WEB listing. And the WEB listing is really key because it then provides users, both utilities, implementers, and so on a good way to verify that the product is, for instance, OpenADR tested and certified, or CTA-2045 tested and certified.

So with that, if you go to the next slide, my contact is there. Please feel free to shoot me an email, if necessary, and I'll turn it back to Nicholaus, and then to Walt.

MR. STRUVEN: Thank you, Rolf.

Let's first check with the Commissioner for additional comments.

Commissioner McAllister, do you have any comments?

Well, hearing none, Bruce, do we have any

questions and answer or clarifying questions?

MR. HELFT: A couple of clarifying questions for Rolf.

"What features of OpenADR 2.0 can mitigate denial-of-service attacks by virtual end nodes on virtual top nodes?"

That's from Fred Hewett of the NWEC.

MR. BIENERT: Yeah. Thank you, Fred. I do have to admit, I'm not a security expert but I think I know what this means.

So what, essentially, the VEN and VTN, in fact, operate in a very, very specific protocolic's change pattern. So if, for instance, the VEN would start pinging the VTN at, let's say, crazy rate it would be, actually, very simple for the VTN to either ignore that or completely disassociate that VEN, since we are not necessarily talking about a very open internet connection here; right? We are talking about a connection that is initially set up and authorized through the exchange of the keys and the certificate information.

So a VTN -- and, again, I'm not an expert for this -- but they should be able to ignore the VEN or disassociate them, as I mentioned.

Because the VEN, like I said, if they would just crazily ping the VTN, I think it would be very easy for that to be identified here.

I hope that helps.

MR. HELFT: And then, well, from James Frey from the 250 partners, he asks, "For a sense of scale, how many nodes are in the network now?" Now he's not specifying if they've been certified or not. I think you mentioned last week, there were maybe 216 but then he's asking -- certified.

Then he's asking, "How many watts are influenced by the OpenADR at this time?" Also, "Do you have a sense of how many devices there are that use OpenADR that are not certified versus how many are certified?"

MR. BIENERT: Yeah. Very, very good question, actual. And I wish I had the exact answers here. In fact, we are just preparing a survey, together with a partner company, to evaluate exactly that. So hopefully by the end of Q1 next year we should have pretty good answers here. But maybe a few like more kind of partial answers here.

Just on the sense of scale, it is really only limited to the IT infrastructure that is

available at the utility. Because, as you can imagine, you know, if you think about big services, big web services, like Facebook, Twitter, and so on, their biggest bottleneck is in their service, of course. That's why they built all these network corporation centers all over the world to accommodate that traffic; right?

So I think it's really important for a utility, when they are thinking about implementing an OpenADR VTN, that the pipeline, if you will, is big enough to accommodate, eventually, all the devices that they have. Because, otherwise, there's really no, in the protocol itself, there is no limitation on how big the networks can be.

And I do know that there are several DR programs in place, in California, for instance, that have, you know, thousands of participants here. And the exact number of watts is, of course, also a good question. I believe in California it is increasing. A few years ago it was about 300 megawatts but it is going up as far as I know. So hopefully by the end of Q2 we have, actually, much better answers to this.

MR. HELFT: Thank you, Rolf.

No other questions at this time.

MR. STRUVEN: Okay. Thank you, Rolf.

Now I have Dr. Walt Johnson, who is a retired Technical Executive at the Electric Power Institute and will speak to us today about technologies and communications and standards that promote flexible demand capabilities in appliances.

Welcome Walt.

DR. JOHNSON: Thank you and welcome. I'd like to express my appreciation for being excited to speak to this workshop. And I want to pick up sort of where Rolf left off and, also, tie back to a couple of the other things that we've heard today with respect to the end-to-end nature of communications that will be required for full utilization of flexibility of demand resources. I'm going to use a couple of examples of technologies here in order to illustrate this. But in ten minutes, this is not a tutorial, nor is it a survey of all the different ways these things can be done.

So let's start with the next slide.

The first thing I want to address is the

issue of OpenADR and CTA-2045. I'm using OpenADR as an example of wide area inform and motivate sort of protocol, as we speak of it. Because primarily, as Rolf explained, the messages are sent to controllers, not to specific devices. And those messages typically provide information about the state of the grid, such as a request from a gird manager to reduce consumption or, potentially, to increase consumption if there's, let's say, excess solar available, but they are not specific device commands. There's not a command and control protocol that would tell a device to turn on or turn off, or a specific thermostat to adjust its set point.

Instead, the information in the OpenADR message typically either has, like a said, a grid condition, or it may have some kind of a tie to a motivational element such as, in particular, price. It might simply be indicating a time of use or, let's say, a critical peak period where the price is implicit and it is derived from a tariff, or it might contain a specific pricing mechanism if we go to, let's say, in the future some kind of real-time price distribution mechanism.

But when the message gets to a controller of some sort, whether that's a campus-wide controller, a building energy management system, or a residential home energy management system, it would typically be translated from that or interpreted by the local device into specific instructions to, let's say, turn on a pool pump and run a pool sweeper if we're trying to consumer some excess power, or to reset at a thermostat or something.

What distinguishes CTA-2045 from most all the other protocols we talk about is that it also defines a physical interface. It's not simply a set of messages, although it does contain message definitions for controlling the consumption of a smart grid device, which is what they call the end loads, water heaters, thermostats, pool pumps, whatever. But it defines, actually, two physical port architectures or designs, one for low-voltage type devices that operate and don't need -- don't operate at line voltages but operate a lower DC Voltages, such as thermostats where a small device can be tucked in behind a thermostat without significant physical impact, or for larger devices, typically HVAC units.

Water heaters tend to use the larger AC type.

Now that module defines the specific set of pins. It's a connector, just like a USB port is, for example, on a computer. And I can plug in a module that let's me talk cellular. I can plug in a Wi-Fi, Bluetooth, FM radio, whatever I wanted. And then manufacturer of the device, of the actual appliance, does not have to concern himself with which of those types of communications are being employed.

So the distinction then is that OpenADR and similar high-level sort of informative communications typically don't depend or define the specific physical interface. CTA does that and then defines the actual electrical messages across that interface.

Let's go to the next slide.

So the end-to-end system looks something like this. At the upper left-hand side of this figure we see the OpenADR VTN that Rolf just described, the top node, that's operated by the utility or demand response operator. Since communication is through the internet, it's intercepted or received by a module on the appliance, which is that little box floating

there that the internet is connecting to. Now there may be intermediate steps and I'll talk about the deployment architectures in a moment.

I just said internet there but there could and there usually would be some kind of a terminating controller that terminates the OpenADR message, for example, and then reissues some other kind of local command message for the CTA module. It could potentially, as Rolf mentioned though go directly to the CTA module if that module has an OpenADR VEN built into it.

But in any case, that same kind of module could then be plugged into any of the kinds of smart grid devices we see at the bottom of the screen, to give some examples, a EVSE or a water heater or a thermostat. And that's where the CTA standard could be used to provide a uniform mechanism for speaking to and interfacing to any manufacturer's devices.

Next slide please.

So the reason why we can do this is because the OpenADR and CTA protocols are both message oriented. And both are intended for implement or for describing and controlling the flexibility of these demand resources. They use

a slightly different language or a different dialect to do so.

For example, in OpenADR, it's quite common in the current implementations that are widespread to express the grid condition as being in one of several states. We may be asking for the grid to -- we may want to express that the grid is in a critical peak period, for example, and that might be mapped to an OpenADR Tier 3 or Level 3 message that's a simple protocol or simple.

Too, there's an arbitrary mapping between the grid condition and a set of signals in OpenADR. We can then remap those in the controller into CTA messages that might say load up or shed or might express the fact that we're in grid emergency. So because we're just simply mapping information, it's simply like a language translation problem that we have to face.

At the same time, or in addition, we could use that to simply reflect an established time-of-use tariff, or we could use it to communicate a specific price if we wanted a price response from the device -- or from the controller of the device.

So those are possible and can be mapped between the two protocols.

Next slide please.

I don't intend this to be a technical discussion but I thought I would show at least a little bit about why this works.

At the upper left we see some kind of a controller entity, utility, demand response, aggregator, whomever, issuing an OpenADR message that is pushed down into the network system, if you will. And it goes through a bunch of magic at the different layers of the network, again, we're not describing that in detail, gets communicated over some wide area communication mechanism -- the medium is irrelevant for OpenADR -- and it comes out at the VEN, in the second column there.

The message is then extracted from that by the controller. And it may be translated, as I said, into a CTA language, or it could even pass through the message in its -- just preserving the OpenADR message itself and send it from the VEN into the communication module, the UCM, which is what the CTA module is called. So we could either translate the message into CTA

language from OpenADR, or we could actually pass the OpenADR message all the way through to the end device if the end device has an OpenADR VEN capability within it, and we've heard a little bit about that earlier today.

Next slide please.

So the way we deploy these is pretty straightforward. Actually, there was a little preview of this in Rolf's presentation. We have an OpenADR VTN on the left which is sending an OpenADR signal into the internet.

One more click.

And the most comment deployment mechanism today for this is that the -- there's a VEN, a virtual VEN, which resides in the Cloud. And that does a translation into the local command protocol. Sometimes it's proprietary protocol, like, for instance, Nest would do this, or it could be translated into CTA-2045 messages.

Those are then sent, again, through the internet to the target device, generally through a home gateway perhaps. But in my case, I have some devices that talk directly to the cellular network, for instance, to get this information. This is called the VEN in the Cloud architecture

and is, like I said, by far the most commonly deployed, even if CTA or OpenADR are not the specific protocols which are employed.

Another click please.

A more common or more common we see coming in the future, and certainly for larger installations, the OpenADR message is terminated in a VEN in an energy management system at the home, or a residential system, or a building energy management system, for example. That then gets translated to the CTA or local protocol, sent to the local module, and then that's connected into the smart grid device. This is the gateway architecture, we call it.

And then, finally, one more click.

This is the ultimate end-to-end, something that requires the smartest device, in that the OpenADR message is sent through the internet, retains its OpenADR message structure, and the entire OpenADR VEN is implemented inside the UCM -- or inside the CTA-2045 module, which is then plugged into the smart grid device, giving it direct OpenADR connectivity for use by the aggregator or response operator.

That's a quick overview of how some of

these protocols can be used and how a couple of the leading ones can be used and how they differ from one another or compliment one another in an end-to-end architecture for flexible device controls.

In fact, I'm at the end. I'll just -- one more click and I think I have a contact there.

And I'll turn it back to you, Nich. Thanks.

MR. STRUVEN: Thank you, Walt.

Let's first check with the Commissioner for additional comments.

Commissioner McAllister, do you have any comments?

COMMISSIONER MCALLISTER: Hey. So I just want to thank everybody. I've been listening in this afternoon since we came back and, yeah, just good solid information. I'm really glad, everybody, for being here.

And I'll kick it back to you, Nich. Thanks for moderating.

MR. STRUVEN: Sure.

Bruce, are there any questions in the Q&A?

MR. HELFT: No raised hands and no submitted questions at this time, Nich.

MR. STRUVEN: Okay. Now you've heard from the individual panelists. We'll go to a panel discussion on some possible questions that stakeholders might have. So let's have -- I'll pose this question.

Can any you speak directly to cyber security that would be applicable for standards for flexible demand capabilities and appliances? And I'll just throw that out there and see if any of you have any comments?

MR. BIENERT: Maybe I'll kick it off. And I'm sure Zubair has, probably, way more information on that than myself.

But I think one thing to always keep in mind is that, you know, we are looking at a number of different components here in this overall system; right? So we're not only looking at securing, basically, the transport layer, which we are trying to do in OpenADR with the TLS 1.2 and server client certificates. But certainly, you know, what the server does and what these client devices, as Walt mentioned, some building management systems, energy

management systems, gateways and so on, how they secure themselves is, of course, outside of the OpenADR protocol. So, right, I always like to emphasis that, you know, just by doing, basically, TLS 1.2 in OpenADR, that does not necessarily secure the entire chain here; right? And I'm sure Zubair can chime in on that.

But one of the biggest issues is, certainly, not only like brute force attacks but rather like phishing and other things that would affect them, more or less. For instance, a server or a utility network or a gateway, you know, open Wi-Fi nodes in homes and buildings, and so on and so forth.

So just really wanted to make sure everybody kind of understands that we are talking about multiple components here which, each on its own, needs to take care of security.

MR. SHAFIQ: Yeah. Just to add to that, I would say that, just mainly on this point, it is important that the standard takes that holistic picture into account so it is not just looking at the communication protocol, per se, but is also looking at securing these endpoints, the devices which are going to implement this,

and then maybe on the server side, maybe from the utility side. And I think the standards should also take into account the human aspect of security as well.

So it's great if some of the security is built in. This has been the mindset of the security community for many years. But after painful -- we have learned painful lessons, that if you just think of this as a technical issue and don't take into account the human element, so if there's some security built in. But to properly configure it, you need to inform the user of the device, and they need to take certain actions, for example, changing the default passwords. That is also important that these standards emphasize the human element as well.

MR. STRUVEN: Okay. Thank you.

We also -- it looks like we have some questions.

Bruce, would you --

MR. HELFT: There's a question, a written question, from Laura Petrillo-Groh from AHRI. She asks,

"Specifically thinking about security, do the panelists have any thoughts around the

transfer of connected appliances between homeowners or tenants? Some of the appliances are fixed within the house, for example, water heater, air conditioning, a heat pump air conditioner, and could present problems if not transferred properly. Any research, best practices or suggestions would be appreciated."

MR. SHAFIQ: I can maybe jump in.

So one of the things I was actually just reading this morning initiative the XE Cyber Sector Standard are recommendations for monitoring devices. One of the recommendations was, indeed, that appliances, when possible, do support having multiple accounts.

So in cases where devices are used by multiple users or, for example, there is a change of ownership there should be capability for users to, in some sense, like factor reset the devices when there is change of ownership, and the ability to create like a brand new account which does not contain, let's say, some personal information for the previous user.

So that is certainly relevant. And there are some industry best practices. And this is

definitely something that the standards can take into account.

MR. HELFT: A comment from Dean Taylor, that,

Electric vehicles seem to be different with additional laws and regulations. Rule 21 requires IEEE 2030.5." And also comments here, "Don't know if OpenADR 2 will be added.

"Also, Senate Bill 676 is vehicle grid integration requirements. And Low-Carbon Fuel Standard Regulation has greenhouse gas signals for smart charging via the EV of EVSE."

MR. BIENERT: So maybe I'll chime in briefly. I think this looks more like a comment than a question, per se.

But just the general thinking from our end here is that we have to distinguish a little bit between using EV charging or EVSE in general as a grid resource in demand response programs may, in the end, be different from, for instance, controlling invertors for a vehicle-to-grid implementation and controlling these invertors for power quality and other aspects. So a lot of

the Rule 21, of course, is looking at, you know, both, you know, safety, emergency shutoffs, power quality aspects, and so on and so forth, which is a very valid opportunity and proposition there.

But on the other hand, to really incorporate larger-scale charging networks, or whether this is based on home or residential chargers or commercial chargers, that seems to be more along the lines of demand response. So that's where, you know, you could see an OpenADR signal going, for instance, to a ChargePoint controller. And from there, you know, it could be going OCPP or other technology to the charger, or in turn, then eventually 2030.5, if there is an invertor involved that feeds back into the grid.

MR. STRUVEN: Are there any other questions in the Q&A or any --

MR. HELFT: All clear.

MR. STRUVEN: All right. While we wait for some more questions to come in, I'll pose kind of a non-technical question that a lot of people can relate to.

So what are some of the cyber security measures that consumers are using right now and

not even realizing it?

MR. SHAFIQ: So if I can maybe jump in?

I think one of the big things which is really, you know, I think a major security milestone over the last few years is that most communication, including communication by internet-of-things devices, has shifted from clear text or plain text to encrypted, and primarily using TLS and public infrastructure. And this is something which is completely seamless to everyday consumers. They probably don't know this. So in regular, let's say, web browsing, you see that green lock icon internet browser. But on IT device there is no such visual element to it.

So I would say like that's probably one of the most crucial and important security features, which a lot of users of smart devices are probably using without actually realizing it.

MR. BIENERT: Yeah. I mean, I can only speak from my personal experience. And, of course, I kind of keep an eye on it a little bit. But, absolutely, you know, the two-factor authentication basically, you know, a lot of -- many people might not understand that really, but

it's really there because the consumer side, for instance, does not use specific security certificates as well; right? So, I mean, there's multiple, multiple users to that.

But like I said, in OpenADR, of course, it's machine to machine, so you cannot really have a two-factor authentication which then, you know, makes it necessary that we have these security certificates on both sides so that, essentially, server and client can both independently verify that the other party is correct. And server certificates, it's certainly something that a lot of people do not realize are being used.

Like Zubair said, you know, when you go to any kind of website and it goes to an HTTPs mode with the little lock there, you know, are you are -- you have never realized that, essentially, the server has identified itself with a valid cyber security certificate. So the browser that you're using has verified that certificate.

And, you know, a quick note for everybody, it's not technical. If you get these little messages that say the website you're

trying to reach does not have a valid security certificate, you may want to consider not further continuing on that link because that's exactly the reason why that message pops up.

DR. JOHNSON: I have a question for Zubair. Although it's not completely transparent to the users, I'm seeing increasing usage of VPNs, virtual private networks, in securing residential communications. Is there a role for that in IOT, a more automated sort of version of that? It does address more problems than just the HTML security of HTTP security does.

MR. SHAFIQ: Yeah. I think it really depends on the tech model. And most people use VPNs to protect against a network adversity.

So let's say, so the classic motivation for using VPNs is when you are not on a trusted network and you are concerned that someone might intercept your traffic, might try to decrypt it. This could be, let's say, if you're using internet in a coffee shop, that's the classic example. But there could also be cases where, let's say, you don't trust your internet service provider for some reason, or maybe you don't trust some of the network in the community

because the traffic has to traverse the public internet. So in those case, using a VPN is particularly useful.

So I think if the motivation is to secure the communications from a network adversity who can potentially intercept or do this so-called man-in-the-middle attack the use of VPN is definitely going to be quite useful. But it does not protect against other sorts of attacks which, for example, directly attack the endpoints, the device, or the server at the utility site.

MR. STRUVEN: It looks like there's two more questions.

MR. HELFT: Dan Nephin of e-Radio asks, for Zubair,

> "Two-factor authentication is one of your recommendations. Are there good ways for internet-of-things of devices to do two-factor authentication that you can speak about? Will the human element always be present in the initial bootstrapping of devices? What about after initial setup?"

MR. SHAFIQ: Yeah. So two-factor authentication is a little bit more challenging on IOT devices, in part because there is no like

visual interface.

So I will give -- maybe like start off with the example of Alexa device which many of us have in our homes. And these are smart assistants. And the way they do kind of like two-factor authentication is through voice recognition, so recognizing who is the speaker of a particular command. So this is kind of like one type of biometric authentication technique which is, essentially, a two-factor.

So other examples could include things like things like fingerprints or retina, or other types of like facial recognition, again, depending upon the cost and how much security you want. So these are the stronger two-factor authentication mechanisms which can be used.

But since many IOT devices' cost is like a huge concern and you probably don't -- if you cannot, let's say, afford these kind of like stronger biometric two-factor authentications, the classic technique which has been used is where the second factor simply shows that you are in ownership of the device, you possess the device. So this protects against a network attacker how is, let's say, launching an attack

from some other part of the world. And the techniques which are commonly used here are things which, let's say, there could be like Bluetooth or Wi-Fi-based proximity sensing which can be used. Or let's say there could be a physical button on the device. And this is a technique used by routers, that you have to press a button to actually configure something, which shows that you are, actually, in physical ownership of a device.

So these are the best practices for two-factor authentication.

MR. HELFT: We have a question.

Thank you.

We have a question from Abigail Daken of ENERGY STAR.

"How do you think about consumer willingness to trade security or privacy away for convenience amenity when considering IT security for demand response devices?"

MR. BIENERT: I'm not sure about the last part of that question about, you know, the demand response aspects here. But from a consumer perspective, I mean, I'm just thinking out loud here about how many people have an iPhone and

have their location services and everything on. So if your iPhone suggests to you that, oh, today at four o'clock you wanted to drive to the gym, you certainly know that your iPhone is monitoring your moves; right? So there are certainly aspects to that being, you know, laid wide open when the technology is convenient.

Now, again, how that would translate to demand response, that's a good question; right? Because I think if people do not directly benefit from something, you know, they might be more conservative on, you know, wanting to see, or at least wanting to hear that there is a certain level of security available.

At the same time, I think over the last 10 to 15 years, we have also noticed that -- at least that's what I hear here, and the manufacturers on the call can certainly chime in on that -- but the most success seems to be, you know, when a program does not require constant consumer input; right? Initially the idea was, hey, we need to engage the consumer in all of this. And pretty quickly, I think, it became clear that, well, knowing your energy price and knowing whether your pool pump turns off or turns

off is not really something that the consumer wants to be reminded of every five minutes.

And so more of the set-it-and-forget-it attitudes that now more modern energy management systems provide is certainly a part of this. And that can then play into the security aspects -- right? -- so to give consumers a choice to, you know, how much they want to open up to the outside.

MR. HELFT: There's a -- oh, yeah, there's a hand raised. I'm going to un-mute Ken Nichols.

MR. NICHOLS: Sorry. I was muted on my side. Can you hear me?

MR. HELFT: Yes.

MR. NICHOLS: Hey, Rolf, how's it going? I haven't seen you in a while about OpenADR.

MR. BIENERT: Hi.

MR. NICHOLS: Hey, I was just curious. I wanted to just throw this out. I wrote it in the Q&A as well. But I'm curious, why not just do one-way price signals and then let, you know, appliance vendors respond, and let the existing utility metering system, you know, price consumer load.

And I realize part of that, I'll just say, is, you know, there's some bit of services, like reserves and things that are really fast responding where that doesn't work, like you can't really accommodate it or, more, transact it. But, in general, you could get a lot of what Mary Ann is talking about as far as shifting with just price signals.

Thanks.

MR. BIENERT: Yeah. Maybe I'll start real quick, I think.

Oh, hey, Ken, by the way.

Yeah, I think, in fact, the Energy Commission is, in fact, looking at a price distribution-type server. I believe there's a grant out there to maybe do exactly what you have in mind, Ken, to do just a simple -- to implement a simple server -- maybe I shouldn't call it simple at the end of the day -- but to implement a server where via machine-to-machine communication, folks (indiscernible) pool the current price, depending on which tariff they are on and then, you know, use that price for their own purposes and to curtail or not when it's convenient and stuff like that.

So I think there are thoughts about that going on. And we are also thinking about having a reduced function set OpenADR certification plan to really only have price-sensitive notes there. But at the end of the day, if you're talking about demand response, I think we do need additional, you know, actionable functions, so that would then, really, in the end require still some demand response functionality.

MR. STRUVEN: Thank you, panelists and stakeholders. We're about out of time for Panel 2. And we'll be now moving on to Panel 3, so I'll be taking a look at the agenda.

Okay, next up we have Messay Betru from the CEC to speak about consumer perspective and equity.

MR. BETRU: Okay. Thank you. And welcome, everyone, to Panel 3. My name is Messay Betru. I'm an Energy Commission Specialist I in the Flexible Demand Standards Unit. And I'll be the moderator for this panel while we discuss consumer --

MR. STEFFENSEN: I think the audio is pretty bad.

MR. HELFT: Yeah. You've got a problem

with your audio.

MR. BETRU: Okay. I apologize. One second. Is that any better?

MR. STEFFENSEN: No, it's the same.

MR. HELFT: No.

MR. BETRU: How about now?

MR. STEFFENSEN: It's mechanical.

MR. BETRU: I switched my mike. Is that any better?

MR. STEFFENSEN: That's perfect.

MR. BETRU: Okay. Great. Okay. My apologies. Let me start over.

So my name is Messay Betru. I'm an Energy Commission Specialist I with the Flexible Demand Standards Unit. And I'll be the moderator for this panel on Consumer Perspective and Equity Considerations.

So as we think about implementing Senate Bill 49, how do we ensure that Californians have equally inclusive access to flexible demand appliances without adverse impacts to consumer confidence and choice? So we'll explore this conversation from three tracks, looking at consumer perspective, equity inclusivity via housing stock, and then exploring programs and

barriers regarding the financial decision making process.

Next slide please.

So before we explore these issues in depth, let's think briefly about what energy equity means. So the Energy Commission defines energy equity as the quality of being fair or just in the availability and distribution of energy programs. It is crucial to end users that low-income Californians achieve this energy equity from flexible demand appliances, which is a critical component of the state's strategy towards ambitious climate change and clean energy goals, including alignment within the framework we are discussing in Senate Bill 49.

Next slide please.

So let's also talk about energy equity in terms of what a utility bill and what impacts comes from a utility bill. So the Energy Commission created the Energy Equity Indicators Report in 2018. And it reported that Californians in disadvantaged communities continued to pay a disproportionately high amount towards their utility bills.

I'll give two examples, the first one

being that in around 23,000 households in the low-income census tracts that is in the Los Angeles Basin received a Summer 2014 electric bill of more than $300. This is equivalent to or almost ten percent of their monthly average income. And in nearby Riverside County, low-income areas in 2015 paid up to 15 percent of their average income towards electric and other public utilities. So these disproportionate payments are classified as a metric called an energy burden.

Next slide please.

So thinking about ways to resolve this, I'll quickly highlight two examples of the state's progress on targeting and solving these solutions.

In the first report the Energy Commission released, in the summer of 2020, and with work from its partner agencies, created a final report on the Retail Automated Transactive Energy System, or RATES, platform. This is a subscription-based tariff system with the grid operator, like California Independent System Operator, and a utility, Southern California Edison, using over 200 participants. In this

pilot, they demonstrated flexible appliance utilities and pool pumps. And they also utilized algorithms to help customers automate and self-manage their energy usage. This was able to fairly allocate cost amongst consumer classes, supporting investment in energy efficiency, all exclusive to disadvantaged communities.

In the second report the Energy Commission also studied barriers to energy efficiency and weatherization investments for low-income customers and made these recommendations on how to increase access in the Senate Bill 350 Barriers Report.

I'll quickly run through some of the key recommendations, the first one being the ensuring that metric and target setting is being done. Specifically, the legislature is requiring collaboration to establish metrics so that low-income persons have product selection options and information necessary, recognizing that low-income appliances and consumer products are commonly less efficient than other appliances and products.

The second is regarding market delivery and program setting. So programs, essentially,

should be guided by the renewable energy needs of low-income customers rather than, quote, "relying on qualified product lists that exist today," such as ENERGY STAR. This could entail developing program criteria or a qualified appliances list for disadvantaged community applicability.

However, if an entire subsection is to be created, the study cautions in striking the balance between compliance and noncompliance strategies. As, quote, "multifamily housing markets already suffer from a dearth of standards used to gage efficiency retrofits and maintenance."

And, lastly, the lack of information for consumers continues to be a stumbling block for disadvantaged communities, specifically, quote, "Building owners often have difficulty obtaining tenant-level and whole-building energy data from utilities, thus reducing awareness for potential benefits for energy upgrades."

Next slide please.

So as we think about all of these issues and components and how they intersect, I want to pose this question to the panelists. So what

solution or resources can Senate Bill 49 Standards for Flexible Appliances provide to help address energy equity, capacity, or inadequacy issues with consideration to consumer choice?

Next slide please.

So with that, I'd like to introduce our three panelists who are subject matter experts in their respective fields.

So first up we will have Amy Dryden, who is the Director of Strategic Energy Innovations at the Association for Energy Affordability. At AEA, Ms. Dryden leads business development initiatives and spearheads research and development projects focused on advanced energy technologies in low-carbon buildings. Ms. Dryden will also speak about what appliances equity means in the renter, tenant, and end-user dynamic.

Second we have Mel Hall-Crawford, who is the Director of Energy Programs for the Consumer Federation of America, who will speak to us about consumer education and consumers concerns for low-income users of flexible appliances. Ms. Hall-Crawford is responsible for the CFA's energy efficiency work, advocating for policies,

practices, and cost-effective standards for home appliances, all to help consumers save money on their energy bills while also benefitting the environment.

And third we have Stacey Tutt, Visiting Professor and Director at the Consumer Law Clinic at the University of California, Irvine Law School. He will speak about the financial decision-making process and consumer protection-level areas as appropriate for Flexible Demand Appliances Standards. Ms. Tutt focuses on keeping low-income consumers in their homes after experiencing home improvement fraud through the property-assessed Clean Energy Program.

And as a reminder, panelists will provide a ten-minute presentation, followed by a short opportunity to ask follow-up questions. After that there will be a 20-minute panel discussion on stakeholder questions that I will pose following the last presentation.

So with that, let's go ahead and queue up Amy's slides please. Thank you.

MS. DRYDEN: Great. Thank you very much. Hopefully, you can all hear me okay.

Thank you to the Energy Commission for

hosting this workshop and inviting me to speak. I'm honored to be here. Hopefully I can shed some light on a little bit of my perspective in this industry. We've heard from a number of experts of far, great presentations throughout the day, and hopefully I'll try to tie those into what we're -- what I will be talking about.

Before I get into it, as I mentioned, my name is Amy Dryden. I'm with the Association for Energy Affordability. We are a nonprofit that does training, research and development, and program implementation, really focusing on our more vulnerable populations. And we are not an environmental justice organization. We partner with folks, like those organizations, to be more effective in our work.

So with that context, my approach for this presentation is to provide, first, some context just on what we're talking about here, building off of what was just presented, some references for our framework of putting equity at the center, and then some consideration based on our experience working in the multifamily industry, doing research and development, program implementation, you know, from load shifting, R

and D, to Low-Income Weatherization Program implementation.

So with that, next slide please.

So as I said, just put this up here for some context. As was mentioned, under SB 350, we have the development of CalEnviroScreen to kind of categorize all the census tracts within the state of California in terms of a number of variables from income to environmental factors to help prioritize where we're investing to serve our more vulnerable populations. And so this is important as we think about we're targeting to kind of develop metrics and definition so we can focus our resources appropriately.

On the left-hand side is the definition of environmental and social justice communications from the CEC. There's definitely overlap in these two kind of metrics but not 100 percent. If we take the CalEnviroScreen and then we look at, well, what are the disadvantaged communities within that, because we see that full spectrum -- can we go to the next slide? -- the DACs are really the top 25 percent of all of those census tracts. So you can see then, here in this slide, with the large portion kind of

concentrated in the Central Valley. You know, I'm so far zoomed out you can't quite see, you know, where else in Northern California, but a lot in Los Angeles as well. And just to provide as reference, about 33 percent of our Californians are low-income, with approximately 25 percent of those living in disadvantaged communities. And out of those, 75 percent of our low-income are renters.

So just some high-level characteristics, just to think about as we start looking at -- you know, we've been hearing about technologies and cyber security and systems and products, and now we're thinking about geography and people.

The table on the bottom that I have there for you is, actually, the climate zones across the top. The percentages there are the percentage of the census tracts within that climate zone that are considered DACs. So, you know, population might have been a better metric to put out there but this is what we did. But what you can see, and just kind of keep this in mind as we think about kind of the strategies -- right? -- that SB 49 is considering, like timers and thermostats and plugs and water heater

controls, how do these relate to where, geographically, where we're targeting?

So eight and nine -- right? -- not a lot of heating or cooling, a little bit. Ten, pretty mild, with 29 percent. And then we have 12 and 13, kind of our hotter climate zones that are going to see both heating and cooling at that end. So we kind of have a spectrum there. And so that, I think, I think is an important context just in terms of as we're thinking about the different geographies and conditions that we're trying to target.

Next slide please.

So that's just some context on the population. What I wanted to do in the next two slides is just provide some framework. I mentioned, you know, AEA is not an environment justice organization. But two things that have come out over the past -- or last year, in 2019, I think are really useful. A lot of folks have put in time and energy and expertise in providing guidance and frameworks and putting these forward to support affordable equitable electrification. And so as we navigate this path forward and we take our flexible demand as one of our tools --

right? -- in our electrification toolbox, in our decarbonization toolbox, these frameworks may be useful context.

So this first one here is from Gridworks, again, released in 2019. It documents a number of different policies and approaches, local and statewide, designed so that carbon neutrality and our emission reductions can be executed to ensure a just transition. They talk -- there's discussion of long-term planning, new construction strategies, and I just pulled out a couple of bullet points to raise up for this conversation, so this is a narrow slice of what they have presented.

So under the comprehensive strategy to ensure low-income are empowered in benefit from electrification a number of things that they outlined, like undertaking barriers for low-income electrification. They're looking at bill protections of protections for renters, developing programs to enable electrifying, and aggregating kind of our resources together. And I think that aggregating the resources together is something we heard previously as well.

Next slide.

So those recommendations also resonate with the equitable electrification framework that was put out by Greenlining, also, in 2019. What's important here for building electrification, it must be pursued equitably. It must ensure that environmental social justice communications can access the major benefits of electrification, including cleaner air, healthier homes, good jobs, and provide greater access to clean energy and energy efficiency to reduce bills. So, again, it's a comprehensive approach. It's not kind of a single strategy. We've heard that a number of times throughout the day.

They provide five steps in here, from assessing the community needs, what are the challenges to electrification? What programs have been supported? What relationships exist? Bringing in the community for decision making. Developing metrics so we can ensure that we're meeting our goals. Bringing program and funding to the table and kind of layering those, and I'll talk about that in a moment. And then, obviously, reflecting back so we can evaluate our metrics and are we having the outcomes we want so we can continue to iterate and improve and ensure

that we are serving all of our communities and benefitting our more vulnerable populations.

So both of these frameworks, before I go into kind of my next couple of slides, really highlight kind of a multidimensional approach. So building electrification must be holistic. And my considerations -- so we can go to the next slide.

The next two slides are tables of considerations from my perspective and how we have been interacting, you know, in the industry. And it's nicely laid out in a table and bullet points, which kind of gives you the sense that it's siloed. And really, I think, a better representation would be if it was circles and connected lines because these are overlapping. It's not a siloed piece. It's integrated planning. So we just want to kind of set that framework before I kind of take each one by one.

So the first is support and complimentary and comprehensive scope to maximize benefits. This is really about harmonizing efforts, I'll use that word from Ashley earlier today, and demand flexibility, again, is kind of one of our tools; right? But it must be coupled with other

programs, like energy efficiency, PV and/or storage, to be most effective. I think we'll see, you know, if we just do thermostats with poor systems or really leaky envelopes, we're going to squander those benefits of pre-heating and pre-cooling. So, really, we want these to be integrated services that are delivered.

We want to align the criteria with replacement programs so we can ensure that what we want to see from a demand flexibility standpoint is getting installed now and we minimize some of those go-backs.

And there are a number of things here but I'm only going to hit a couple given kind of our time frame to set the stage and we can discuss other ones later.

So understanding the loads, generally we'll see low-income households, they have larger households. They also have increased hours of occupancies. Earlier we were hearing about kind of early morning peaks and early evening peaks, so we've seen a lot of that in our monitoring of low-income households that we've been doing in all-electric buildings, particularly with varying shifts, like farmworker housing. So these are

all things to kind of consider where we have potential to shift loads and where we don't.

We also see a higher proportion of in-home cooking, probably twice as much as the Title 24 has estimated. And that's a really hard load to shift that's going to occur right during that kind of shed period. So these need to be kind of considered.

And last on this slide, we want to make sure we define that service of standard, and I've heard this a couple of times, because we must have customer satisfaction, as well as reducing greenhouse gas emissions and minimizing costs. And we need to consider how to minimize unintended energy use in the shed or post-shed period.

So kind of an example of that is if I'm trying to kind of supercharge my water heater right during the afternoon solar peak but, because of my scheduling, I'm going to have a significant drawdown right at the end of it, I'm going into that shed period with not a full tank. And that's going to be a little bit -- that's going to be harder from a cost standpoint and a usage standpoint.

We also heard about rate structures before. And again, if we think about the loads that can be shifted or not shifted and occupancies and schedules, maybe not having such an extreme price difference between peak and non-peak that may really erode benefits of being on an all-electric time-of-use pricing where folks are kind of heavily penalized during the peak period because of things that may not be shiftable.

Next slide.

Trying to keep myself going. I've got -- this is the last slide, so this will be okay.

So a couple of things. In all of these frameworks we talked about, engaging with all the stakeholders is key. And so the one thing I just want to call out here is landlords. I had mentioned earlier that 74 percent of our low-income are renters. And so how do we engage those landlords? We have different conditions, kind of metering conditions in these homes, whether they're central metered or individually metered. And so how do we consider getting to both of those stakeholders and ensuring benefits can get to the renters when they may not be in

that decision making for selecting appliances?

We've heard a lot about accessibility to technology, so I'm going to touch on it briefly, but I will confirm what others have said, Wi-Fi is unreliable or low quality or even nonexistent. We've seen a project where we were assessing homes for heat pump water heaters and 50 percent of them who were going to receive it didn't have access to Wi-Fi. And many folks are accessing the internet through smart phones. So, again, figuring out how to meet people where they're at so they can access the benefits.

And quickly, kind of in closing, just in terms of we talk about supporting education. And it's really important to take that opportunity to engage with residents so we can support their education on how to use these devices to maximize TOU benefits of that rate. And so with that, you know, we have this opportunity of bringing demand flexibility, coupled with our energy efficiency and other electrification efforts, to really deliver some great benefits if we take all of these things into consideration.

And I think I'm a couple minutes over, so I'm going to leave it there.

MR. BETRU: All right. Thank you so much, Amy, for that conversation. I really liked how you highlighted the multidisciplinary approach.

So I want to also pause and see if there's any comments or questions from Commissioner McAllister?

COMMISSIONER MCALLISTER: Hey everyone. And thank you, Messay. You're all familiar to me and, obviously, great, knowledgeable advocates in this role, and really appreciate you being with us here today and helping us frame these issues.

You know, the low-income space, and the equity issues, and really the inclusion and inclusiveness is really the top priority in all of these. And the consumer benefit is a requirement for getting this done right. So don't have any particular questions for you but thanks for your substantive presentation. I really appreciate you being with us here today and, certainly, look forward to interacting with you as we plan and prioritize and begin to implement and create this program. It's really going to serve us all for the long term, and it's fundamental that we get it right, so thank you.

MR. BETRU: Okay. Thank you, Commissioner.

At this time let's move to see if there's any raised hands or questions from the Q&A?

MR. HELFT: Nothing yet, Messay. All clear.

MR. BETRU: Okay. Great. Thank you, Bruce.

Let's go ahead and move over to Mel's presentation please.

MS. HALL-CRAWFORD: Great. Can you hear me okay?

MR. BETRU: We can, yes.

MS. HALL-CRAWFORD: Okay. Great. Hi. My name is Mel Hall-Crawford. I'm the Director of Energy Programs for the Consumer Federation of America, also known as CFA. CFA is a Washington DC-based association of appropriate 250national, state, and local organizations working in the consumer interest through advocacy, research, and education. I appreciate the opportunity today to provide the Commission with CFA's perspective on consumer and equity considerations as you work on developing an approach to Flexible Demand Appliance Standards.

Please bear in mind that while we get involved in state proceedings relating to Appliances Efficiency Standards, CFA brings more of a broader but not as in-depth perspective as our work is largely on the federal policy level, but we clearly recognize and appreciate California's leadership in the area of energy efficiency and have been pleased to participate in a variety of Commission proceedings. We are keenly aware that greater efforts need to be made to bring energy equity to disadvantaged communities, as well as communities of color.

Next slide please.

So let's talk about the considerations that should be made, some of them that -- for a flexible demand appliances program. So first, from the consumer perspective, here are some areas we think the CEC should be considering or is considering.

First, the cost effectiveness of flexible demand appliances, that encompasses our natural first set of questions, what is the first cost increase to the appliances to make it demand flexible? What is the payback period for the increase in the cost of the product? At what

point will the consumer be paid back for the incremental cost increase and actually start to realize net savings on his or her utility bill? How much are the annual savings to the consumer, as well as over the life of the product?

So in thinking about this issue, it would -- I want to talk about the categories of consumers that seem to break down in my mind. There are distinct ways consumers will respond to participating in having their appliances subject to flexible demand management. These are the grips or buckets that came to mind at this point.

And assuming this is an opt-in program, there will be consumers who opt out, opt out by default, in other words, not proactively opted in. There will be those who simply opt in, allowing their flexible demand appliances or certain appliances to respond when it is determined by the grid operator or utility that the load needs to be shifted. There are those who opt in but wish to have the capability to override the response of their appliances.

So some questions I'd like to pose are what are some good ways to handle this? Should it be a certain number of times per year or month

that the consumer can override or turn off the demand response capability? There may be extenuating circumstances, a medical situation, where activating the demand response of an appliances would not be desirable for the resident to compromise his or her health or safety in some manner.

An important category, which Amy also mentioned, was the landlord-tenant relationship or situation. The optimal situation is that both simply opt in. But how is this formalized? And the other question would be should the party who is paying the utility bill decide? What if it's the landlord who's paying the bill and wishes to opt in, should the tenant have the right to decline participation? So then how do you incentive the tenant? These are some challenging questions to the landlord-tenant scenario.

Next slide please.

Now some other considerations from the consumer vantage point include the consumer should not experience any discomfort or harm when the flexible demand appliances, be it room or central ACs, water heaters, heat pumps are responding to load shifting. The appliances

should function as needed at all times.

And just to call it our separately, the health and safety of the consumer cannot be compromised. If a consumer has a medical condition, what options make sense in this situation?

Consumers must be guaranteed that their privacy is protected and that the data is secure, that it will not be exploited or used for any other purposes. And I'm really glad that the previous panel went into this subject area.

Next, the rate design needs to be equitable to those who do not opt in, especially if lower rates are an incentive for those who do opt in, for those who opt in and may not be workable, such as those with a long-term medical condition, as I mentioned, or those who work swing shifts, night shifts, or are likely to be from low-income or communities of color when they should be held harmless.

Some other considerations I'd like to just throw into the mix are if there's a substantial price differential with the cost of a flexible demand appliances for a low-income homeowner can a subsidy be made available,

perhaps modeled after the Weatherization Assistance Program eligibility criteria?

Will there be a possible longer-term impact of COVID-19 if more people continue to work from home? How might this impact load management with flexible demand appliances?

Next slide please.

So onto messaging and outreach with an eye toward disadvantaged communities and communications of color. The underlying building blocks for messaging are education and motivation, i.e. incentive to participate. Messaging needs to clearly highlight the benefits of flexible demand appliances' cost savings on the energy bill, as well as helping to address climate change, decarbonization. Messaging needs to be straightforward, simple, if you will. A description of how the flexible demand appliances will work/operate and what will the consumer experience?

Next, clear disclosure is an absolute. If the incentive is energy bill saving, the consumer needs to have a full understanding of the implications of opting in. Again, what will he or she experience when the flexible demand

appliances is helping to levelize or shift demand? It's important to avoid surprises and misunderstandings about the program as they would have the potential to sour the consumer and impact the success of the program.

Next, as was discussed again by the last panel, privacy data protections must be guaranteed and the data must not be exploited.

Lastly, messaging needs to be culturally sensitive and in non-English languages with an awareness of cultural aspects, as appropriate, for respective ethnic communities.

Next slide please.

Now here are some outreach possibilities, peer support, a neighbor talking to neighbor. Church groups, other community networks.

Next, an obvious one of our times, social media, Facebook, Instagram, Twitter, Next Door, those are good conduits. Traditional media, radio, PSAs, free print. And then ethnic broadcasting stations. I guess there is an organization or an in-language radio entity that helps outreach to ethnic communities.

There are a variety of state-administered programs in which you can do outreach, such as

the Low-Income Home Energy Assistance Program, the California Weather Assistance Program, CalFresh. Credit counseling agencies can be helpful. Flexible demand appliances can be a strategy to help the client reduce debt.

There is the possibility of funding a nonprofit with an extensive network of community groups and a track record of success with outreach to communities of color and disadvantaged communities to coordinate the outreach.

A subset to help with targeted communities would be to have influencers who would be funded, those who already have a base of followers. This would be community-based organizations.

And I believe that consulting with the Commission's Disadvantaged Communities Advisory Group, which I learned about today, will be extremely important and useful.

Next slide.

So what can help make -- help with making sure you get it right to engage consumers? Here are some possibilities.

Conduct a random sample survey to measure

public receptivity to the program or concept to having certain appliances respond to demand or load management. In the survey you can ask or find out what's the response to various incentives or benefits? You can pose questions about the data you need to help inform your messaging and outreach efforts.

Next, employ focus groups. They can help determine the right messaging and, especially, with different cultures and communications. And through focus groups, you can learn where various groups or communities get their information, social media, print media, what's the best networking or media source for them?

Then you could actively test the information collected by using a pilot program to see how the outreach and messaging works. And then you would adjust accordingly to whatever the pilot program would reveal in terms of improving the program. Then, ultimately, you'd go statewide with metrics to measure response or success.

Next slide.

So in closing, with good implementation, i.e. smooth experience by the consumer, energy

bill cost savings and other benefits, clear messaging about how flexible demand appliances work, they can help consumers save on their energy bills, as well as reduce climate and pollution impacts, which will help California meet it's decarbonization goals.

I hope this input through the consumer lens is helpful to the Commission. Again, thank you for the opportunity to appear before you today.

Then last slide.

Here's my contact information if you have any questions. Thank you.

MR. BETRU: Thank you so much, Mel. I really appreciated the discussion about the appropriate choice levels needed when looking at the opt-in versus the automated opt-out selection criteria. And then the creating the messaging platform is really important too.

MS. HALL-CRAWFORD: You're welcome.

MR. BETRU: So thank you again.

And while Commissioner McAllister is out, we'll just go ahead and jump right into any Q&A or raised hands, if any.

MR. HELFT: Well, I also want to thank

you, Mel. Thank you very much.

There are none, no raised hands or open questions at this time, Messay.

MR. BETRU: Thank you, Bruce.

And we'll go ahead and move on to our final presentation by Stacey.

Take it away, Stacey.

MS. TUTT: Thank you. And I do appreciate this opportunity to come before everyone today and discuss this very important policy and considerations for consumers in looking at its development.

So what I'd like to discuss is go a little bit more into the question of -- and we've already heard about the energy cost burden on our low-income households -- but why might it be that low-income households aren't choosing efficient products or engaging in optimizing their energy usage?

So if we can go ahead and turn to the next slide here?

I think it's important to first understand the burden that is on our low-income households that are experiencing financial scarcity and what that does to the decision-

making process for those consumers.

The visual here, actually, highlights a book that I recommend on learning and understanding the financial decision-making process for those who experience scarcity of resources. And largely, what the book covers is the fact that financial scarcity unconsciously captures attention, whether the mind's owner wishes it to or not, and makes it harder for them to focus on anything else.

And then what they do experience, as well, is a bandwidth tax in which people are forced to constantly focus on that most immediate crisis which causes them to ignore other decisions and this tunneling or focusing on the most immediate or pressing financial need to the exclusion of all others. This, in large part, is why we have found that financial education is not as effective as such methods as financial coaching or being there with the person when they need to make that important decision and understand fully the cost-benefit analysis of any decision that they are making.

We also can hear, too, that, you know, one of the biggest problems for low-income

households with this, as well, is access to those kind of higher-cost efficient products. We heard that low cost is usually more inefficient with that product usage.

But if we look at this financial scarcity question and the decision making that occurs, what often we see is that the consumer is faced with a situation in which they may have had an appliance break down, or that they've had to move in which they now have to obtain a new appliances for that property. And when those types of things occur it's more of a crisis situation when somebody is dealing with financial scarcity, which makes it harder to think about those long-term consequences of the less expensive product and take into consideration that value of maybe a higher priced, more efficient product instead.

And so looking at that analysis and trying to do that, we have to keep in mind, when people are acting in crisis, it is harder for them to process the information, make decisions, and weigh all of the relevant factors.

But one thing we do know about our low-income households and communities is that energy costs is such a significant burden for them that

they are continually looking for ways in which to reduce those costs and find a better way to use their resources instead of expending it on those significant percentages of energy cost.

So if we can go ahead and go on to the next slide?

I do want to share, as I call it, a cautionary tale of the Property Assessed Clean Energy Program, which is an area my clinic has worked extensively on, both in representing the homeowners that have had these assessments, as well as working on policy and regulatory measures regarding this program. Now what I'm showing you here is just a bit of a legislative history of this program and that's part of that cautionary tale that I'm sharing with you.

So first, let me explain what PACE is. PACE is the Property Assessed Clean Energy Program which what that program was designed to do was to provide up-front financing to allow homeowners to make energy efficiency improvements to their homes. As the up-front costs would then be financed and then a lien would be placed on their property which would allow the homeowner to pay back those costs over an extended period of

time, sometimes as many as 20 years they had to pay back those improvements. And the idea of this and the design of the program was that the energy efficiency improvements that would be allowed would be limited to those that would help to pay for themselves, that were on designated product lists and would, hopefully, ensure then that the homeowners would receive a net benefit value from the program itself.

However, what you can see here is that when the program was implemented, initially we did not have any consumer protections put in place. And, in fact, it took almost -- I think we're looking here at about ten years to get even the most basic consumer protections in place, and also ensuring that there was a net gain, and that the homeowners had an ability to pay back that financing.

Now the one thing we've learned from PACE is, is that our low-income homeowners want these energy efficient improvements, that they look at this as a way to benefit themselves, especially when they're on a limited or fixed income.

One of the homeowners who often times took advantage of the PACE Program were older

adults that had more significant equity in their home. And what we may kind of characterize that as is older homeowners who are equity rich but they're income poor because they're on that fixed income from their retirement benefits. And so the idea of being able to have their homes become more energy efficient, and then also looking at their carbon footprint, was something we saw again and again on why homeowners decided to utilize this program.

However, because there weren't basically consumer protections in place, regrettably, what happened is that we did see fraud and misinformation and unfair practices taking place under this program when those consumer protections were not taken into consideration from the very beginning and development of the program.

And now, regrettably, the PACE Program is facing numerous class actions, different actions that have been taken against the program administrators and home improvement contracts that have been operating under this program, for the failure to appropriately disclose information and make sure that the improvement that were put

in place were actually energy efficient, that met those standards, and really helped homeowners to make good choices about what they wanted to do for energy efficient improvements.

One example of that is, though there would be approved product lists, there were no energy audits or assessments on what the home really needed for energy efficient improvements.

So if we can go on to the next slide?

This right here shows some of the lessons that were learned from PACE as they particularly apply to our low-income households. And so what we can see here is some of those recommendations that I think can be taken into consideration now is ensuring that there is careful explanation, both written and verbal, in this situation. Now in PACE, we're dealing with complex financing. And so it's also a recommendation not to use the financial sector jargon.

We've also heard about the importance of ensuring that there is equal language access to the information that is being provided to ensure that there's, again, full, complete disclosure of what's happening. And there needs to be significant up-front communications, as well as

being realistic about how people tend to manage their budgets.

And I would add a few more points to this list that we saw with PACE, in particular, that I think are relevant as we talk about the usage of technology, as well as what disclosures need to be made and what format that those need to occur.

So one, I would echo what we've heard here today from my fellow panelists, as well as others, is that low-income households have more limited access to technology. One of the issues that occurred in PACE is all the transactions that were done were done through electronic signatures and communications and electronic disclosures.

Regrettably, then what we saw is, with our low-income households, is that that information actually wasn't conveyed to them. Those individuals may or may not have had an email address, which was particularly relevant for our older adults. Many of our older adults had no email address or information. And so instead of providing the information in written disclosures or in an up-front way that would help the consumers make good decisions, that

information was transmitted through electronic communications in which the homeowner didn't even have access to the information.

So I think that using technology through this or -- and providing information to low-income households or older adults should be carefully considered, given the lessons that we have learned from this program.

What we also saw in the PACE Program is that when the program administrators had an eligible product list and they actually put a maximum amount of what those products could be sold for or financed for under the program, we actually saw that it was often misconstrued in such a way whereby which the home improvement contractors used that as a way to up-sell the products and only sell at the highest amount, rather than what the cost was, and a misconstruing of the information of actual cost to the homeowners which, regrettably, inflated those energy efficient improvements rather than making them more cost effective and accessible to low-income populations.

And so, again, these are just some of the lessons that we learned through the Property

Assessed Clean Energy Program. And as I said, just a cautionary tale as we move forward with this on how we can assure that low-income households and older adults have equal access to information, as well as the energy efficient measures that we would want to take. And, again, I would echo much of what my fellow panelists said on different measures and thoughts in protecting consumers within this program.

Thank you.

MR. BETRU: Great. Thank you so much, Stacey. I really like the idea that you were hitting home regarding some of the inaccessibility issues with the older tenants, whether that be an email address of understanding what an electronic disclosure document might look like, so thank you again.

While Commissioner is dealing with a phone call, let's go ahead and jump right into the question and answer or raised hands, if any.

MR. HELFT: There are none at this time, Messay.

MR. BETRU: Okay. Great. Thank you, Bruce. All right.

So with that, we have heard from the

individual panelists. So let's go ahead and move on to the discussion portion of the panel.

Next slide please.

So with the conclusion of those thought-provoking presentations, let's go ahead and think about the following questions. The first one, the first question I'll open up to everyone.

What mechanisms can be implemented to ensure equity considerations are woven into the Flexible Demand Standards?

So we kind of talked about this broadly but I wanted to see if there were any specific thoughts regarding what a transactive mechanism might look like with regards to, I don't know, that could be like load protections? What about any communicative mechanisms like that a smart appliances might be required to have?

And I'll pause there.

MS. DRYDEN: I think, Messay, I'll take a crack at it first and provide some thoughts there on some things I kind of didn't cover.

I think there's a couple of things that, you know, I was thinking about in terms of, I guess part of it is, into the Flexible Demand Standards. But maybe we could also expand that

to offerings as well.

So one thing I would say is to be effective, I think a number of these efforts and kind of technologies that we want to target should be integrated into electrification retrofits because I think there's a number of things where a number of households could have really limited appliances that would be available because they may happen to be gas appliances at this time. And some of that could be seen, like in like Climate Zones 7, 8, and 9 where we just see like single-point space heating that's gas, with no air conditioning, and they have water heating that may be gas. And so I would say to try to reach these households, we need to make sure that there's appliances in there that can benefit and that can be connected. So I think that's one, just kind of, a coupling.

The other thing I was thinking about is, you know, again, as I think about renter populations and/or multifamily, thinking about the appliances that are in every home because often renters are not supplying those appliances. And I think Ashley touched on this earlier, like everybody's got a water heater. Everybody's got

a refrigerator. So kind of thinking about prioritizing those.

What we've seen in some of our data, like dishwashers and laundry don't exist to the number of apartments. And even if dishwashers exist, they're not used, so kind of figuring out how to prioritize those loads is one thing.

And then the other, I guess I would add, just in terms of Demand Standards, is are there particular things that we need to look at for, and I'll take water heaters as an example, for like system sizing, ensuring that mixing valves are installed, ensuring that there are certain temperature set points so folks, and particularly in higher population households, can still benefit from the opportunities?

MS. HALL-CRAWFORD: I'll address a couple of the questions. I mean, I think I mentioned them in my presentation, lack of access to information. It's about education. It's about, you know, non-English materials so that people in ethnic communities can understand the program. And I have to say, in talking with some of my colleagues in the consumer advocacy community, it takes time. It's going to take time. And I know

the Commission wants to move on this quickly but just, you know, it is going to take some time.

And with regards to consumer interests in flexible demand appliances, I think it feels to me like it's relatively new. So consumers, again, need to be educated.

That's it from me.

MS. TUTT: And I would like to add on another aspect to this, when we look at lack of access to information, and again, going back to looking at what happened under the PACE Program, but what we saw with that program in particular for having access to the information, and again, thinking about that financial decision-making process and when people are able to engage and make that decision, one of the reasons PACE was, I think, so effectively marketed and used as, actually, door-to-door solicitation because they met people where they were at. They didn't need to go out and search out the information or obtain it in some other way. And, instead, that information was just directly provided to them in that moment to allow for that decision to be made.

Now, regrettably, what that did in the

PACE Program is mean that people were not educated on all the different aspects of it. And the only person who was there to really provide that information was the solicitor who actually had an interest in the homeowner signing up for that program.

And so that's another cautionary tale, I guess, on access to information is that, though door-to-door solicitation was a very effective way to meet consumers where they were at, it was the incentivizing of the solicitors to enroll people actually backfired within the program itself. And it kind of incentivized them to up-sell or do price gauging within the products themselves.

And so, instead, some of the things that have been looked at in this, and one of the things that we've looked at before as we were helping to look at how to help those experiencing financial scarcity to make those financial decisions, is partnership with a number of the community organizations that really help consumers in these particular situations.

For example, there are a number of what we call financial opportunity centers that are

put on by SparkPoint, is just one that I can think of, that actually provides financial coaching to consumers to help them make effective decisions. They look at their budget. They look at way to save costs and that, as well as maximize benefit programs, like weatherization and other things, in order to help affect that monthly budget in a very concrete way with information provided to the consumer at the time they need it and to make that decision.

Often times, they even have savings programs to help map savings to invest in, maybe, energy efficient appliances or things of that nature that would actually help the budgeting circumstances of those low-income households or populations.

And so I think if we look at access to information, it is important that that access is there, that it is done. But I, again, would echo a number of the recommendations, I think Mel made it in hers, as well, is engaging with those community organizations.

Also, if we have the individuals that are already working within those communities, working with them because they built that trust and

relationship and have an understanding of the needs of the populations that they serve.

MR. BETRU: Okay. Great. Thank you. Thank you so much for that feedback and discussion.

Moving along, I think we kind of already touched on the lack of access to information, so let's move on to the third question and take a step back a little bit and more broadly think about thinking about the barriers that exist today and anticipating what might happen long-term, what do we think that might look like?

MS. TUTT: Well, I think -- and I may have touched on this too much, so I'll definitely make sure I don't talk too long so the other panelists can join in here. But, you know, I think one of the barriers that we see, again, just representing low-income populations in this respect, is that ability to make the up-front investment in this or to bear the cost or the burden of that new, maybe more costly appliances. And that, really, just that up-front cost is that barrier for so many.

And I did notice that someone had posted in the Q&A about, "Are there any programs that

help Californians assist in own or lease EVs and things of that nature?" And I think that would be important in looking to ensure that there is equal access. And equity and opportunity is recognizing that as a significant barrier that is there.

In addition to that, we cannot forget that barrier of access to technology, the Wi-Fi problems, or access to internet. And that ability to have Wi-Fi can be very problematic for a number of our households. And so I think until that barrier is addressed it will continue to be a problem as we look at these issues.

MR. BETRU: Yes. I think affordability can be a major stumbling block here and tomorrow. I really do like the financial mechanisms of the Clean Vehicle Rebate Program that made EVs more affordable. And I think maybe mimicking that model can be really crucial to adopting flexible appliances.

Does anyone have anything else to think about implementation for the future?

MS. HALL-CRAWFORD: Well, I had mentioned earlier that, you know, if there could be a subsidy given to low-income households,

disadvantaged households and communities, modeled after the Weatherization Program, that might be a place to start.

MS. DRYDEN: I would just add on, you know, as we think about this, you know, what's the opportunity to align standards for other programs, like energy savings assistance program, like low-income weatherization? Adjusting the standards of federal programs might be a little bit more challenging. But how can we look to align those programs so when appliances are getting replaced and they're covered for low-income populations, that we get something in there that aligns with Demand Flexibility Standards and we're not trying to, again, go back; right?

I think one of the things I've seen in terms of working with low-income customers is, you know, getting the time and getting in the home is the biggest effort. And I think the opportunity is, once we're there, how can we aggregate all the resources that, ideally, are harmonized in their standards to deliver kind of maximum benefits to the customers?

So I think from an implementation

standpoint, I think, you know, this is new. And I know there's all these programs in these different silos. But an opportunity to try to figure out how to align things or kind of weave them together to be complimentary would be hugely beneficial.

I also think the rate structure will definitely be, you know, something to consider, too, particularly if it's -- you know, if we're fuel switching and there's not solar PV, and we don't have a favorable TOU electrification rate, you know, we may need to think about things in the short term to minimize utility costs.

MS. HALL-CRAWFORD: The other barrier, I think, is the people who work the evening and night shifts, the nontraditional work hours, you know, how do they fit into this program, or can they? So I don't have the answer but it's an important question to look at.

MS. DRYDEN: One of the things I wanted to add, because I saw a question, just in terms of like replacement upon failure, I don't think that's something unique to low-income populations. I think it's something we're addressing kind of across the Board in the market

in terms of when we have a failed appliance, and particular like space conditioning appliances, you want to get that rectified as quickly as possible.

And so, you know, our challenge, it's often easy to do like-for-like. And I think our challenge is working with the market and working with installers and contractors and distributors and retailers to kind of make appliances that we're looking for kind of more accessible, you know, easier to access so they can be turned to, you know, in that regard, versus kind of perpetuating appliances in there that we cannot connect to.

MS. TUFF: And then, also, on that question that was posed, I just wanted to add another point in there about what happens when there is a failure of one of these major systems. And, regrettably, what we see when there's that failure, most of our homeowners have not even $500 in savings. I think I've seen a number of reports that show how few Americans have more than $500 in savings or that ability to meet a crisis like that with their current financing.

Regrettably, then what we see with our

low-income households, or even our older adults who have less income coming into the home and, again, maybe just the equity in their property, their access to credit is extremely limited. And, in fact, most of the time what they have to do is seek out high-interest, high-cost financing in those emergency situations, payday loans, things of that nature, with such significant interest and cost being there that, if they're even able to get access to that high-cost credit, it ultimately will create that debt spiral and respond in other problems of other bills and things not being paid as they were forced to make that, again, that scarcity, that tunnel-vision decision and then suffer later the long-term consequences.

I have worked a great deal with foreclosure prevention. And I've actually seen a number of homeowners come in facing foreclosure that was actually brought about because of maybe the loss of a furnace or things of that nature and they need to immediately invest and instead of being able then to meet their ongoing monthly expenses.

So I think it's very significant. And

these costs are very significant to the populations we serve. And it will remain a barrier to the households to be able to access this if there's not a better way to effectively deal with the up-front costs.

MR. BETRU: All great, great points, so thank you so much for that. Let's move on to the last question.

So what do we think consumer interests will look like for flexible demand appliances? Are there some key attributes that we need to consider specifically? And, if so, do they need to be grouped by, for example, by appliances type, or should it be segmented in another way? But how do we make sure that these consumer interests are indeed met, first and foremost?

MS. DRYDEN: I have one comment. I'm sorry, I'm not sure. It's tangential to the question, I think, somewhat related, but I just want to make sure it's kind of tagged in this conversation.

I think in terms of what our consumers' interest in it -- right? -- may also depend on what kind of building they live in. And so I think that's just something to consider. And

I'll just throw out there, like the centrally metered versus tenant metered.

If I'm in a tenant metered building, I can -- my interest in this would be a convenient appliances that is accessible that I could use that is not too constraining on my schedule; right? But I'm going to see those benefits of it because I am directly paying the utility bill. I may not have the choice in the purchase of that appliances though. So, again, I think my interest in that benefit may not be the same interest as the purchaser of the appliances, or the landlord.

In a centrally metered property, you know, owner may have some interest in providing flexible demand appliances. But as the tenant, am I going to get the signal, am I going to get the benefit of it, I'm not paying the utilities directly, and so that kind of response so loads and benefits may not come to me as an individual because of the structure of the metering, and because of the utility allowances.

So I just wanted to put that out there because I think it's an important consideration as we're thinking about what's the consumer

interest and say who's the consumer; right? But when, I think, Mel, you had brought this up, like who's buying it or who's using it and how do we kind of benefit probably both parties, you know, given the relationship?

So I know it's slightly tangential but it crossed my mind. You know, it's something I've been thinking about, and I just wanted to make sure that it got shared.

MR. BETRU: Well, I think you hit on some valid points there, too. I've heard stories of, you know, people in multi-unit dwelling apartments or otherwise do not pay their water bill. It's shared by the entire building so they have no incentive to save water; right? Unless their tenant bears down and sends a message. So, you know, we have to make those considerations when adopting an efficient or a smart water heater; right?

So with that, is there any final closing comments? All right.

Well, thank you so much, panelists and stakeholders. So that will conclude the time that we have for Panel 3.

MS. HALL-CRAWFORD: Thank you.

MR. BETRU: Thank you so much.

Let's move to the next slide please.

So doing a time check, it's currently 3:44, let's be cognizant of the agenda. And just as a quick reminder, we'll be jumping into the public comment period next. And then the conclusionary portion of the workshop will follow.

Next slide please.

So this public hearing is being recorded by a Court Reporter. And all statements today will become part of the public record.

Just a few housekeeping rules.

All attendees are muted. If you have questions, you may type them into the question and answer function and they will be forwarded to the moderator.

If on the phone, please raise your hand by pushing star nine and the host will give you the ability to speak. Then you can push star six to mute and un-mute.

As a reminder, comments may be limited to three minutes per person and one person per organization. Prior to speaking, please state your name and affiliation.

MR. STRUVEN: And before we start, let's give the Court Reporter a quick five-minute break.

MR. FERRIS: Perfect. Thanks. Thanks Nich.

So we'll come back at, basically, about 3:50, 3:52, I guess.

(Off the record at 3:45 p.m.)

(On the record at 3:50 p.m.)

MR. FERRIS: Okay, we'll get into the closing comments.

Messay, do you want to repeat the public comment rules, must for convenience, and then we'll get started?

MR. BETRU: Sure.

So this public hearing is being recorded by a Court Reporter. And all statements today become part of the public record.

As I note, all attendees are muted. If you have questions, you may type them into the question and answer function and they will be forwarded to the moderator.

If on the phone, please raise your hand to speak by pushing star nine and the host will give you the ability to speak, and then you can

press star six to mute and un-mute.

Comments may be limited to three minutes per person and one person per organization. Prior to stating your comment, please state your name and affiliation.

(Pause)

MR. BETRU: Bruce, can we check to see if we have any comments?

MR. HELFT: All clear.

MR. BETRU: Okay. I'll pause for a few more seconds to make sure no one is missed.

(Pause)

MR. BETRU: Okay. And with that, we can go ahead and move to the next slide please. I'll pause again for last call for comments.

COMMISSIONER MCALLISTER: So, Messay, is that my queue? This is Andrew McAllister.

MR. BETRU: No, Commissioner. I just wanted to also confirm that we have the Court Reporter back --

COMMISSIONER MCALLISTER: Oh, got it. Okay.

MR. BETRU: -- before moving forward, so --

COMMISSIONER MCALLISTER: Great.

MR. BETRU: -- please bear with us.

COMMISSIONER MCALLISTER: Okay. Great. I wasn't hearing -- if there are public comments, obviously, we want to get those in.

MR. BETRU: Okay, if there are none, I'll go ahead and pass it off to Nich.

MR. FERRIS: Commissioner, did you want to say something before we let Nich do the closing remarks?

COMMISSIONER MCALLISTER: Whatever the best -- I was hearing no public comment and so I was thinking we were, basically, ready to go.

But, Nich, do you want to go ahead and I'll just wrap up and adjourn after that?

MR. STRUVEN: Yeah, we're ready to go, if you wanted to say anything?

COMMISSIONER MCALLISTER: Yeah. I think this has been a complete day. I wanted to just commend all the presentations, all the presenters, both in the morning and the afternoon. We hit, I think, the big ticket items that we need to think about in order to begin to develop, really, a rulemaking infrastructure for this enterprise which, you know, it needs a frame, it needs a super structure. And then as

we get started with prioritization, figuring out which device categories and technologies we want to include in this discussion, and then which device categories, actually, we're going to begin to move ahead first with -- to develop actual regulations and actual requirements that then would have the force of law.

So, obviously, we don't do this lightly. And the reason we're doing it is because it will create tremendous value for the State of California, the citizens of California by, as we heard in the morning, I think pretty clearly, and many of us strongly suspect or even think we know, by producing really kind of a trifecta of optimization of the electricity grid that improves reliability, and decarbonization in, you know, some flavor and some magnitude, and also lowering costs.

And those three are really the big -- those are the big three, the trifecta of what we need going forward as we move, as we really scale up our electric system, as we onboard a lot of new loads, both in the electric transportation sector, as well as the -- as well as in the building sector, and as we try to free up space

in the grid to optimize investment with those new loads coming on.

So lots of real excitement here. And, you know, fortunately, we have lots of good technology, we heard about much of it today, but we can always do better. And we can invest through our EPIC Program, work with our sister agencies, and partner with innovative firms in our broader economy. And, certainly, we must focus on the disadvantaged communities, low-income sector, multifamily buildings, existing building retrofits, bring a lot of capital to places where it doesn't always appear just on its own. And so we really do need to be paying good attention.

And so all of the stakeholders that we've heard today, I've been very happy with the attendance, maxed out at 180 or so. And thanks to all of you who have stuck it out throughout the day. But really happy to get this train moving down the track.

And, finally, thank you to Staff's extreme competence throughout the day. And I really have faith that we've got the right team on this to move it forward and prioritizing DR

responsibly. So really, really looking forward to what the future holds on this and thanks very much.

And I'll pass it back to Nich.

MR. STRUVEN: Well, thank you, Commissioner.

Today we've heard from subject matter experts that have talked about many aspects about flexible demand appliances. And most important, we've heard from you, the stakeholders. Thank you.

Today, Staff introduced Senate Bill 49 and highlighted the work that will be incorporated into Flexible Demand Appliance Standards. The Flexible Demand Appliance Standards plays an important role in achieving California's ambitious goals to decarbonize California's energy, transportation, and building sectors, consumers savings on electricity bills, electricity grid reliability, and improving air quality, and Staff values your input.

Today was the Lead Commissioner Workshop to request comments from the public. Staff will review and analyze comments received. Commission Staff will have future meetings to discuss

comments on proposals for Flexible Demand Appliance Standards. Shareholders are encouraged to sign up for the load management LISTSERV to receive updates and notices on this topic. Note that this is the load management LISTSERV.

The table shows approximate dates for key milestones for pre-rulemaking and rulemaking schedules. Staff plans to recommend to the CEC for adoption the first Flexible Demand Appliance Standards in the third quarter of 2022, with an effective date one year after adoption.

Thank you for your comments today. Please submit your comments in one of the three following ways before 5:00 p.m. on January 4th of 2021. We welcome your comments.

This slide shows the CEC team that has been created to develop Flexible Demand Appliance Standards. Thank you for your hard work and dedication to prepare for the workshop today.

And, finally, the last slide. Here's our contact information for those that wish to reach out to us directly.

This concludes the meeting. Thank you.

(The workshop concluded at 4:00 p.m.)

CERTIFICATE OF REPORTER

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

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

IN WITNESS WHEREOF, I have hereunto set my hand this 5th day of January, 2021.

MARTHA L. NELSON, CERT**367

CERTIFICATE OF TRANSCRIBER

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

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

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

MARTHA L. NELSON, CERT**367

January 5, 2021