DOCKETED	
Docket Number:	20-IEPR-04
Project Title:	Microgrids
TN #:	234952
Document Title:	Transcript 7-9-20 - IEPR COMMISSIONER WORKSHOP ON ASSESSING THE FUTURE ROLE FOR MICROGRIDS IN CALIFORNIA S3
Description:	7-9-20 SESSION 3: RESIDENTIAL MICROGRIDS AND EMERGING MICROGRID TECHNOLOGIES
Filer:	Raquel Kravitz
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	9/29/2020 3:59:59 PM
Docketed Date:	9/29/2020

BEFORE THE

CALIFORNIA ENERGY COMMISSION

In the matter of:	
)	
)	Docket No. 20-IEPR-04
2020 Integrated Energy Policy)	REMOTE ACCESS WORKSHOP
Policy Report Update)	
(2020 IEPR Update))	

IEPR COMMISSIONER WORKSHOP ON

ASSESSING THE FUTURE ROLE FOR MICROGRIDS IN CALIFORNIA

REMOTE VIA ZOOM

SESSION 3: RESIDENTIAL MICROGRIDS AND EMERGING MICROGRID TECHNOLOGIES

THURSDAY, JULY 9, 2020

2:00 P.M.

Reported By:
Martha Nelson, Cert. 00367

APPEARANCES

Commissioners and Executives

Janea A. Scott, CEC Vice Chair

Karen Douglas, CEC Commissioner

Genevieve Shiroma, CPUC Commissioner

Neil Millar, California ISO Vice President, Transmission Planning & Infrastructure Development

CEC Staff

Heather Raitt, Assistant Executive Director, Policy Development

Mike Gravely

RoseMary Avalos, Public Advisor's Office

Panel 1:

Giovanni Damato, Principal Project Manager, Electric Power Research Institute (EPRI), Moderator

Jason Caudle, City Manager, City of Lancaster

Richard Schorske, Executive Director, ZNE Alliance

Haresh Kamath, Senior Program Manager of Distributed Energy Resources and Energy Storage, Electric Power Research Institute

APPEARANCES (CONT.)

Panel 2:

Elisa Wood, Editor-in-Chief, Microgrid Knowledge, Moderator

Alex Morris, Executive Director, California Energy Storage Alliance

Jack Brouwer, Professor and Director of National Fuel Cell Research Center, UC Irvine

Julia Levin, Executive Director, Bioenergy Association of California

Public Comment

Chris Ball, Microgrid Team, Bloom Energy

Laura Nelson, Executive Director, Green Hydrogen Coalition

Robert Perry

Claire Broome, 350 Bay Area, Adjunct Professor of Public Health

Allie Detrio, Microgrid Resources Coalition

Diane Moss, Policy Director, California Hydrogen Business Council

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P R O C E E D I N G S

JULY 9, 2020 2:00 P.M.

MS. RAITT: All right. So, it's two o'clock, so we can go ahead and get started. Good afternoon everybody, welcome to today's Workshop on Assessing the Future Role for Microgrids in California. This is part of the proceeding for the 2020 IEPR Update.

I'm Heather Raitt, the Program Manager for the Integrated Energy Policy Report, or IEPR for short.

Today's workshop is being held remotely, consistent with Executive Orders N-2520 and N-2920, and the recommendations from the California Department of Health to encourage physical distancing to slow the spread of COVID-19.

This workshop is being held in three sessions, over two days, to encourage participation, and this is the third and final session. And we'll be addressing Residential Microgrids and Emerging Microgrid Technologies.

The meeting is being recorded. We'll post the recording and a written transcript on our website. Today's presentations are also posted on our website.

And if you were in the prior sessions, we will continue using the Q&A function in Zoom, with the capability to vote on questions posed by others.

Attendees may type questions for panelists by clicking on the Q&A icon. Before typing a question, please check to see if someone else has already posed a similar question. If so, you can just click the thumbs up to vote on it and that will move it up in the queue.

We'll reserve five minutes at the end of each panel for attendee Q&A. And given the time restrictions, it's unlikely that we'll be able to elevate all questions received.

I'll now go over how to provide comments on the materials today. There will be an opportunity for public comments at the end of the session. Please note that we will not have time for the panelists to answer questions during the public comment period.

In Zoom, click the raise hand icon to let us know you'd like to make a comment. And if you change your mind, just click it again and that will put your hand down.

For those on the phone, not using Zoom, press star 9 to raise your hand. And when it gets to be public comment time, we will open your line one at a time during that period.

Alternatively, written comments after the workshop are welcome and they're due July 30th. Again, the notice gives you all the information for providing

comments.

And with that, I'll turn it over to Vice Chair Scott. Thank you.

CEC VICE CHAIR SCOTT: Okay, thank you very much, Heather. Welcome back everybody. This is, as Heather noted, our third and final session in the Microgrids Integrated Energy Policy Report Workshop.

I'm delighted to be joined again by Commissioner Shiroma from the Public Utilities Commission, and by Neil Millar from the California Independent System Operators.

I do not have new opening remarks for this section, but if either of you do, I would be delighted to hear from you. I see a no from Neil and a yes from Commissioner Shiroma. Commissioner Shiroma, please.

CPUC COMMISSIONER SHIROMA: Thank you, Vice Chair Scott. I never miss an opportunity to say something. I just wanted to say that the sessions on Tuesday and this morning were excellent, really good panel discussion.

And then, the CPUC voted out our Track 1 decision on Microgrids this past month, in June, and we're now working on Track 2. And as we move forward, we're looking at developing service standards, addressing cost shifting issues, the development of

rates and tariffs. We'll be asking to comments relating to potential islanding requirements. And then, opportunities for non-diesel backup for power alternatives.

And these are detailed in the scoping memo that was issued last Friday. So, stay tuned and all that. And I look forward to our last two panels of the day. Thank you.

CEC VICE CHAIR SCOTT: Thank you. Okay, so let's get started then with our first panel of the afternoon, which is on Increasing Residential Reliability during Grid Disruptions, PSPS events, and Responding to Wildfire Events.

And that will be Giovanni, Jason, Richard, and Haresh. So, if you all will please turn on your videos, my dais mates and I will turn off ours and we'll let you go from there. Giovanni, please take it away, welcome.

MR. DAMATO: Thank you all for joining this afternoon. I'm going to be moderating this first panel in the afternoon on Increasing Residential Reliability During Grid Disruptions, PSPS Events, and Responding to Wildfire Events.

We're going to have three panelists today, each giving a specific perspective on residential reliability. Jason Caudle is the City Manager from the

City of Lancaster. Richard Schorske, the Executive Director of the ZNE Alliance. And Haresh Kamath, Senior Program Manager of the Distributed Energy Resources and Energy Storage Programs at the Electric Power Research Institute, or EPRI.

And I am Giovanni Damato and I am a Principal Project Manager at EPRI, with Haresh, as well. And to begin, I am going to talk a little bit about analysis and the tools that we use for microgrids, and to understand the valuation and optimization of this particular application of residential reliability for PSPS events, and other grid disruptions, among many other applications as well.

So, we could go to the next slide. I think that there's a slide for me as well, and it should be next. But in any case, we can't get that up. I'll talk a little bit about, like I said, some of the modeling tools that are available. And, specifically, I, in one of my positions, also am the project manager for one of the CEC-funded projects in microgrids, called DER-VET. And that is a microgrid and DER analysis tool that is -- there we go -- that helps with understanding the valuation and the optimization of various microgrid and DER portfolios for applications of those technologies.

And, you know, on Tuesday Commissioner Shiroma

asked a question and I think Mike Gravely talked about, and alluded to this tool, and we wanted to kind of connect the dots a little bit about what's some of the CEC funding in this area, to help with the various topics that we're going to talk about in this session on residential reliability.

So, as you can see here what I've tried to lay out in this slide is kind of the main goal of the DER-VET tool. And, really, what it is, is this putting together technical and economic analysis to really get a robust result, and set of scenarios for decision makers to make good decisions about, first, sizing microgrids and a portfolio of DERs. Second, helping with improving reliability and resilience, and also stacked benefits.

So, one of the key features of the DER-VET tool, and that's kind of in the center of this slide, is a multi-perspective that we have. And this really enables users of the tool to not only look at customer value, such as this application of residential resilience, but also look at T&D values. So, looking at the utility and the ratepayer perspective, and putting those two together in both in terms of economic value, and also the technical ability to do those. So, all those stacked services are co-optimized, together, to really -- with the end result of giving greater reliability,

resilience and value to all customers on the grid.

So, with that, one other thing I want to mention is that, you know, this tool is publicly available. And you can see the website there on this slide. It's in beta testing right now and we're open to any and all opportunities to get feedback from stakeholders of all types that are interested in DERs and microgrids, as well. And you can go to the website there and take a look at that to help with understanding these applications that we're talking about throughout these panel sessions.

And also, to mention, we're targeting at the end of this year, in 2020, to have the full release. So, we're really excited about this tool and we're hoping that it helps with many of the questions, in terms of analysis, for all the topics that we've talked about here.

So, with that, I will introduce our first panelist, Jason. We want to move to that slide. Thank you.

MR. CAUDLE: Great. Good afternoon, thank you guys for having me. I'm Jason Caudle. I'm the City Manager for the City of Lancaster. I'm also the Executive Director for CalChoice. And the presentation I'm going today, and I'll be honest, is completely

biased. It's completely biased to local government. I've been a local government guy for 25 years and I generally believe that local government has a huge role in many things, including energy.

So, I hope today, with the goal of kind of instilling in the group and the listeners that local government plays a key component of the solution for DERs and the challenges we face in the energy markets.

And it's not just local governments with CCAs. I think these tools are available to every local government that has legislative authority. We happen to have a CCA which gives us greater authority and a little more activity, and Richard will talk about the details of what we're doing in Lancaster. But I wanted to share just the tools that are available to local government that help you guys, decision makers at the state level, implement the goals you're trying to implement.

I think it's key to understand that local government controls many things. We manage transportation systems, we operate sewer systems, water systems, lighting systems, so when you look at the big picture of the energy market local government is a large consumer of energy. Yet, oftentimes, we're excluded from the process. We're not thought of in the solution aspects of it.

But if you look at those operating systems we operate, we have great control over those and, again, a great influence over them to make them either, you know, converting transportation to electric systems, or energy efficiency in our water systems or, you know, changing of our usage in our sewer plants, and energy usage, and consumption to impact the energy markets. So, these tools are available to us.

We also have local government laws, ordinances that give us the authority to implement rules and regulations on our local citizens that not all of that ability to do. Local government does. And we set that example in Lancaster by being the first city to actually require net zero homes construction prior to the state requiring it. That's just a small example of what local government can do with local laws.

We control development standards. So, we talk about the electrification of residential neighborhoods and the installation of DERs in residential neighborhoods, as well as resilience for neighborhoods, we can legislate that. Local government has the authority to pass ordinances to require that.

We also, in conjunction with that, and this is where it comes to from a regulatory perspective, we also have the authority to place special taxes on those. So,

we have the funding mechanism as well to impact outcomes from a DER perspective and resilience perspective.

And as everybody else, we have access to cheap capital. Local government has access to cheap capital as it relates to tax-exempt financing.

So, when you put all these tools together, we have a true opportunity to help impact and solve the problem.

Now, Richard's going to talk a little bit about what we are doing in Lancaster, with the graciousness of the CEC and some money from the state that we hope to set an example that we can implement throughout the state, as local governments.

But I want to leave with this idea of financially what it means to local government as well. And I'll use Lancaster as an example. So, from a local government property tax perspective, Lancaster receives 1 percent of the total property tax -- or, the property tax is 1 percent of the total value. Of that 1 percent, Lancaster receives 6 percent of the 1 percent of property tax.

That, with an average house price in Lancaster's about $310,000, that equates to $186 a year in property tax. Our average electric bill, residential electric bill in Lancaster is $140 a month. That's about $1,750

a month. So, you can picture the revenue, the costs that our taxpayers pay in energy is ten times the revenue that they pay in local property tax to their local government.

So, not only do we have these tools available to us as local government, there is potential incentive for local government to get involved in this business, right, to get involved in this game.

So, I leave you with that, not only as it relates to the powers that we have as local government, but also the ability we have to finance and the financial values that present to local government to implement this.

So, with that, I'll turn it over to the moderator and be happy to answer any questions as we progress.

MR. DAMATO: Thank you. And next up we have Richard. Take it away, Richard.

MR. SCHORSKE: Thank you very much. Can we get a sound check? We're good?

MR. DAMATO: Yes, we can see you and hear you.

MR. SCHORSKE: Great, thank you. So, thank you, Commissioners for this opportunity and thanks, Jason, for that great intro.

So, this is a project that's actually now in its

third or fourth year. It's the implementation phase of an advanced energy community project which is focused on community microgrids and a virtual power plant design.

So, just a quick shout out to our other partners in this project. Olivine is the VPP and DERMs provider. Energy Solutions and Blue Strike Environmental are advising on the microgrid. GridScape is providing the controller.

And we'll go to the next slide. And, of course, Lancaster City is actually the host of the two residential microgrids I'll be talking about today, as well as there are three additional school-based microgrids that are all together, in conjunction working through the VPP to provide a lot of load management flexibility and, we hope, procurement savings for the LSE, which is Lancaster Choice.

So, the overall project outcomes here are to develop these two ZNE residential communities. One is a multi-family and one is a single-family design to improve community resilience, optimize the value of the DERs and, of course, scale these AEC solutions around the state.

The next slide. And there are two ZNE residential projects in play here. One is a 78-unit single-family and one is a 167-unit affordable, multi-

family property. And that one, the first, Avenue I, the single-family is just a more conventional microgrid arrangement being proposed. The second has some innovative flywheel kinetic energy storage that we hope to demonstrate in that context.

And then, all of these are going to be implemented in the contest of potentially a new residential rate design that helps to capture some of the DER value streams that we're developing through this project.

The next slide. So, the VPP is an overlay across all of the microgrids, as I mentioned, and it includes not only the solar and storage assets, but also we hope to bring in about 5 megawatts of flexible load.

We have another project involving the Antelope Valley Transportation Authority and there's a lot of flexible load in those bus charging, potentially, and also in other kinds of EV charging that will be coming in the coming years.

The next slide. So, we are encountering, you know, some challenges and some options for how to proceed. The original microgrid design is a master-metered configuration. So, essentially, what we had looked to is to emulate what is being done for mobile home parks which is that there is a master meter, and

then the distribution infrastructure, and the billing occurs behind that meter. And the local entity, be it an HOA, in this case potentially the city, owns that last mile of distribution infrastructure, including the metering.

So, to do this from scratch in this approach is novel and we may or may not be able to get all the way through the regulatory process and potential concerns of Southern California Edison, our partner.

So, we are looking to, one, as a policy recommendation we would love to get increased clarity from the Track 2 and Track 1 proceedings with regard to master-metered microgrid configurations. That would be super, super helpful because this is at present a gray zone.

Second of all, we are preparing kind of a fall back approach, which is what we're calling the network of distributed nanogrids. And this is a very exciting approach which basically enables the houses and/or apartment buildings to island, auto-island in the event of a grid outage, and to have a number of resources available behind the meter.

So, the auto-islanding would be executed by a new technology called a Microgrid in a Meter that includes an actual auto-islanding mechanism, a physical

mechanism that takes the premise off grid. And behind that, a variable frequency inverter that provides some significant energy savings.

The second innovative piece is a V2G integration. There's a new product company called Ossiaco that is coming into the market that has a CHAdeMO Fast Charger for home use, and it's fully certified for V2G with Mitsubishi and Nissan. Very excited about that. It opens up that mobile storage for resilience purposes and that's a relatively good price point.

And finally, a solar allocator device company called Powertree has another mechanism for eliminating back feed and the necessity for utility interconnect on solar or the multi-family market.

So, we're excited about all those options and we look forward to a discussion about how we're proceeding on this. Thank you very much.

MR. DAMATO: Thank you, Richard.

Now up we have Haresh. Are you ready?

MR. KAMATH: Thanks Giovanni. Yeah, I'm Haresh Kamath with the Electric Power Research Institute. And thanks for this opportunity to talk about some of the things that we're seeing in this area.

And, you know, following up on Jason and

Richard's commentary on how to apply these systems, I just want to talk a little bit about some of the technology and grid technology issues that go into it, without going into a lot of detail.

One of the things that has happened in the last decade as we've seen more and more integration of solar, especially behind the meter, is that people are surprised when they have outages and they can't use their solar to actually power their homes. This is something that's very common to find that out. And they say, well, I just went off grid by putting solar on my roof. But in fact, that's not actually the case.

To actually go off grid, you have to have a energy storage and you have to have a home inverter. This is a term that you're going to hear more about in the near future. And I'm going to talk a little bit about what that means. I'm going to talk a little bit about what technology we're seeing here in this area.

The next slide, please. So, if we do want just to talk about energy storage, residential energy storage and a little bit behind residential solar in terms of deployment. We're probably seven or eight years behind solar when we're looking at energy storage on this point. But there are starting to be significant numbers of storage that are deployed all around the world.

In fact, many other parts of the world, just as in solar, have seen a lot more adoption than here in the U.S. And globally, we have about 5 gigawatts of energy storage that's gone in. So, you can see that this is no longer an infant industry, but it's still quite young and there's still a lot of progress to be made.

Next slide, please. So, what we're going to see as we start to install energy storage, most of the energy storage that's going out there is going for resilience. The reason that people are putting it there is because they want to have backup. And most of these energy storage solutions are relatively small, you can't back up everything.

The easy way to back things up in the early part of resilient solutions is just to do partial home backup, just to power certain critical loads when you go offline. But eventually, we want to get to the point where we have a whole home backup solution. And so that even if the home trips offline, that is if there's a grid outage then you are able to service all the loads, as long as you're careful. If you try to run everything at once, your air conditioner, and your refrigerator, and your washing machine or whatever else you have, then it might be a little bit more difficult for you to get everything running.

So, in the long run you want to have active whole home backup, so an active load management. And when you have active load management then you're able to basically control your load so that it never actually overloads your system. To do that, you have to have a pretty sophisticated control behind the meter.

So, this is something that the industry is really quite focused on.

The next slide, please. Looking at the actual implementation of these systems, the current design can be pretty complicated, especially if it's a retrofit of an existing home. When we install these systems, we have to put in a whole bunch of extra material, and panels, and hardware, and there's a lot of work that goes into it. So, one of these installations can get quite expensive. It can be upwards of -- I think the average cost is about 10 to 15 thousand dollars right now for a 5 kilowatt system.

So, now, that's a significant price if a homeowner is just trying to add this to their system. But it's not that significant if it's put in when the home is being constructed in the first place. Especially in California, they're used to fairly high home prices. So, if you're adding another 15K on top of that is quite possible. And many homebuilders are very

interested in this possibility.

So, what we're seeing is one standardized design for retrofits where you're seeing, you know, reduction in the installation size, as well as seeing homebuilders actually find standard ways of installing this. And that will increase customer control and, ultimately, grid designs.

The next slide, please. So, finally, you know, building on what Jason and Richard was saying, I think one of the things that we want to really look at is community level designs, rather than individual homes. Not all homes are going to have the ability to put local storage on them. For example, if you have multi-family homes, multi-level residences, then you might want to talk about other approaches to this.

So, really, we're also working at ways in which we can combine resources across numerous homes and put that together with the grid to actually create designs at the community level. This is a very active area of research and this is something that we are talking with DOE about and, hopefully, also the CEC.

So that concludes my comments. Thank you very much.

MR. DAMATO: Thank you, Haresh.

I think we'll turn it back over to the CEC.

CEC VICE CHAIR SCOTT: All right, well, thank you very much. This was a very interesting set of information. If I could have my fellow dais mates please turn back on their videos, and also the presenters to please turn on their videos so that we can have a little bit of a question and answer together, with one another.

I always have my whole list of questions. But let me start and see if any of my fellow dais mates have questions for you. And seeing a no from Neil and a yes from Commissioner Shiroma. Please, Commissioner Shiroma.

CPUC COMMISSIONER SHIROMA: Thanks. Yeah, this is not a question, but just to say thanks, Giovanni, for the information on the DER-VET application tool. And we'll be sure to check out the website. Thank you.

MR. DAMATO: Okay, thank you.

CEC VICE CHAIR SCOTT: Great. And I should also note that Commissioner Douglas has joined us and she said she will text me any questions that she has for you all. So, I may read a couple questions from her as well.

One of the questions that I have for you, maybe for Haresh, but for all of the speakers is you mentioned how complicated these systems can be, and also how

expensive these systems can be. And one of the things that I'm thinking about is if we're headed to a 100 percent clean energy standard in the 2040s, we have tough goals that we're also trying to meet in the 2030s. Which is, you know, just eight or nine years from now, not very far at all.

How do we take some of the complication and cost out of these systems so that we can deploy them at the speed that I think we're going to need to go in order to hit 2030 goals and definitely to hit 2040 goals?

MR. KAMATH: That's a great question, Commissioner Scott -- Vice Chair Scott. So that's, I think, an active area of research for a lot of folks. And especially for the California Energy Commission, which I understand is actually putting -- through their renewables group, they're putting together a list of approved hardware for solar, and storage and, you know, other components of these inverters and so on.

That kind of an approach is actually really useful because that means that especially, you know, of course retrofit installations, but even homebuilders can choose from that list, and those lists, and make sure that they all work together, and relatively simply put these things together and actually make them run.

So, hopefully, with an increased amounts of

standardization as we get more experience out there, and what we're observing already with the CEC and other entities putting a need on standardizing equipment, hopefully what we'll see is that the cost will fall, you know, with experience.

I do think that there's a lot of work that's still happening in terms of research on the component level manufacturing. And, you know, what we're seeing of course is just through buy in, you know, the price is falling.

I think in California, the leadership in this area is making a significant impact and the lessons learned here in California have been communicated back to manufacturers, and as they become aligned with lessons learned from other places in the world. We're seeing tremendous information coming out of Australia, Germany, and other places that will hopefully help to bring the cost down.

CEC VICE CHAIR SCOTT: Thank you, that's great. Did any of the other panelists want to weigh in on that? Richard, we can't hear you.

MR. SCHORSKE: Hi. Can you hear me now?

CEC VICE CHAIR SCOTT: Yes.

MR. SCHORSKE: That's great.

CEC VICE CHAIR SCOTT: And then I see, also,

that I have a question from Commissioner Shiroma and from Neil. I'll get to you in just a moment.

Please go ahead, Richard.

MR. SCHORSKE: Well, yeah, I'd second Haresh's emphasize on standardization for sure. I just wanted to add two other points. One is that a performance standard for utilities on interconnection that requires a decision within a very short time frame would be enormously helpful. I think to put some pressure on utilities around a 30-day window, or something like that, aspirationally perhaps at this point, but there's no reason we should have many months of custom engineering behind analysis behind every microgrid once we get, you know, the processes in place.

And another item is I really want to commend the Commission, the CPUC for the suggestion around auto-islanding as a requirement for 10 kW stationary storage installations that opt for residential, and integrating that. And I think we're coming to a world really quickly where solar and storage are always going to be deployed in tandem. But even when they're not, having self-consumption of solar be standard through an auto-islanding requirement for solar, as well as for storage, I think is within reach technically, and economically, and would give us a lot of resilience benefit. Even in

the absence of storage, just to have solar self-consumption in the event of an outage would be a big boon from where we are now.

CEC VICE CHAIR SCOTT: Great, thank you. And then, I think Neil was next, and then Commissioner Shiroma.

CAISO VICE PRESIDENT MILLAR: Hello. Thank you. Actually, I think my question would be more for Haresh, but if someone else wants to jump in that's fine.

It just looks like with the economies of scale, even with the prices falling, there will always be an advantage for some economy of scale of having the resiliency provided at some sort of community or neighborhood level as opposed to residence by residence, which I have to admit seems more like a luxury item as opposed to something that can be -- that people can afford on average.

So, would you see more effort being going into managing these community-based efforts or do you see the residence by residence being the logical approach?

MR. KAMATH: We see -- well, obviously, there's room for both. And what we would like to see in the future is some coordination such that residential systems and the systems that are installed even on commercial and industrial locations can be used together

with community resources. And when we talk about community resources, you know, we're talking about installations on the front of the meter that are, you know, managed in some way. You know, some sort of a local control.

There's a lot of technical challenges that have to be addressed before we can get to that point. But, you know, that's -- so, those things are relatively straight forward.

One of the things that I should point is that, you know, from a regulatory stand point there are incentives in place for behind-the-meter installations that, you know, community assets don't have. So, that's one of the things that we've observed is, you know, it favors the residential and the CNI investment at the grid level.

CAISO VICE PRESIDENT MILLAR: Okay, thanks.

CEC VICE CHAIR SCOTT: Great. We'll turn to Commissioner Shiroma, please.

CPUC COMMISSIONER SHIROMA: All right, thank you. A comment, then a question. So, prior to coming to the CPUC I was an elected director at the Sacramento Municipal Utility District, SMUD, for 20 years. And during that time I think the peak energy usage was in the summer of 2006, and we had just built a 500-megawatt

natural gas-fired power plant and had started it up. And if we had not had that power plant, we would not have been able to cost effectively take care of the peak. We would have had to purchase extremely expensive electricity, and so forth, and so on.

Anyway, it started a dialogue at that time of what was forecasted ahead. And our staff came to us and said that there are about 40 hours a year during the summertime when it's really expensive and we can't be building another 400-megawatt power plant to cover that short period of time. What do we do?

Well, we ended up investing substantially in energy efficiency, and so forth and so on. Okay.

So, my question to whoever wants to answer this is has anyone looked ahead at the growth expected homes and commercial in the next 5, 10, 20 years and whether it's more cost effective to invest in, say, a microgrid option versus more conventional sources of electricity? This might be a question for academia, or for EPRI. But say for the City of Lancaster, are you looking ahead to the viability of your community? Has anyone done this kind of analysis?

MR. CAUDLE: Yeah, and I think it's obviously a factor of the cost of energy and your electric bill with the utility, and the cost of technology. And I think

eventually those are converging, right, to be cost effective. So, the cost of energy is going up, as we all know, and the cost to deliver that energy is going up, and the cost in technology's going down. Eventually they're going to meet, right, where that technology from a price perspective is going to be equal to connecting to the grid.

And I think that's what we're working on with Richard's group is saying is there a way, from a community basis, from a community scale to be resilient, but also be cost effective? Is it possible to behind this meter as a group, a society of homes, in this case we've got 164 and 78 homes, on that micro scale. Is it possible to do that and be cost effective, and more affordable than the incumbent utility?

So, we hope to prove that. And I think that's what we're looking at. And I think that's some of the questions that are going to be answered through our projects are is this viable today or, as you look at technology decreasing and costs increasing is it going to be viable two years from now? Is it going to be viable before 2030 where, you know, we may not have that problem.

And that's really, hopefully, what we're trying to design? I think are we early today? I think we're a

little early. But is it around the corner? It is absolutely around the corner where it will be more cost effective to be off grid or islanded, than be connected to your incumbent utility.

MR. SCHORSKE: If I could --

MR. DAMATO: I'd like to also --

MR. SCHORSKE: Go ahead, Giovanni.

MR. DAMATO: I was just going to jump in and say, you know, with the microgrid analysis piece they started off with -- a key premise for the cost benefit analysis that we do is looking at the conventional alternative and comparing it to the microgrid solution or portfolio of DER. So, that's really the basis, I think, of your question there, Commissioner. And that is the approach and the framework that we take when we're looking at answering the question of which solution is more cost effective.

MR. SCHORSKE: And in terms of just the overall system, I would suggest that looking at the flexible load management and DR program expansion into the residential segment, and just making that a more user-friendly offering for customers, both CNI and residential is a big piece.

So, for example, right now we could do a residential thermostat program for maybe $150 a year,

where a resident will allow, you know, the Nest, or the LSE, or whoever it is that's operating that program to shave a couple of degrees off their AC in peak times in return for a free smart thermostat, or a couple of hundred dollars a year, or both. And that's a very, very cost efficient approach to peak load management versus either microgrids or centralized generation where it's -- you know, where it's proven to be effective. But there's huge leverage and head room in the DR programs that are available to folks. And we're working with that, as well.

MR. KAMATH: If I could briefly comment. One thing I will say is that, you know, what we've found is that scale solutions are almost always lower costs, at least in principle, than redistributing solutions. Distributing solutions can be effective, however. And a lot, you know, a great deal depends on what customers want and what customers are looking for.

We think that some combination of centralized generation and distributed generation makes a lot of sense in the future. And certainly, I think in the future integrated resource planning needs to incorporate aspects of both as we -- you know, as we see what the best way to make our energy investments are in the future.

CPUC COMMISSIONER SHIROMA: Thank you.

CEC VICE CHAIR SCOTT: Thank you. Do I have other questions from my fellow dais mates?

Okay, I see that we have just a few minutes left so, maybe, Giovanni, I'll turn to you. Is there a burning question you have for your panel that didn't get asked or answered?

MR. DAMATO: Well, we might have one, you know. I have one set off for Jason. And this is kind of a question where you have some flexibility here to answer. And that's, you know, you mention that as a CCA, you know, a unique position to address solutions for PSPS. And I'm curious, you know, if you had more time from your presentation what would you like to kind of dive into more on what unique aspects you have in more detail?

MR. CAUDLE: Right. Well, and I think it comes down to the conversation we had about resilience and the project that actually we're working on in Lancaster, is this idea where you have these islanded neighborhoods that are -- and I wouldn't say that's unique to CCAs, specifically, but it's unique to LSEs is their ability to behind-the-meter manage these assets separately, as a community.

And, you know, those authorities we have are

taxing, right, and legislative. So, we have the ability in neighborhoods, as cities, to go in and mandate the resilience component associated with the development standard. And then, we have the ability to assess a special tax associated with that. Those are two things that the utility can't do, that nobody can do -- well, the state can. But on an individual level that only local government can do.

So, when we look at these neighborhood-based systems, if controlled locally there are greater opportunities for resilience through the PSPS.

There are also, as we look at that financial leveraging, if there's a way to leverage that revenue that would traditionally be going to the utilities, right, is now going to the system, right, the system of resilience, whether it be flywheel, battery, solar, storage, and the infrastructure as part of the development, you then start seeing a financial metric that might really work to the future. So that any new development is designed this way.

And I guess it's maybe it's the Hippocratic oath is -- well, I don't know if this is the Hippocratic oath or whatever it is, but do no harm. Right, we've obviously got a problem now. How do we stop doing -- how do we stop creating what we've created? Is being

honest and saying is there a better way to do it now for the future, and that's what we're trying to get to.

MR. DAMATO: Great, thank you.

And this one's for Richard. Yeah, you briefly touched on the master meter concept and I'm curious, you know, what are your -- if you could future cast or predict, what do you think are some of the high level impacts? If your project is able to implement that, how will that affect projects as we go forward in California?

MR. SCHORSKE: You know, I think there's a lot of concern everywhere in the state about the PSPS events, and the wildfires, and the added scenarios and just the overall stress of the grid on a warming environment. And I think, you know, PG&E has said publicly that this is going to be a problem for ten years. And I assume it's going to become an increasing problem in the southland.

And so, to be able to say to a homeowner we've got you covered, we've got your whole neighborhood covered, and of course at the city level to be able to say, you know, we're building toward a very resilient and sustainable city, I think those are really great selling points for both, you know, developers and for city leaders who are competing for the business.

And so, I would say being able to codify and streamline what it means to have a master-metered development, and have that be a more standardized offering for any load-serving entity, any CCA, any city, any developer, you know a variety of entities can get into this game. But having those rules clarified and streamlined for everybody would be super helpful.

MR. DAMATO: Great, thanks Richard.

And Haresh, this kinds of builds on that. You know, your last slide talked about community level resilience. Are there any key barriers you want to talk about, you know, on the technology side to build on what Richard just talked about?

MR. KAMATH: Yeah, and I think, you know, just from a technology perspective we still have to do some of the work in terms of developing effective controllers to be able to orchestrate, you know, a large number of inverters to actually work together to produce resilience at a community level. But, you know, that's a matter of engineering.

There's also the question of simple adoption. Right now we have a larger number of solar inverters than we did before. Solar inverters are not grid forming; they are grid following. There are some terms that we're going to become very familiar with in the

next few years, just as we've become familiar with the term smart inverter in the last ten years. And increasingly what we're going to be asked -- you know, what's going to be asked to happen is that we switch over to grid forming inverters, backed up with energy storage, along with your solar, to actually be able to provide end solutions. Not only at the home level, but in the community level.

MR. DAMATO: Thank you. I think we'll move to Mike Gravely.

CEC VICE CHAIR SCOTT: Yep, that's what I was about to say as well. We want to be interactive and we have some questions that have come in from the folks who are listening in.

Let us turn to Mike and he'll ask those questions to us.

MR. GRAVELY: Okay, so we have two questions that are pretty high on the vote. So, I'll give you the first one. And we've talked about this topic just quite a bit here. But the ultimate question is what regulatory innovations would have the greatest impact on the ability to serve multiple residents for the block scale, or neighborhood scale generation versus the individual?

So, I guess we've talked about the different

opportunities. But the question here was if there were regulatory interventions that would encourage, I guess, the bigger scale versus the individual scale what would you see.

And any one of the panel members or all of them could address it, but I think this is a topic we've talked a quite a bit about so it's clearly an area. So, I guess the question here becomes, as we are a regulatory agency, what innovations could be considered in the future that might make these consolidated systems more agreeable with the current regulatory environment?

MR. CAUDLE: You know, I guess, let me address that real quick. I think when we look at the project we're working on that relates to kind of this mobile home, you know, behind-the-meter concept is, you know, we envision that behind-the-meter -- this is the irony of it, we envision that neighborhood being connected to the meter because of resilience, right. In case the solar system, the flywheels, and other things don't work, we have that resilience.

We hope to test that there's very little energy, if we can design it right, and that's the real puzzle, is there's very little energy going to be running through that meter. Only if there's some design flaw or something happens within the system behind that meter.

So, I mean in that setting, if you're able to create an islanded area, right, a neighborhood that is financially and technologically independent, you may not even need that meter so there isn't any regulatory challenges.

I think the regulatory challenge comes when you try to connect to that grid and how that functions. And I think that's what Richard's message has been is that there -- if we could solve for that problem, you know, cities have the opportunity to manage all the infrastructure beyond that meter for that neighborhood, no different than we manage their sewer, water, cable, streetlights, everything else that's associated with that neighborhood, there's no reason we can't manage that same infrastructure behind that meter.

I don't know if Richard wants to add to that.

MR. SCHORSKE: No, I think you said it really well, Jason. And, you know, right now we're in a situation where going fully off grid, you know, is not quite as economical as getting those last, whatever, 10 percent of electrons or those peak electrons from the grid. And we're really pleased that in Lancaster there's a hundred percent green product, so we can continue to be zero net emissions, even if we're working with grid-based electrons. But I think, you know, we're

getting close, maybe in the next ten years where these developments could be fully self-sufficient and off grid as the prices of both solar and storage continue to decline.

So, I think it's kind of the next ten years is like can we work out, you know, a modus vivendi with all the entities to say can we be behind-the-meter with a master meter configuration, and these community DER assets. And that's where we're trying to work out a happy medium right now.

MR. GRAVELY: Okay, thank you very much. There's just time for one more question and it has several thumbs up, so I'll just address it. So, obviously, California's leading the nation right now with the number of electric vehicles and there's a large number expected in the next five years, and certainly more than that later.

So, the question is just the aggregation of these electric vehicles obviously is much larger than any battery system we have right now installed. So, what planning or what regulations would help us try to leverage these assets? Obviously, a lot of them will be residential assets, not at all at fleets. So, I guess just from your perspective of as we get more and more electric vehicles in California, how do we turn them

into a grid asset as opposed to just a grid load?

MR. SCHORSKE: I'll just throw in a couple of things. I think having bidirectional chargers become more of a standard in workplaces, and elsewhere is great. And we're starting to see, you know, this product from this company, Ossiaco, that I mentioned, for 5 grand to have a bidirectional fast charger is a major breakthrough in price and would enable -- you know, as those prices become routine, I think that enables bi-directionality with a high rate with energy transfer. Like this one is, I believe, 40 kW. So, with 40 kW of continuous, you know, energy both ways you can really do a lot for the grid and you can also -- there's a number of technical innovations to avoid battery degradation in that context that are important, and will really help the whole VGI ecosystem to develop further.

MR. KAMATH: I'll just really quickly point out that, you know, there are some technical challenges with respect to, you know, after coordinating all of these assets, especially customer assets. It's always the question as to whether or not the customer really wants to use their asset this way, but presumably they do.

You know, there are some challenges in just orchestrating this, making sure that you can handle this but without compromising the need for people to actually

use their electric vehicle for their primary purpose, which is for getting from one place to another.

All of that said, you know, I think one of the major challenges is agency. You know, you've got several different organizations or groups of people. You know, you have the vehicle owners, you have the vehicle manufacturers, you have the grid, you have, you know, all of the stakeholders in this and they all have to agree that this is a good idea. And they just hook it up and despite, as has been already pointed out, a slightly higher cost of having vehicles that are set up to this and having them operate on the grid.

MR. GRAVELY: Okay, thank you very much. I think I'll turn it over to Vice Chair Scott, so we can prepare for the next panel.

CEC VICE CHAIR SCOTT: All right, that sounds great. Thank you so much, Mike, for reading some of the questions from our participants. So, thank you so much Giovanni, Jason, Richard and Haresh. I really appreciate you taking the time to lend your expertise to us today and bring us this really great information.

So, Panel 1 may turn off their cameras if they like. Also, my dais mates as well. And we will turn it over to Heather to get us kicked off for Panel 2.

MS. RAITT: Okay, thanks Vice Chair. And

actually, just as I may, a moment before we go to our next panel, ask folks to let us know if they play on making comments during the public comment period. Just go ahead and press that raise hand icon if you're on Zoom, and press star 9 if you're on the phone. And that just helps us plan for the afternoon.

And with that, we can move on to our next panel on Emerging Technologies to Extend Islanding. And the moderator is Elisa Wood. Go ahead, Elisa. Thank you.

MS. WOOD: I seem to be having some kind of problem here with our sound. Can you hear me?

MS. RAITT: Yeah, we can hear you, but there is a bit of an echo.

MS. WOOD: How's that? Can you hear me? We're having a bit of a technical problem here. I don't seem to be getting through. Still no sound?

MR. BROUWER: No, we can hear you Elisa, we can hear you.

MS. WOOD: Okay. Okay, wonderful. Good. So, welcome. I'm Elisa Wood. I'm the Editor-in-Chief of Microgrid Knowledge.

We can go ahead and put up the first slide there. We are a website devoted to all things microgrid. We've got about 3,500 free articles on our site. And we've got the largest white paper library in

the world on microgrids as we speak. So, come visit us. You might learn some more about microgrids.

We also had a conference last month, a virtual conference, which drew about 2,100 people from around the world, as well as, you know, the dogs, and cats, and kids who also kind of jumped in there occasionally. But it reflected just how much interest there is in microgrids now. Very exciting for us.

You know, what's really fascinating is in the five months that we've been up and running we've noticed that California really is an epicenter of microgrid innovation, policy, growth. It's just fascinating to see what the CEC, and the CPUC are doing. We really appreciate it. And I feel incredibly honored to be here, to be able to participate in this really rich workshop that they've been holding this week. So, thank you everybody who's been involved in this. I've really enjoyed it tremendously.

So, let's get to our wonderful panel that we have here today. I'm going to introduce our three speakers. We have Alex Morris, who is from the California Energy Storage Alliance. We have Jack Brouwer, who's from the National Fuel Cell Research Center. There's Jack waving his hand. We have Julia Levin from the Bioenergy Association of California.

So, we will get started, now, with the presentations and then as we start before the Commissioners, they'll ask some more of their really interesting questions. I really enjoy those questions.

So, let's get started then with Alex. Are you set to get going, Alex?

MR. MORRIS: Yes. Hello Commissioners, thank you for having us today. I commend you for having what I think is a very important --

Okay, is the sound quality okay? I think it's clear now, okay.

Great. So, I'm from the California Energy Storage Alliance. I have provided some slides which I think could be brought up as well. And in the slides you'll see a little bit about the California Energy Storage Alliance and how we represent close to 90 companies doing energy storage development or support in California. And, naturally, the role of microgrids has come up quite a bit for energy storage.

And I think a key dimension to it is, you know, how can storage help with not only microgrids, but address customer impacts for the public safety power shutoffs that are occurring.

And so, we've been doing a fair bit of work on many fronts on this issue, including through direct

proceedings with the Commission, the Energy Commission and the Public Utilities Commission. It was good to hear some of the remarks from earlier about how from a customer's point of view, it would be easier if we had faster interconnections, more tools in our toolkit, remote disconnects, and things like that. So, I'll speak to some of those issues now.

I think the larger arc of what I wanted to express today, and I hope there are questions on it, is that we have been doing modeling and we know that the amount of storage we're going to need in California is vast. You know, somewhere between ten to forty thousand megawatts of storage. A lot of that storage can be behind the meter, or it can be in front of the meter. It can be part of a microgrid or just part of the larger grid.

And so, in light of this massive transformation we're going to undertake for the grid, I hope we can think smartly about the roles for storage.

And I also wanted to acknowledge that -- two things from the Energy Commission folks. You guys are doing a great job of helping strategically target pilot funding to add to our toolkit, particularly with some of the long duration work you've been helping fund lately. I know Mike Gravely can speak a lot to that. But I

think it's really smart what you've been doing.

And then, also, I think this IEPR workshop is really great because one of the challenges we've faced, as Commissioner Shiroma knows, is that the public safety power shutoffs showed up and they hit us very quickly, us as Californians. And it was -- we felt -- I think many of us felt we wanted to do something and we all rushed to try and do something as quickly as possible. But a lot of it was, at least initially, ad hoc. And I think over time, especially with the IEPR we can develop comprehensive strategies for rolling out microgrids and addressing PSPS in a way that's principle -- balances between utility investments or other solutions, and whatnot.

So, that's kind of the arc of my remarks. And I'll just speak a little bit about how we're seeing interest from the storage side to pursue and target microgrid opportunities to help address California's needs.

Just about CESA, you know, quickly we're based in Berkeley. I haven't seen my office in months, so I'm posted up here in the Alps. Just kidding. I'm based in Sacramento and, you know, often work with our key agencies here, trying to help energy storage be part of the electric power system here to support for a clean

energy future.

We represent almost every energy storage company that's involved in California, as you can see from the next slide. We have a lot of the big, most serious companies, and we also have a lot of the emerging technology companies. And hydrogen companies are part of the emerging tech group. Some of the hydrogen efforts, which often focus on long duration storage are targeting, you know, new -- targeting long duration storage through big company deployments, but then also we have the emerging guys developing it.

So, let me jump straight to how we enable more microgrids. I've already mentioned that we know the CEC in storage can play a role here, and that's great, and that we're going to have massive storage needs. So, I think some of the near term actions we can pursue are continue to get more storage and more long duration in our toolkits. This can take the form of using electric vehicles, lithium harvesting in the state, or just continue the incubation of long duration technologies. You can see this on the next slide.

Some no regrets ideas would be to support a fast interconnection or fast additions of storage to existing solar.

And then, we also think there's a lot of value

in small technology improvements like remote disconnects that leverage the already existing utility metering infrastructure. And a good example of this is a small company called Connect California that uses a remote disconnect, and then an EV power source for a home. It's very, you know, clean and simple, and probably available, you know, really quickly. So, I just throw that out as an example of where clever experts are looking at how to very cost effectively add resiliency benefits. In this case it's through an electric vehicle, but it also could be from allocated storage. And it tries to work around some of the cost barriers of the more heavy-handed utility interconnection or of, you know, subpaneling and whatnot. So, it's a pretty neat solution that I think is on the table and I'd like to see that reflected in some of the thought work in the IEPR.

And then, finally, the strategy for microgrids could be honed and sharpened in the sense that, you know, microgrids is a term that's often used broadly. But, you know, a customer's resiliency needs, an individual customer may differ a lot from a campus. And so, we really need a strategy that addresses these different sizing and density groups. And I think once you go down that path, you very quickly see where and

how we may want to allow private microgrids to be fast tracked, and then where that may be economically rational.

And so, that's the type of strategic thinking I hope we see and I hope CESA can credibly support these discussions. So, thank you. And I'm open to any questions, Elisa.

MS. WOOD: Thanks, that was great. And thank you for the work that CESA is doing.

Next, we'll turn it over to Jack.

MR. BROUWER: Thank you very much. I appreciate your invitation and giving me an opportunity to speak here and focus my discussion on fuel cell microgrids.

The next slide, please. So, fuel cell microgrids are currently in use in many jurisdictions around the world. And in particular, in the Northeast we have fuel cell-supported microgrids in the town of Woodbury, at the University of Bridgeport, and in a disadvantaged community in New York, the Marcus Garvey Village, in Brooklyn.

And so, for example in Woodbury, this utility microgrid is actually serving a high school, a state facility, a police department, a fire station. It's one of those community microgrids that we were starting to talk about in the previous part of the panel discussion.

And fuel cells have this opportunity to do that because they have very high power capabilities to power a whole community.

And this is an example in Connecticut. Also, the Marcus Garvey Village is a very interesting microgrid that incorporates solar, and fuel cells, and battery energy storage, all three of these working together with the fuel cell providing that grid signal that was talked about earlier, right. So that when the grid goes down, the fuel cell serves as the grid signal and the solar and batteries can stay grid connected and serve that community during an outage.

Also, because the fuel cell can run continuously, you'll notice in the chart here that more emissions savings are attributed to the fuel cell installation than to the solar itself, because of this continuous operation.

The next slide, please. So, how do these fuel cell microgrids work? They work in both grid-connected and in islanded mode, with fast switch gear to enable the fuel cell microgrid to run seamlessly through power outages.

So, for example, on this diagram that you see here, this is an 800 kilowatt fuel cell that continuously provides power to an elementary school, to

a branch library, to a senior center, and to a charter care health center. During normal operations it is providing the majority of the power and it's grid connected so that power can flow back and forth to this community.

When the grid goes down there are fast switches, and these are indicated by the orange switches that you see here, that enable this same fuel cell to then support an adjacent store and gas station. Essential services during the time of an outage, like a PSPS event, or a wildfire, or earthquake, or storm.

The next slide, please. And they've proven this resilient operation in these communities, serving communications facilities, like telecommunications facilities, keeping them up and running for long periods of time during natural disasters. Starting here, with the fires down in San Diego, a Doosan fuel cell was able to do that.

The winter storms in 2011 and 2012, 23 Doosan fuel cell systems were able to seamlessly transition their loads, including some telecom stations, okay, from operating on the grid-connected mode to continuously operating through this storm.

Also, you can see in the very last couple of instances here, the Ridgecrest earthquakes, the Napa

earthquake in 2014, these fuel cell systems, operating with natural gas or biogas delivered through that system were able to run through earthquakes as well.

The next slide, please. And these systems are being built in very large fuel cell systems, up to 59 megawatts in size. So, they can serve very large communities. And they're being installed in places that have strict air pollution requirements, and in disadvantaged communities that are already exposed to too much pollution.

So, these non-combustion resources, complementing the solar and battery energy storage, are enabling this sort of a community level support of microgrids.

And let me mention one last thing with regard to this, and it is that these locations where PG&E is establishing interconnection points for diesel gensets, instead they could install these sorts of large scale fuel cell systems that could provide both primary power and backup power at those sites.

The next slide, please. The last point I want to make is that when we invest in these fuel cell microgrids, we are not investing in natural gas. We are not investing in fossil. What we are investing in is an electrochemical energy conversion device that today may

operate off of fossil. Today it may operate off of renewable hydrogen. But that all of these systems, like those that are used at the Stone Edge Microgrid that you heard about earlier, okay, those currently operate on renewable hydrogen, and so do all these backup systems that are serving the telecom sites. But these same systems that are operating today on natural gas and biogas can also be operated in the future on the renewable hydrogen that is required to complement the sun, wind, and batteries.

Thank you for your attention.

MS. WOOD: Thanks Jack. Those are fascinating projects. Appreciate that presentation very much.

Next we have up Julia.

MS. LEVIN: Thank you. Good afternoon everyone and thank you for hanging in there.

So, I'm going to -- I guess I'm the last speaker, so I'm going to sort of wrap it up with a common theme, which is the need for more diversity in microgrids. In any complex system, diversity equals reliability and that's particular true in our energy system.

The next slide, please. So, how bioenergy adds diversity, well bioenergy can add diversity in a number of different ways. It can provide flexible generation

and baseload power. It provides the only carbon negative fuel for the grid. It can be as much as 500 percent lower carbons than solar or wind. It can provide long duration energy storage in the form of biogas or renewable hydrogen from bioenergy. It can provide liquid or gaseous fuels for backup generators, and renewable hydrogen for fuel cells.

The photo at the bottom actually is a fuel cell combined with solar at UC San Diego.

I want to go back to the backup generators, though, because this has come up a number of times today. And I want to agree with several of the earlier presenters about the need to move away from diesel as fast as possible. And you can do that with a fuel cell, as Jack described. You can also do it with a natural gas backup generator, which is still 90 percent lower NOx emissions, 99 percent lower particulate, and two to five hundred percent lower carbon emissions than a diesel backup generator.

So, there's just really no reason in 2020 and beyond we should be installing more diesel backup generators.

The next slide, please. California produces a lot of organic waste from agricultural and livestock waste, urban organic waste, forest waste that has to be

removed for wildfire mitigation, as well as biogas from landfills and wastewater treatment facilities.

The next slide, please. All of that organic waste together could provide about 20 percent of the state's electricity. Just as importantly, every community in California produces organic waste. This is a slide from a recent report by Lawrence Livermore National Lab. Every community has wastewater treatment, landfills, food waste, yard waste, all of which is local energy source, can provide local energy security.

The next slide, please. And we already have a lot of facilities that are doing this around the state. Wastewater treatment facilities, waste transfer stations, dairies, landfills. And if you look at some of these slides, you can also see that this a form of energy storage. Biogas can be stored. In fact, it's part of the process. But it's produced and can be stored in these large tanks. So, this is a way not only to provide local energy, but local energy storage.

The next slide, please. And I want to give two specific examples because I think we can all agree that the military provides an essential service, along with many of the other services. And two of the microgrids that we already have operating in California are running in part on bioenergy.

So, in San Diego County we have a Marine Corps Air Station with a 20-megawatt microgrid that includes 3.2 megawatts of bioenergy from a local landfill gas. And that helps the air station to keep its critical services running during a power shutoff.

The next slide, please. In Monterey County, a U.S. Army Base, Fort Hunter Liggett, the U.S. Army has both a zero net waste and a zero net energy goal, mostly for troop security reasons. So, the Fort Hunter Liggett Base is converting the waste that is produced onsite, on the base to both electricity and vehicle fuels. And this is going to become a model for the military all over the world, again, for troop protection as much as for environmental reasons.

The next slide, please. So, this is my last slide and I just wanted to end with a couple of recommendations that I think are really critical as we move forward on microgrids.

The first is for a longer term microgrid tariff. We really need a tariff that not only emphasizes a diverse portfolio, but requires it. And particularly requires flexible generation and long duration storage. We will not have long duration microgrids or reliable microgrids if we don't include flexible generation and long duration storage.

We also need pricing mechanisms that account for all the additional grid services that fuel cells and bioenergy can provide, as well as some of the upstream benefits like reducing carbon upstream, reducing wildfire risks and things like that.

We really need to focus on renewable resources. As I said earlier, there's just no reason to continue using diesel at this point and we should be moving away from it as fast as possible.

Finally, there is an interconnection proceeding going on at the PUC that's been talking a lot about anti-islanding recently. And I think it's very important that that proceeding be included with the microgrid proceeding for measures to protect against an unintended islands, don't also make it harder to have intended islands, which are microgrids.

So, these two proceedings really need to be coordinated. Thank you very much.

MS. WOOD: Thank you, Julia. That is -- we've been hearing a lot about bioenergy and RNG, this is also called, I think, and is acknowledged these days, so really appreciated that presentation.

Now, we are going to turn it back over to the Commissioners and questions that they may have.

CEC VICE CHAIR SCOTT: All right. Well,

terrific. Yet another exciting and wonderfully chalk full of information panel here.

As the dais mates please turn your cameras back on, and also panelists, please keep your cameras on as well for our conversation.

And before we open our conversation up for questions, I do also want to make the reminder that if you are one of the participants out there in the audience, and you would like to make a comment at the end of our workshop, please use the raise hand feature. And that let our IEPR team know that you'd like to make a comment when we get to that section.

But for right now, let's open it up to questions from dais mates. And again, I have a whole list here, but I'm happy to start with Commissioner Shiroma or with Neil.

CPUC COMMISSIONER SHIROMA: Neil, I'm going to let you go first.

CEC VICE CHAIR SCOTT: Well, I put you on the spot. I can ask my question, too.

CAISO VICE PRESIDENT MILLAR: No problem. Actually, as we're going through the presentations, a lot of the challenges for the microgrids actually do seem appropriately named to just be a microcosm of the same issues that we're looking at the grid overall, with

more grid-connected solar, more grid-connected batteries now emerging as well. But those solutions alone are still not getting us past the multiple rainy day, cloudy day periods where the solution for now continues to rest with counting on the existing older, gas-fired generation fleet. And I expect that will continue to be as a backup solution until a better solution can be put in place.

Now, when I was looking at these microgrid alternatives, anything moving away to a longer duration than one or several days that could be accommodated with battery storage seems to involve some technology that's totally capable, but does it just boil down to price? Is that what keeps us from moving into some of these technologies beyond solar plus storage as a way to accommodate being disconnected from the grid for a longer period of time?

MR. BROUWER: So, if I may respond to that. The fuel cell technology that I was talking about can be deployed commercially today, and at reasonable prices, prices that end up saving the customers in their electricity prices. Because remember, these are not just backup resources, these are resources that run continuously, displace otherwise purchased grid electricity, and then seamlessly transition to also

provide the backup power that's required.

But this is the case for natural gas operation today, in a way that reduces criteria pollution emissions and greenhouse gas emissions compared to the grid, but that cannot be the final solution. The final solution must be renewable gas going to these facilities. And biogas is one of the solutions. That's what Julia was talking about. And renewable hydrogen has to be one of the solutions. And that's how the system must evolve, from my perspective, to deliver that kind of resilience for weeks on end, or seasonally transfer some of that electricity.

Now, again, the batteries are probably a better resource for the short duration, right. So, if I'm just going to do the evening peaks, I can do all that shifting I want every day, you know, with a battery.

But the solution to get all the way to zero needs something like fuel cells and hydrogen, and biogas.

CAISO VICE PRESIDENT MILLAR: If I can just ask one --

MR. BROUWER: Because biogas has to be with us all the time, right. We have to deal with the biogases anyway, we might as well use them for these really important resiliency features we need.

CAISO VICE PRESIDENT MILLAR: Just taking that one step further, then, what keeps us from moving to that next step? Is it just the lack of requirements for that extended coverage beyond what batteries -- and I totally agree that the solution here isn't one or the other, it's all of the above. That they all help to work together to play a comprehensive solution.

But some of these solutions are only tapping out at a day, maybe two days of coverage.

MR. BROUWER: So, I want to make a suggestion, right.

CAISO VICE PRESIDENT MILLAR: What's the barrier to move forward to a longer-term solution?

MR. BROUWER: I showed several examples of what is going on in the Northeast, in Connecticut, New York, New Jersey, and other jurisdictions. And the key thing that has enabled that is something like what the PUC is working on now, right, which is to establish a microgrid tariff that allows these kinds of certified resources to be used behind the meter, and to serve adjacent customers, right, in a community setting like this. Or, for PG&E to instead of installing these diesel gensets in these locations where PSPS events are going to happen again for the next ten years, we can start to install fuel cell systems to meet continuous power, and backup

during PSPS events.

This is a novel way to think about it, though, because they're thinking of only putting in things that will operate, you know, 40 hours a year. Right, you have to think of this a little bit differently to enable the solution that we've just been talking about.

MS. LEVIN: So, I'd like to add to that. I think -- I totally agree with your question, Neil. I think we need all of the above, as long as all of the above is renewable. But I think to get there, because we've seen in the broader RPS, you know, huge growth, but almost entirely solar with some wind, and a smaller amount of batteries because of the Energy Storage Portfolio Standard.

I think where we start to see more diversity is in a program like the ReMAT program that has carve outs for different operational benefits.

So, there are sort of two ways to ensure that microgrids are diverse and renewable going forward. One is to address the pricing mechanism, because I don't think we're very good, yet, at valuing all the attributes of flexible generation, and baseload power, and longer duration storage. They're going to need to receive a higher price, as they should because they

provide higher and unique benefits.

That's complicated, though. So, honestly, I think the easier way to do it is to have carve outs for different operational benefits. Not specific technologies or fuels, but say, okay, some percentage of microgrids needs to be -- or, some percentage of storage needs to be long duration. Some percentage of generation needs to be flexible generation, some percentage needs to be baseload so that we get all of the attributes we need for longer duration reliability, which is really critical.

I think, you know, we've heard a lot of examples today of microgrids that have been great for a day or two, but we're looking at PSPS's that could be a week or two. We're looking at rainy seasons, or earthquake damage, or other events that could require microgrids for much longer. And the grid, in general, for much longer is going to need long term renewable storage.

So, I think either we need to deal with the price issues or we're going to need, you know, a very specific portfolio approach.

CAISO VICE PRESIDENT MILLAR: Okay, thank you.

CPUC COMMISSIONER SHIROMA: And this is Genevieve. If I could sort of tag team with Neil. So, first of all a few things. Now, in our scoping memo

that we issued from the CPUC last Friday, we do include -- this is kind of long. But we do include that -- ensure that the separate rates and tariffs shall not compensate a customer for the use of diesel backup, or natural gas generation, except as either of those sources is used pursuant to section dah, dah, dah, of the Health and Safety Code, or except for natural gas generation that is a distributed energy resource pursuant to section dah, dah, dah.

Okay. Now, so -- and it's all world peace. Okay, so we realize that there are efforts in the near term and we've got wildfires, we've got PSPS's, but this statute also we're looking for the longer term of what microgrids mean to the California grid. And so, again, we've got that workshop coming up in August. The date's not set, yet, but we're looking for alternatives to diesel.

And what happened during the Track 1 is we were focusing on, substantially, utility scale, and for the wildfire season. So, we're talking about large, you know, large backup power, megawatt plus backup. And there weren't any immediate non-diesel options that could just plug and play for this coming fall, for the 2020 fire season.

Now, we are saying, look, folks, there's a

clamor to move away from this. What do you have? What can you show us? So, hence, many of you will be involved in those efforts.

Now, Jack, I think you're the one, you talked about some of the fuel cells in Korea, and so forth, 51 megawatts, and so forth.

MR. BROUWER: Yes.

CPUC COMMISSIONER SHIROMA: Yeah. Maybe you could talk a little bit more about that in terms of --

MR. BROUWER: Let me make -- yeah, very, very nice discussion, Commissioner Shiroma, thank you for that. You are correct that in the megawatt class a fuel cell backup option is not today commercially available. They are totally commercially available as a backup power plant only, okay, in the kilowatt class up to 10, maybe even 100 kilowatts. This is why the telecommunications, there's over 450 sites in California alone that are backed up zero emissions hydrogen fuel cell technology right now, okay. So, these exist.

If you want small backup generators, you don't have to install diesels. You can get a hydrogen fuel cell today. And it can be cheaper depending upon the duration. If you just have a long duration that's required, it's cheaper even than the diesel. So, this is a really important fact.

The larger systems that exist today are natural gas-fueled or directed biogas-fueled. These systems also exist today and are even being used at telecommunication sites, and could be used at these sites that you're talking about, these microgrid sites, or these PSPS sites that PG&E is putting together. But they have to have a different thinking of use it continuously and backup. It's not just a backup solution.

That's the reason why it kind of -- it doesn't quite fit into a backup-only solution. And you can make those up to 100 megawatts. They are utility scale fuel cell systems.

MS. LEVIN: But I think to Jack's point, to follow on that, and this goes back to the pricing issue, with renewable hydrogen or biogas, they can provide both storage and, then, either regular generation or backup generation. So, somehow, we're going to have to figure out how to add both of those values. Because I think what we're seeing under the RPS more generally is solar, which I believe supports. This is not an anti-solar comment. But solar's not there 24/7, so it requires backup generation, it doesn't provide storage, but it looks really cheap on paper. And per kilowatt hour of output it is, but not when you look at it on a

systemwide basis.

And somehow we have to figure out a pricing mechanism that gives double value to renewable hydrogen and biogas because they can be both storage and generation, including backup generation, and flexible generation which is the most valuable kind. We don't value them that way now, and that is a big barrier to entry in the market.

The other thing I want to mention, though, with biogas in particular is it can provide carbon negative power. And that's something else we don't really value on the electricity side. We do under the Low Carbon Fuel Standard, where it works on a lifecycle basis. If we treated renewable energy the same way, meaning we really valued how much it can reduce carbon, biogas would be able to compete quite well, as we're seeing on the vehicle side.

So, I think there are different ways that the PUC and the CEC could do this that would really more quickly accelerate the use of renewable fuels in microgrids.

CPUC COMMISSIONER SHIROMA: Very helpful, thank you. Go ahead, Vice Chair Scott.

CEC VICE CHAIR SCOTT: Yeah, thank you. Yeah, this is Janea. I was just going to say one of the

questions I have and it's on a slightly different theme than what we've just been discussing, but I'm thinking about it a lot because we just did -- the Energy Commission just did some great grants I think yesterday on long term storage, and also some studies in that space.

And so, one of the things that I'm thinking about a lot, are there any technology or research gaps that we need to be thinking about how do we address those, that you all see as we try to bring on more long term storage. And also, as we think through where are the right places to put different types of solutions in this space, right. So, as was mentioned, we might just need a little bit of short term storage and that could be a battery. And other places, like Stone Farms that we heard from earlier, we might want some longer term storage. Or, you know, as Jack has mentioned, we might want to think about it as power that's provided that can be both, both always on and also on as backup. Or, do we need to do more research in that space as we think about what does the broader grid at large look like as we make our way towards the 100 percent Clean Energy Standard, and we're weaving in these types of solutions. So, that's a pretty broad question but --

MR. MORRIS: Well, I can jump in Vice Chair

Scott. Hi, good to see ya. Yeah, I think the announcements you guys made yesterday are great. It's exciting to see how you're helping incubate our toolkit in those ways.

I think where CESA has recently undertaken some pretty substantive modeling using some very fancy models that, to Neil's point earlier, include kind of the multiple cloudy day scenarios. And so, it is indicative, also, of some of the challenges microgrids have where they need duration at times.

What we're seeing is that California has really large needs, such large needs that it seems very logical to say -- to make sure we're really ready and we've invested in the technology. And I can tell you from part -- you guys are doing part of that work.

There's also the financing side of it, which is also there's this whole downstream getting the support services ready, helping them build comfort and experience with everything, and then looking at the master plan of the grid. And I think to Julia and Jack's point, is it do we have the right levels of diversity? Are we valuing things properly and incentivizing things?

So, I think for the Energy Commission, just trying to wrestle with that financing hurdle is

something where I'm actively considering how to do that because I know there's a lot of next gen technologies that I think should be able to compete against some of the incumbent storage solutions. And part of their challenge is not to figure out the merits of their technology, but more on the financing and risk side. And I'm wondering how we, as a state, should address that.

And I think the way we attack, we approach microgrids will also prepare us for that future by essentially building the state's comfort with an array of technologies, or with stacking say a battery with a longer duration storage solution, and helping engineers and banks get comfortable with that. And helping, also, the ISO learn to feel comfort with that resource being available when it's called upon, et cetera. So, that's some of my thinking on that.

MS. LEVIN: Vice Chair Scott, I would add to that. I agree with what Alex just said and I would add to that. I think we do need to see a lot more demonstration projects that combine biogas and renewable hydrogen with fuel cells in different applications. A number of bioenergy projects, particularly in the forest sector and agricultural sector using gasification, would like to work with fuel cell companies, which really

hasn't been done yet in California.

But gasification produces a lot of hydrogen, so it's likely to be a really good match with fuel cells, and especially in rural areas that have a lot of forest waste, or agricultural waste. So, it would be great to see more demonstration projects in that area.

But I really agree with Alex, I think one of the things we're lacking in California is a good sense of where the portfolio needs to go in the coming years, so that we have the right mix of resources. I know it's impossible to predict perfectly, but I think we're going to have to do that more going forward as we, you know -- we've done the first 20 percent of the RPS, or we've gone from 10 to 35 percent, it's going to get harder now. And we don't want to overbuild things that will only be used 5 or 10 percent of the time because that's going to get really expensive.

MR. BROUWER: So, I agree with both of my previous speakers. I'm going to suggest that we also need to think even further into the future, and that's when you get to a place where something like renewable hydrogen, I think, offers unique capabilities and features that we will need to get to 100 percent on the grid.

One of those is long duration seasonal storage.

Another is massive storage, a huge energy amount, but only a small power amount. You know, when you get to these kinds of things, hydrogen offers those two kinds of features.

Secondly, I think we must think about what we want to do with the gas system. We absolutely can't use the fossil that's in it. How do we transition that? Do we just divest in it or can we do some research and development to repurpose it for use of this zero emissions resource in the future? It offers a tremendous opportunity for resilience, okay, not just bringing this renewable via wire, but via pipes also. And it is a massive energy storage resource already.

Most jurisdictions that have looked at this problem, like Germany, like France, like most of Europe, like Japan, like Australia, almost all of them have come to the realization that we must have hydrogen and fuel cell technology and this transformation of the gas grid in addition to the transformation of the electric grid.

And finally, I want to make this final point. Some end uses in industry that need feedstocks, that need high temperature gases, that need high density fuels, like ships, and aircraft, and these kinds of things, these will need I think a renewable hydrogen-

derived resource for us to go all the way to zero emissions. And these are like more futuristic ideas, but these are also worthy of investment by the California Energy Commission, the California Air Resources Board, and others.

MR. MORRIS: Yeah, and I agree. I totally agree that we should place strategic plans for considering all that stuff. At the same time, you know, what I said in my remarks earlier is we also have near term solutions like the example I used was Connect California, where they have this really small, simple tool to help use to power homes. It's not a forever solution perhaps. It's not a two-day solution. But maybe for the 80/20 rule, the vast majority of people affected, this could be a really quick, easy tool to enable some relief for them. Again, it may not work for everyone, but that's the type of low-hanging fruit maybe we should also factor in. And we could kind of differentiate it as low-hanging fruit versus long-term strategic investment planning. And I think if we had those two halves before us it would probably be, you know, a good start for us.

And Commissioner Shiroma, I mean you probably feel like you're already doing that, so thank you.

CEC VICE CHAIR SCOTT: Great, thank you. Let me transition to Mike Gravely, who I know has a few

questions that have come in from our participants to ask you all, as well. So, Mike, please go ahead.

MR. GRAVELY: Thank you, Vice Chair. There are two questions that have the most votes. I think with the time we'll probably try and answer those two as best we can.

So, Jack, the first question is for you in relationship to fuel cells and your discussions about how they lower emission profiles, lower than solar. In more detail can you explain that? And also, can you explain how fuel cells can achieve emissions and decarbonization goals?

I know you talked a lot about it, but just in that particular context.

MR. BROUWER: Yeah, let me try to be as quick as possible. Nitrogen oxide emissions are near zero or one-tenth of that which is required by law, okay. So, even operating on natural gas they have dramatic nitrogen oxide reductions in the places where they are being used, okay.

And the second thing is they operate 24/7, as opposed to only about 24 percent of the time if you're talking about solar. So, a 400-kilowatt solar system has only one-fourth of the kilowatt hours it delivers compared to a fuel cell system.

So, if you have renewable fuel going to fuel cell, it will provide four times the greenhouse gas savings as a solar farm does. So, it's really capacity factor that is leading to the larger emissions reductions associated with the fuel cell, when it comes to greenhouse gas.

And then, of course, criteria pollutant emissions is always going to be cleaner than the grid.

MR. GRAVELY: Thank you. And then, the last question actually is for you, Julia. And can you comment on the role of bio forest -- of forest biomass and microgrids, and they benefits they can provide above and beyond renewable energy?

MS. LEVIN: I'm not sure if I understand the question completely. But, so, California state law, and PUC regulations, and emergency orders from the past several years require forest fuel removal on about a million acres a year. And we're nowhere near that goal, yet, but we need to get to that goal as part of restoring our forests to a healthier state than they are now. They're full of dead trees, they are full of more biomass and it's natural because we suppressed fires for a hundred years. So, we have to more actively managed our forests. And as I mentioned, several state laws and emergency orders require that.

Right now, both CAL FIRE and the U.S. Forest Service have suspended prescribed fire in our forests because of the massive amount of air pollution it causes and the direct link between air pollution and COVID-19.

So, for the foreseeable future the only way we can get any of that excess fuel out of our forests, that and dying trees, is mechanical thinning. Once the material is out of the forests, according to the California Air Resources Board and the State Association of Local Air Districts, if you use it for bioenergy it is 99 or 98 percent lower particulate matter and black carbon emissions than a prescribed fire, 95 percent lower methane emissions, and significantly lower smog-forming pollution as well.

So, since state law already requires a lot of forest thinning and other vegetation removal around power lines and other infrastructure, once you've already done that there is no question that the best use is bioenergy production. But right now that means gasification, usually in electricity-generating facilities. But there's no reason that it couldn't be used to produce renewable hydrogen for fuel cells, or combined heat and power, or other things.

So, I mean back to the research areas, I think that that's something that we really need to be

piloting. Because forest communities are also some of the most vulnerable communities in the state to wildfire, and they are the first ones to experience PSPS events. So, not only would it help us reduce air pollution, and climate pollution, and get our forests back to a healthier state, but it could provide local energy for these very vulnerable rural communities.

MR. GRAVELY: Okay, thank you. Back to you Vice Chair Scott.

CEC VICE CHAIR SCOTT: Okay. All right, well thank you so very much. This was, I think, a very energetic and enlightening panel. I appreciate all of you taking your time to lend your knowledge and expertise to our dialogue today. So, thank you so very much for that.

We are going to transition now to public comment. So, panelists, you may turn off your cameras if you like, as may my fellow dais mates.

I will turn this to Heather to help lead our public comment section.

MS. RAITT: Thank you, Vice Chair. And, yes, so briefly just if you would like to make a comment there's some hands up. But if you haven't done so already, press the raise hand icon on Zoom. And if you're on the phone, just press star 9. And we have RoseMary Avalos

from the Energy Commission's Public Advisor's Office to help us through the public comments. Go ahead, RoseMary.

MS. AVALOS: Thank you, Heather. I'll first call on attendees using the raised hand feature on Zoom. Please state your name and affiliation, and spell your first and last name. Also, do not use the speakerphone feature because we may not be able to hear you clearly.

Chris Ball, you may need to unmute on your end. Your line is open.

MR. BALL: Great, thank you for the opportunity to comment today. My name is Chris Ball, B-A-L-L, and I'm on the microgrid team at Bloom Energy.

So, my comments are in response to the Q&A that we just had, where it was stated that diesel is the only option for long-term outages today. And the reality is, as Jack Brouwer demonstrated, that Bloom Energy's fuel cells have proven to be a viable solution for long-term outages, without the unhealthy air impacts that are associated with diesel engines.

So, we have 31 operational microgrids throughout California alone. And over the last two years we've protected California customers from over 100 power outages.

Specific to this discussion, Bloom microgrids

have powered customers through 65 power outages that were greater than four hours long. That includes a PSPS-related outage in Northern California that lasted for multiple days. So, for almost a full week we powered a multi-megawatt manufacturing facility with clean, reliable electricity.

And in the epicenter of the 7.1 magnitude Ridge Crest earthquake last year was nine miles from one of our systems. So, while the electric grid went down, the Bloom energy system and the natural gas systems were unaffected. And we can deploy these microgrids quickly. So, to support the state with COVID-related efforts, we deployed a microgrid at Sleep Train Arena in just five days.

So, what that demonstrated is that when public and private entities work together to solve a pressing need, be that COVID-19 or wildfires, the technology's fully capable of extremely fast deployments. Now, our speed is really limited by legal barriers, interconnection and tariffs, not any sort of technical limitations.

And because our microgrids operate 24/7 with or without the electric grid, they are cost competitive with existing energy costs. So, this means that our customers are not paying anything extra beyond their

normal utility costs, which is different from diesel, which is going to come in at an additional cost to their normal utility bills.

And, finally, the California Air Resource Board estimates that 70 percent of the cancer risk that the average Californian faces for breathing toxic air pollutants stems from diesel exhaust particles. So, diesel is not the only option for long-term outages. Like, we have clean options that are being deployed today and as Californians we should do everything we can to support these new technologies. Thank you.

MS. AVALOS: Thank you, Mr. Ball.

The next commenter is Laura Nelson. And please state your name and affiliation, and spell your first and last name. Thank you. Your line is open.

MS. NELSON: Hi, thank you. Good afternoon, my name is Laura Nelson, L-A-U-R-A N-E-L-S-O-N. And I'm the Executive Director of the Green Hydrogen Coalition.

I would like to thank the CEC, the staff, and Commissioners Hochschild and Shiroma for hosting these workshops, and also Vice Chair Scott and President Batjer for your leadership. And, of course, the panelists for their thoughtful presentations and insightful remarks.

We appreciate the leadership to advance

microgrid technologies and solutions, and recognizing the importance especially in critical communities.

The GHC is an educational nonprofit focused on facilitating policies and practices to advance the production and use of green hydrogen in all sectors where it will accelerate the transition to a carbon-free energy system. When we talk about green hydrogen, we're referring to electrolysis to convert renewable energy into hydrogen, and methods converting biomass or biomethane into hydrogen.

We believe green hydrogen offers a clean alternative to diesel and gas backup generators today, based on available technology.

In order to make this a reality, we need to send a strong regulatory signal to the hydrogen supply side of the market that the sufficient demand will be created in California to meet these microgrid and resilience needs.

The Green Hydrogen Coalition hopes to see action on additional funding for pilot and demonstration green hydrogen microgrids, and also authorized targets for investor owned utility procurement of hydrogen fuel cells. And we think investment in hydrogen storage and

infrastructure is also important.

Green hydrogen can provide a flexible and dispatchable clean resource, with longer discharge times than most commercially-available battery energy storage systems. We support all storage and think it is critical to the system, but long-duration storage can ensure reliability for microgrids without needing to over build and over spend on renewables and battery storage capacity.

We look forward to further collaboration with the CEC, and the CPUC, and all other stakeholders on accelerating progress and momentum for green hydrogen in microgrid applications. That concludes my comments, thank you.

MS. AVALOS: Thank you, Ms. Nelson.

We'll now move on to Robert Perry. Your line is open and you may need to unmute on your end.

MR. PERRY: Yes, hi. I want to thank the CEC and the PUC participants for this extremely critical workshop. I also want to thank the panelists for excellent presentations on a real critical topic. I'm a big believer in hydrogen and fuel cells as a dispatchable energy resource that will get us to 100 percent renewable.

I also want to give a quick shout out to Mary

Nichols and the California Air Resources Board for their recent ruling mandating zero emissions transit. I think that ruling, in combination with the proceedings within the CEC and the PUC are going to create a large market demand, and incentives to scale up hydrogen production.

I'd also like to direct the panel's attention to a biomass gasification project that has been initiated by the Sierra Resource Conservation District, out in Auberry, east of Fresno. They've acquired an abandoned lumber mill in Auberry, and are developing a biomass gasification campus that would process some of the 20 million dead trees in their district into biomass. And then, first convert it to syngas, and then later on extract hydrogen from that. Most importantly, both syngas and hydrogen are dispatchable energy resources, which we desperately need.

With California currently threatened by wildfires from approximately 120 million dead trees located throughout the Sierra Mountain Range, expansion of this kind of biomass project potentially presents an incredible opportunity than can benefit the energy, environmental and economic job sectors.

Mostly, as Julia alluded to this, but many of these rural communities are not only threatened by wildfires, they're also economically blighted because

most of them have -- most of them are formerly lumber oriented and are now have no economic engine. This could restart that engine and create a lot of jobs, and create a large renewable resource that is mandated to be 33 percent renewable by law.

So, I'd like for everyone to take a look at what they're doing out there because I think it could be really something. Thank you.

MS. AVALOS: Thank you, Mr. Perry.

And our next commenter is Eli. Please state your name and affiliation, and spell your first and last names. Thank you. Eli, you may need to unmute on your end. Eli, you may need to unmute on your end.

Okay, we'll move on to Claire Broome. Your line is open.

MS. BROOME: Thank you. My name is Claire Broome, C-L-A-I-R-E, Broome, B-R-O-O-M-E. I'm with 350 Bay Area and as a Professor of Public Health.

I would like to respectfully disagree with the previous commentator and suggest that it is critical for the Commission, for the CEC and the CPUC to look in great detail at the claims that are being made for bioenergy, and particularly for use of downed trees in the Sierras.

I think we all would agree that we are not

experts in fire management or forest range management. And while it's correct that prescribed burning is problematic, there are other alternatives such as leaving downed trees to create snags and habitat for forest ecology.

So, I think it behooves all of us to have expert consultation on the range of alternatives. And also, fire risk management is most important around human habitation. And getting out millions of snags from throughout the Sierras is neither necessary, nor constructive.

Secondly, it's really important that there be full lifecycle greenhouse gas accounting that includes indirect land use impact for bioenergy resources, and also a consideration of scalability. I very much agree that bioenergy can be very valuable for a number of functions. But if you restrict to the most plausible and ecologically appropriate sources, there is a limited quality.

And so, being very strategic about how bioenergy is used is really important for meeting our overall California clean energy goal.

So, I appreciate the creativity and importance of looking at diversity and long-term storage, but I think we have to be extremely careful about accurate

greenhouse gas accounting that takes into consideration full lifecycle and indirect land use impacts. And we also have to consider scalability and alternative uses for bioenergy. Thank you so much.

MS. AVALOS: Thank you, Ms. Broome.

Our next commenter has the initials A.D. Please state your name and affiliation, and spell your first and last names. Your line is unmuted.

MS. DETRIO: Hi. My name's Allie Detrio, with the Microgrid Resources Coalition. A-L-L-I-E D-E-T-R-I-O.

I don't want to over-harp on the last two comments, but I'm in strong support of forest biomass and I think that forest biomass microgrids, in particular, could really support a lot of the under-served rural communities in our forested regions, especially since many of those do not have the physical capabilities to go solar installed, large battery systems.

But I wanted to make another comment regarding the lack of alternatives to diesel and just the general direction of where Track 1 went with the microgrid proceedings.

SB 1339 was never about utility solutions for microgrids. It was about customer microgrids. There is

only one line in that entire bill about utility solutions. And so, I don't think that we were really going in the spirit of the actual legislation when we started to look at utility solutions, only, for Track 1, when really the goal of the bill was about customer microgrids.

Secondly, in that proceeding, both when it first opened and then as we continued through it, many parties asked to submit proposals that would have included alternatives to diesel back in September, when the very initial scoping memo was released. Again in December, at the prehearing conference. And then, again, as we moved forward through Track 1 of the proceedings.

So, there are a lot of alternatives, as many other stakeholders have spoken about before. And many parties asked to submit alternative proposals before January of 2019.

So, to the extent that we have diesel, it's because we did look just at the utilities and we looked just at conventional solutions, instead of looking to others.

And so, I'm really excited for Track 2 and for the Commission to now really look towards customer microgrids, look at developing the microgrid tariffs, as the SB 1339 legislation stated, so that we can get a

diverse portfolio of microgrids deployed widely across the state.

So, I just wanted to make sure that everyone was aware that there were lots of parties that did want to submit alternative proposals when it comes to alternatives to diesel and utility solutions. Thank you.

MS. AVALOS: Thank you, Allie.

The next commenter is Diane Moss. Your line is open and you may need to unmute on yours.

MS. MOSS: Hi. Can you hear me? This is Diane Moss. And are you able to hear me?

MS. AVALOS: Yes.

MS. MOSS: Okay, great. I'm Diane Moss, D-I-A-N-E M-O-S-S. Policy Director for the California Hydrogen Business Council.

And thank you so much to the panelists for this wonderful panel. And to all of our agency officials who put aside the time today to have this very important discussion.

As it was pointed out during the panel, the rise of fossil fuel generators in the wake of wildfires and PSPS has air quality impacts that are all the more devastating now that we are dealing with COVID-19, as well as elevated pollution during fire season, in fire

communities.

And I just want to reiterate the CHBC's support for the concept that hydrogen fuel cells for backup generation are a really obvious choice over fossil fuel combustion generators. Because along with the long-duration power that they supply, like traditional generators do, they also emit zero criteria air pollutants which helps a lot with that air quality issue, as well as being more reliable and emitting less greenhouse gas, even when using conventional hydrogen.

The CHBC, to be clear, supports a transition to 100 percent renewable or zero carbon hydrogen content. That said, the renewable hydrogen market, similar to the renewable electricity market, needs a transition time to achieve the economies of scale to get there.

So, we need programs to make it easier for consumers to affordably choose hydrogen fuel cells for multi-day, onsite generation over the polluting status quo fossil fuel generators currently dominating the market.

And as we also heard, and CAHBC wants to support, that electrolyzers also have a role to play in resilience applications like microgrid systems, which UC Irvine's research, and pioneers like Stone Edge Farm, earlier today, are so brilliantly showing us.

So, in sum, we strongly support programs, including pilot programs that help expand the market for hydrogen fuel cell and electrical technologies as applied to microgrids, and that would allow the state to better understand the challenges and benefits of these technologies.

So, we hope that the Energy Commission will include this among the recommendations in the IEPR Update, and that our colleagues at the PUC also pursue this in their microgrid program designs. Thank you so much.

MS. AVALOS: Thank you for your comment, Ms. Moss.

That concludes the comment period. I turn to you, Vice Chair Scott.

CEC VICE CHAIR SCOTT: Okay, let's see, have I popped back up, yet? Thank you very much. Appreciate all of the comments.

Let me turn to my fellow dais mates to see whether they have closing remarks, and when they're finished I will make mine.

I see Commissioner Shiroma first, would you like to go?

CPUC COMMISSIONER SHIROMA: Sure, thank you. Well, thank you so much, Vice Chair Scott. Folks, Vice

Chair Scott contacted me a number of months ago saying she has this chapter to complete for the IEPR and looking at a two-day workshop, and how about collaborating. And I very much appreciate the opportunity to listen, learn and participate in the day and a half, two days of workshops. The panels were excellent and the slide deck was very good. And I feel like, okay, got to roll up our sleeves and figure all this out for now and for the future. So, thank you so much.

CEC VICE CHAIR SCOTT: Thank you. I was delighted to work on this together with you.

Let's turn to Neil and see if we have closing remarks from the ISO, please.

CAISO VICE PRESIDENT MILLAR: Yes, thanks Chair Scott. I also want to thank you for the invitation to the ISO to participate in this workshop. The connection to the ISO might not have been as obvious, but this has been a wonderful opportunity for us to learn about the state of evolution of the microgrids, where we can play a role and what we can do to support.

I have to admit, too, I also enjoyed how part of this discussion evolved from microgrids to backup, to actually resource planning on any grid, whether it's a microgrid or the grid. There's an awful lot of overlap

with common challenges and issues there.

So, thank you very much and I really appreciated the opportunity to participate and learning about where we're at. Wonderful presentations and panels. Thank you.

CEC VICE CHAIR SCOTT: You're more than welcome. Delighted to have you, as well.

Let me, I just wrote down a few quick summary points that I heard. This obviously will not recapture everything that we heard over the last two days, but just some things that jumped out at me as we were talking. I do want to thank all of our panelists for their excellent presentation. I feel like it was just chalk full of really good information. And I'm really looking forward to seeing all of the comments that we receive on the docket, as well.

A couple of the themes that I heard was the need to continue the education on microgrids and the services that they can provide, and that's how we can really roll them out into places where folks are not as familiar with microgrids as those of us who sat on these two days of Zoom meeting are.

And how can we emphasize the benefits of the microgrids when we're talking to folks that we need to help install them.

How do we make sure that the components are more modular so that microgrids are easy to scale and easy to replicate.

How do we make sure we highlight the benefits to rural, low income, disadvantaged and Tribal communities.

We talked a little bit about the financing. And so, even though that there are savings that people are seeing from microgrids, it's not always calculated, and these are oftentimes savings that aren't up front. So, they may not be considered as folks are making investments.

And we also heard that in these tough times, with COVID and the economy right now, the discretionary funds that people have, they may not want to put them towards things, even though they can see that the benefits are coming from them.

We talked about how we bring these solutions to existing buildings, and existing neighborhoods, and how important that is to getting the state to the 100 Percent Clean Energy Standard.

We heard through several panels questions about whether we are appropriately valuing resilience and flexibility as we think about the cost of microgrids.

We heard a strong sense of needing to move away from diesel for multiple reasons, including at hospitals

and other places because of the dire health impacts of diesel particulates. And that we ought to consider hydrogen and other options when we need to island from the grid, especially when we're looking at longer terms, or needing longer-term storage.

So, that's a super quick summary of, you know, two and a half days -- a day and a half of panels. But I just wanted to reflect back a few of the things that I heard during the discussions.

I do want to say thank you so much to all of the folks who participated, and put in questions, and provided comments to us. And I really do want to thank our excellent speakers, our moderators, and the IEPR team. They just brought in, I thought, really thought provoking presentations, and robust data and information for us to lay a really good foundation, and keep moving forward working together.

And last, but certainly not least, I want to thank my fellow Commissioners, and the Public Utility Commissioners for joining us, and also the California Independent System Operator. It's always great fun to do these IEPR workshops jointly, in this way, and to gather and share information, and to be able to share with you what the Energy Commission's thinking about, and also to hear back what's important to the Public

Utilities Commission and to the ISO.

So, thank you again for also taking time out of your days to join us on Tuesday and today. I really enjoyed having you here.

I might ask our team if they could please pull back up the screen that showed the comments, and maybe we can end on that. So, if there are folks that would like to provide written comments to the Commission, the instructions have been up on the screen previously. And I believe they were due on July 30th, if I remember correctly.

And I'm not seeing the link pop back up but, of course, you can find that on our webpage. And if you've got -- here it comes. If you have studies, or data, or other information that you would like to share with us, please be sure to send that into us on the docket. We would really like to hear more from you.

And with that, thank you again to everyone for joining us. I thought this was a terrific day and a half. My brain is happy. So, on that note I think we're adjourned. Thank you everybody for joining us.

(Thereupon, the Workshop was adjourned at 4:04 p.m.)

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