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STATE OF CALIFORNIA

CALIFORNIA ENERGY COMMISSION

In the matter of:

2021 Integrated Energy Policy Report (2021 IEPR)	)	Docket No. 21-IEPR-06
	)	RE: Building Decarbonization – Grid-Interactive Efficient Buildings

IEPR COMMISSIONER WORKSHOP ON

GRID-INTERACTIVE EFFICIENT BUILDINGS

REMOTE VIA ZOOM

TUESDAY, OCTOBER 5, 2021

Session 1 of 2: Grid-Interactive Efficient Buildings, 10:00 A.M.

Reported by:

Martha Nelson

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INDEX

<u>P R O C E E D I N G S</u>

10:01 A.M.

TUESDAY, OCTOBER 5, 2021

MS. RAITT: Well, good morning everybody. Welcome to the 2021 IEPR Commissioner Workshop on Grid-Interactive Efficient Buildings. I'm Heather Raitt, the Program Manager for the Integrated Energy Policy Report, which we refer to as the IEPR.

The workshop will be held remotely. It's being held remotely, consistent with Assembly 361, to improve and enhance public access to state agency meetings during the COVID-19 pandemic and future emergencies to allow greater access through teleconferencing options. The public can participate with the workshop, consistent with the direction provided in the notice.

To follow along today, the schedule and slide decks have been docketed and posted on the CEC's website. All IEPR workshops are recorded. And a recording will be linked with CEC's website shortly following the workshop. And a written transcript will be available in about a month.

Attendees have the opportunity to

participate today in a few different ways. For those joining through the online Zoom platform, the Q&A feature is available for you to submit questions. You may also up-vote a question submitted by someone else with the census icon type vote. Questions with the most up-votes are moved to the top of the queue. We will reserve a few minutes after the panel to take a few questions but, likely, will not have enough time to address all the questions submitted.

Alternatively, attendees may make comments during the public comment period at the end of the morning and, also, in the afternoon session today. Please note that we will not be responding to questions during the public comment period.

Written comments are also welcome and instructions for doing so are in the workshop notice. Written comments are due on October 19th.

And with that, I'm happy to turn it over to Commissioner Andrew McAllister, who is the Lead for the 2021 IEPR.

Go ahead, Commissioner.

COMMISSIONER MCALLISTER: Thank you,

Heather. Really appreciate your hard work, and your whole teams work, on putting together today's workshop, and also Staff in the Efficiency Division who have been working very hard to bring together just a stellar group of presenters, both our keynotes and our panelists. I've been looking forward to today for a long time.

And I'm really lucky to be joined on the dais by Vice Chair Siva Gunda from the Energy Commission, as well as Commissioner Genevieve Shiroma and Commissioner Darcie Houck from the Public Utilities Commission. Thanks, all of you, for being with us today.

The reason I'm so excited about today is, I mean, as you all know, I'm really a big proponent of buildings being part of our solution for responding to climate change. They are where we spend most of our time. They're where we breathe most of our air. And they're where we use most of our energy. And so it's just fundamental, of human importance, just in uncountable ways that we try to make our built environment as high performing as it can be. And here, we're talking about energy and, increasingly, grid responsiveness. And that's sort of a driving idea behind today's workshop, grid-interactive efficient buildings.

I'm going to paraphrase Shakespeare a little bit and just say, the grid's the thing, okay? So we know that the grid is now, more than ever, a living-breathing entity that really, you know, has to modulate with the rhythms of nature increasingly. And so, obviously, we use technology to make sure that it behaves itself, and the electrons have somewhere to go, and everything functions in the real time properly. But, increasingly, distributed technologies and buildings themselves, all the devices and appliances in them, are part of that ecosystem and part of the idea, the core of the idea of grid-interactive efficient buildings is make them as efficient as possible so that they're as light a touch as possible, but also that they are listening to the grid and can respond to the grid and its needs at the same time.

And increasingly, in the age of electronics and power conditioning and communications and controls and automation, we can leverage all of these increasingly low-cost technologies to help us manage the grid at all scales. And so, in particular, the distribution grid is a place of increasing focus in California, and not just here but everywhere, as the proliferation of distributed energy resources takes hold.

And I'll try to brief here but I just, I wanted to sort of frame it. You know, we have a number of pieces of legislation that are driving this discussion, sort of in parallel and, increasingly, in concert. Senate Bill 350, the doubling of energy efficiency, that's a key driver. It's asking us to do more and more with the same or less energy.

And AB 3232, many of you saw that report, the Building Decarbonization Assessment, where load flexibility is one of the decarbonization strategies that has come to the fore to help us manage the transition to 100 percent clean energy, use those molecules and use those electrons when they're low-carbon or no-carbon and try not to use the higher carbon one. And that's part of what we're talking about with grid responsiveness.

And then SB 100, our long-term planning

for a carbon-free grid, also has shown preliminarily and, I think, will continue to show as we deepen the analysis that grid flexibility can help maintain lower costs. They can actually do -- maintain grid reliability, transition toward renewables, and shave, you know, a few tenths of a cent or cent, or however much it ends up being, from a kilowatt hour so that that helps in some way keep costs manageable.

We have a lot of tools that we'll hear about today, both in the morning and the afternoon. In the morning, we'll talk about all the neat stuff that's going on out there in the world and California. We have great speakers.

First, we have David Nemtzow from the Building Technologies Office at the Department of Energy. We really appreciate the partnership there over decades now with DOE, and with David specifically, just a big leader in this area. We really appreciate him being with us. And then some great entities that are experts in this field and have different perspective, so a big panel in the morning.

And then a couple -- and then another panel in the afternoon, looking at GEBs themselves, grid-interactive efficient buildings, in the morning, and then really focusing in on load flexibility in the afternoon.

And so we will hear about a bunch of initiatives that we, at the Energy Commission, have going and that the PUC has going. And they all kind of complement each other wrap into a whole where, really, what we're trying to do as a policy direction in California is enable load flexibility, enable flexibility at all scales, really, here, today, we're talking about buildings and appliances, to be able to participate fully in the grid, so in our Building Codes, in our Appliance Flexibility Standards that are under development, and our Load Management Standards that are under development, and a number of other areas. R&D at the Commission, we're doing some really innovative and fundamental things that are going to create a platform for all of this to take shape at low cost in a way that helps consumers.

So, anyway, with that, I will pass the microphone to my colleagues, starting with Vice Chair Gunda, please.

COMMISSIONER GUNDA: And thank you,

Commissioner McAllister. And, as usual, it's always hard to follow you. I'm going to just try and take a couple of high-level themes from what you were sharing from the standpoint of grid planning and reliability moving forward and the importance of the topic today, and it's a really exciting topic for me too.

Before we jump in I also want to welcome and thank Commissioner Houck and Commissioner Shiroma for being with us today, it's always a pleasure to have your company, and the entire IEPR Team for their tireless work during the year, and the Efficiency Division Team for putting this workshop together.

So I wanted to highlight a couple of high-level things.

As we're coming out of the summer and the summer reliability, the grid is at least, hopefully, not a part of our focus for the next couple of months. I know we can take a breather here. But as with 2021 and 2020, we have really experienced the confluence of, you know, the electrification strategy towards pursuing our climate goals, the kind of transition from the conventional generation that we depended on for so long to more a more intermittent and a new preferred portfolio of resources.

But, also, we're really trying to grapple with the changing behaviors coming out of COVID. For example, we really do not know how the COVID and the work style, kind of the energy used in buildings is going to change as we move forward.

So there a lot of things happening that really puts us at this place where we cannot undermine the importance of load flexibility and being able to really manage demand to support the grid.

Just as an example, on the grid as a whole, at a system level, for example, a shorter month like May, you're looking at anywhere, you know, ten gigs of swing in any given year. So as we move forward toward the SB 100 goals and trying to, you know, accelerate our building of resources on the system, we -- you know, it's imperative that, you know, we balance that really well and soundly with the distribution side.

And really grateful for Commissioner Houck's leadership on launching the DER proceeding at CPUC and looking forward to working with her on that area.

So I’m really excited to look at the role the buildings can play, and the opportunities, and how we can overcome any barriers there might be.

So with that, I will pass it back to Commissioner McAllister.

Thank you.

COMMISSIONER MCALLISTER: Thank you, Vice Chair Gunda.

Commissioners Shiroma and Houck, I’ll pass it to you in sequence next. Thanks for being with us.

COMMISSIONER SHIROMA: Thank you. Thank you. Good morning. It’s a real pleasure joining you all today.

Thank you, Commissioner McAllister for your invitation and your continued engagement with the CPUC on issues of load management.

My name is Genevieve Shiroma. I’m the -- I am a Commissioner at the California Public Utilities Commission. I work on rate design to support load management issues for our investor-owned utilities. My pronouns are she and her.

During my time at the Commission, almost three years now, we have been leveraging the general rate piece phase two of San Diego Gas and Electric, Pacific Gas and Electric, and Southern California Edison as a venue to create real-time pricing pilots to learn how customers can best engage with rates and adjust their use to respond to pricing that it reflects conditions on the grid.

In addition to the technical aspects of the load, like cloud-based technologies to update rates in smart appliances, as Vice Chair Gunda said, there is also the human aspect where customers understand the role they have in introducing greenhouse gases and building the decarbonized grid of the future, its technology and human partnership.

Long-term, it can allow customers to more closely manage their electricity used to lower their bills. And, eventually, customers can design their homes to seamlessly manage these processes for them with an eye to making sure these programs are equitable and accessible to all. For example, I am working on a customer financing rulemaking to create affordable pathways for customers to make their buildings grid-interactive and to make it easy to not only access but to understand.

I want to give a special thanks to Maryam Mozafari from the CPUC’s Energy Division for presenting later on today on the evolution of our demand response programs and how we are bringing demand response and rate design together in a staff technical paper that is being finalized to support a future CPUC rulemaking on load flexibility.

I’m looking forward to all the presentations.

David, we’ll be hearing from you soon. And thank you for reminding us that we can interrupt you with questions, which, believe me, we do with no hesitation. Looking forward to further opportunities for our agencies to collaborate on these issues and problem solving.

Thank you. Back to you, Commissioner McAllister.

COMMISSIONER MCALLISTER: Commissioner Houck, did you want to -- thank you very much, Commissioner Shiroma. I appreciate your comments. And it’s great to know the relevant rulemakings that are both here and coming up. And our coordination is really terrific along those lines, so thank you.

Commissioner Houck, did you want to make some opening comments, please?

COMMISSIONER HOUCK: Yes. Thank you. Thank you, Commissioner McAllister, for inviting the CPUC to participate. We appreciate all of the work that you're doing on so many fronts in regards to efficiency and load flexibility.

I just want to thank Commissioner Gunda for the work that he has done in regards to support that the CEC has been providing on our DEI -- DER rulemaking.

And I just want to say that I want to echo some of the comments that Commissioner McAllister, in particular, made earlier regarding the number of programs that we're working on and the joint efforts between the two agencies in regards to load flexibility and how the grid is going to manage all of this.

California has been a world leader in energy innovation. And this is just one more example of what California is doing to set the bar for the rest of the world. And I'm really excited about all of the different programs, and the information that we're going to hear today, and the joint efforts between the two agencies to further grid-interactive abilities for buildings for DER.

And just, again, want to thank our staff, both at the CEC and the CPUC, and all of the presenters today. And I am really looking forward to hearing all of the presenters.

I do have to leave at noon for another meeting but will be back in the afternoon.

And I'll turn it back over to Commissioner McAllister with those remarks.

COMMISSIONER MCALLISTER: Thank you very much, Commissioner Houck.

So high expectations for today. And I think we have a really high-level set of speakers that are going to help us really bring out some of the nuance in a lot of these topics, interrelated topics around building and flexibility and reliability.

So with that, I think I'll pass it back to Heather to introduce David Nemtzow, our first speaker, who we're really honored to have with us today.

And for those of you who have tuned into multiple IEPR workshops this year, we're doing our level best to involve the federal agencies and the administration as much as we can in these, particularly, the building decarbonization issues just because there's so much alignment now. And there, potentially, are resources coming from the federal government that we want just make sure that we're getting prepared for and getting on the same page with the agencies on that end to use those most effectively.

So, Heather, over to you.

MS. RAITT: Great. Great. Thank you.

It's my privilege to introduce our first speaker, David Nemtzow. And as the Commissioner mentioned, he's with the U.S. Department of Energy. And he's the Building Technologies Director in the Office of Energy Efficiency and Renewable Energy. And David has more than three decades of experience in the industry, including running a large state government energy and water department, serving as the President at the Alliance to Save Energy, and working in executive management and energy consulting.

So thank you so much for being here, David. Go ahead.

MR. NEMTZOW: Great. Thanks so much.

And thank you, Commissioner McAllister, and Vice Chair Gunda, and Commissioner Shiroma, and Commissioner Houck. Just the U.S. Department of Energy and me, personally, are very pleased to be part of your IEPR workshop and to work with your agencies.

I do want to talk about grid-interactive efficient buildings, a term I personally coined to my great regret because I've heard nothing but grief about its lack of poetry. But it's an important term because we are trying to do multiple things simultaneously.

Buildings, as was implied, are a huge source of our nation's energy economy and, therefore, of our nation's energy challenges. On a national basis, buildings consume -- are the largest consuming sector, 39 percent of U.S. energy use occurs in buildings, 74 percent of U.S. electricity consumption, even more at peak, well over 80 percent in most of the United States, 35 percent of U.S. energy-related CO_2, and perhaps most damning of all, buildings in this country, just the utility bills, just the gas and electric, consume well over $400 billion per annum in electricity and natural gas. And at least $100 billion of that, if not more, is wasted and simply performing no service. You all know that.

Grid-interactive efficient buildings need to be grid-interactive. They need to be efficient. They need to be flexible. They need to be smart. And that's what I'd like to talk about.

But I do want to say, before I start, you can see, and as many of you know, it's nice to see a lot of colleagues again virtually. I spent a decade in California. So I was bold enough to -- I am a fed now. I want to talk about a national roadmap for grid-interactive buildings. But I will be so bold as to make some suggestions for California's consideration, and as well as for ours.

And I do want to say, Commissioner McAllister, I -- and all of you, I consider this, I hope it's a race to the top. California's leadership, as you all have said, is, of course, noteworthy and is world-renowned. I want to give you a run for your money. I want to give -- I want the federal government to play some catchup over here and give you a run for your money. And

I hope it’s a race to the top in partnership and collegiality and friendly competition on this issue.

And I do want to say that I want to talk about the partnership today. And look, I’m the Director of the Buildings Technology’s Office at DOE within Efficiency And Renewables. I certainly want to talk about the partnership between building technologies and the California Energy Commission, but it’s more profound than that. It’s a partnership between the United States Government and the State of California on our shared goals, our energy and climate and related goals.

I can’t speak on behalf of the President of the United States. But I can note that if you look at everything this administration, Secretary Granholm, the President of the United States, I’m a civil servant, but reading the newspapers, what this administration is doing on the issues or climate and energy and demand flexibility, you can also see the important role that the administration places on the role of state governments. And it’s a real partnership. You can see that in the American Jobs Plan and the bills that are before congress now. And so I just want to underscore that.

And it's part of this administration's decarbonization goals to decarbonize the power grid by 2035 and the economy as a whole, including buildings, by 2050. There's three basic components to that decarbonization of buildings and I'm going to focus on one. First, I'm going to start with energy efficiency, that is the role buildings can play in decarbonization. I hope that goes without saying. Number two, it is the role of demand flexibility, grid interactivity, renewables integration, that's what I want to focus on today. And three, I would say, put in a separate bucket, the role of beneficial electrification and decarbonization.

So if you could go to slide two for me? I will get going and talk about the enormous opportunity. Next slide if you'd be so good?

So why grid-interactive efficient buildings? I think I've covered this. I think you know it. I'm not going to do a one-and-one here. And most of these slides, I'm not going to read aloud. I'm going to let you look at that.

So that's the benefits of grid-interactive buildings.

I want to focus, in particular, on the multiple buildings nature of grid-interactive efficient buildings. There's 130 million buildings in this country, residential and commercial alike. Of course, California has more than any other state. It is -- we will not do this on a onesie-twosies basis. And so there are a lot of activities, whether it's building codes or R&D, but we need to look at multiple buildings.

At DOE, the way we think about that is something called Connected Communities in which we can take multiple grid-interactive buildings, this is just a scheme, a photo of residential, but it could be residential or commercial or a mix, of looking at what we can do in groups that single buildings alone won't do, the economies of scale, the load balancing, innovative business models, et cetera. So we want some -- the whole needs to be greater than the sum of the parts, and we call that Connected Communities at DOE.

Next, please. And if I could see the next slide?

We borrowed this idea of connected communities. So I'm going to start with some communities. And then I'm going to come back to the grid-interactive buildings topic in my talk today.

So we started this in -- a project in Hoover, Alabama, which is just outside of Birmingham, and you can see a photo of it, a new residential development that was built just a few years ago. And it was a partnership of the Southern Company through their Alabama Power subsidiary of the -- DOE's Oakridge National Lab, of my office, of the other parts of DOE, including the Office of Electricity, EPRI, a local homebuilder, and many other key players, and this was to do a test bed, 62 homes, to say what if we built these homes really snazzily, for lack of a better term, that included these grid-interactive features, that included distributed energy resources?

So this neighborhood -- and these are well-to-do homes outside of Birmingham. If I told you the price -- well, I'll just tell you, they're 3,000 square feet, they're gorgeous, they have the latest technologies and that's why they charge a premium, these retail for $400,000, or as you would call it, a garage. But in Birmingham, Alabama, you get a beautiful, grid-interactive, highly efficient home for that kind of money. And it also includes some neighborhood-scale. You can't see in the photo, but less than a mile away -- this is on a microgrid -- less than a mile away is a field of PV, natural gas backup and of lithium ion batteries. So this was an experiment, granted, a high-end experience.

Next slide, please.

And, folks, families have been leaving in the 61 of these homes for a couple of years, they saved the 62 -- 62nd as a showcase, the results are spectacular. They're better than even the models showed.

So Reynolds Landing, the graphic on the left, Reynolds Landing, it's the same thing, it's just the name of the development, and you can see the numbers. If you look in the middle, so if you compare it, and in Alabama the fair comparison is to an all-electric community that was built to the code in Arizona [sic], these homes use, over the course of a year, 44 percent less kWh. And at peak the number is a little --

the savings is a little less great, it's not shown here, but after the first year, corrected for weather, the peak reduction was around 35 percent.

Southern Company through a different subsidiary, Georgia Power, did a similar neighborhood on the right, actually, in the City of Atlanta, Georgia. That one is not single-family homes. Those are connected townhomes. This one doesn't quite have as much technology but it still has PV, lots of insulation and fenestration controls, heat-pump water heaters, EV charges, so many of the same technologies. And, again, the savings have been very impressive.

And so these neighborhoods have been very successful. Look, I'll let you in on a secret. The one in Alabama included some subsidies from the utility company, from Alabama Power. And I lost track, whether that came from the shareholders or the ratepayers, but in a way, it doesn't matter in that this is not a sustainable model if they require a subsidy. So we're using these as demonstration projects so that they can be freestanding and can be supported. We think the analysis shows that they will be.

Next slide, please.

We've learned some lessons from these two neighborhoods which, again, only have a couple of years of inhabitancy, one I already told you about. There is significant load flexibility here. And with that comes renewable integration. And with that comes decarbonization.

By the way, all the technologies in these, both these neighborhoods, with the exception of the sensors and the algorithms, everything else was off-the-shelf. So, yes, there is a role for R&D here. And my office and the Commission, of course, is investing in that R&D. But both these neighborhoods were built with Rheem water heaters, with Mitsubishi products, with Trane. They're built with things that anybody can buy, with the exception of some Oakridge-developed control algorithms. And that was an important part of the demonstration, to show that it doesn't require, necessarily require, new technologies.

So there are -- so we see significant load flexibility. We're seeing the important role, no surprise, of standardized data frameworks in communication protocols so that the buildings can talk to the -- so the different equipment within the building can talk to itself, and that the buildings can talk to each other and talk to the Alabama Power and Georgia Power grid, respectively.

And we also learned how to improve the value proposition. That, of course, is a diplomatic way of saying, you know, what didn't go quite right? What did we learn in the first year or two?

One that we learned is that end users, the customers, the real people there, they want to know in advance when their home, through either a signal from the utility or from the pre-designed algorithms that the homeowner signed off on, they want to know in advance if there's going to be a temperature shift.

We know from both -- we know from experimental design that most of the time end users don't notice small customer changes -- sorry, small temperature changes. And we know they certainly don't notice small temperature changes in hot water. But sometimes they do notice if the change is a little too big, or they're greatly sensitive, and they want to know that in advance. Sometimes the end user overrode the algorithm. We can't pretend otherwise. That's, of course, an option, let them -- that Alabama and Georgia Power let them have. And we also, to improve the proposition, we want to scale demonstrations.

I will add that the townhomes in Atlanta were built by Pulte Homes. Pulte Homes is the fourth largest homebuilder in this country. And that was, again, part of the evolution of this. We want homebuilders and homeowners to see value in it, not just Commissioners at the Energy Commission and the PUC and those of us professionally in the field.

Next, please.

And as we look forward to these Connected Communities, bringing them elsewhere, and I'm going to steal my thunder a little bit, Department of Energy, and my office, and others are funding more of these. If want to call them smart neighborhoods, that's fine by me. We call them Connected Communities. We're going forward. And because we're doing it increasingly -- we just started this two or three years ago and we focused on the energy benefits for reasons -- you can do the math yourself.

In 2021, we're focusing on the decarbonization benefits. It's the same messaging statement on my part. The substance is the same. It delivers both simultaneously. But as we look forward, and the Department is more committed to helping the nation deal with the climate crisis, we need to make sure that grid interactivity not only saves peak power, not only saves kWh, but is part of the transition to beneficial electrification and to cleaner energy sources, and to a grid that is based, of course, more and more on variable renewables. The same way storage plays a role, grid interactivity needs to.

There's a whole host of things. I'm going to come back to these policy interventions later.

If you could go next?

I got a little bit of an advertisement for my office. I mentioned that, on the next slide you'll see, we're funding, I think you know, something called a competitive funding opportunity announcement, a FOA in my world. And we put some money on the street a few months ago and we said we're interested not just in new construction residential, like the two in Alabama and Georgia, the ones we started, but in all sorts of other ones, campuses, commercial, mixed-use.

And we were overwhelmed, happily overwhelmed, from our end with applications for that, many more than we expected. Many of them are in California, of course, as you would imagine. Unfortunately, we only had enough funding for eight of them. I'm not free to share how many applications we got but I will say it was triple digit, triple digit, and it didn't start with the one. And, unfortunately, we can only fund eight of them.

We were able to scare up some more money because of the overwhelming nature of great projects. We're going to fund ten of them. We're in an awkward time here now. Those who have SEED support will learn that. This will be announced by the Secretary of Energy. I like my job. I am absolutely not going to steal the Secretary of Energy's thunder, and so I am going to stop talking on that, except to say when you look at these eight boxes, when you see the ten projects that have been selected, you will see all eight of these represented to one degree or another. And that was important for us.

In any demonstration, we know that in the Energy Commission and the utility, the PUC, that for demonstrations to work they need to be as close -- they need to demonstrate. And so we want, again, different types of decisionmakers, architects, engineers, developers, homebuilders, homeowners, universities, we want them to see something that is relevant to their space. So we developed a portfolio of projects, a cohort, not just individual projects.

We also will be using, your friends and mine, the Lawrence Berkeley National Lab to be -- to help coordinate these.

Next, please. And I'm going to run out of time. I want to talk -- I'm going to skip ahead a little bit because I want to talk -- if you could go to slide ten for me real quick?

And the slides, I'm sure, will be made public. And I would welcome -- my email is at the end, we would, at DOE, we welcome comments from anybody in the audience, and certainly from the Commissioners.

If you go to slide ten for me, you will see that there's a lot of R&D in this space that you are conducting and we are. But here's a -- this is a setup for the policy issues I'm going to talk about, Building Codes, Appliance Standards, research, utility programs, these are some of the activities we see around the country in this space of grid interactivity that are going on. Many of these are -- many of these are yours. Many of these are California. Quite a few of them are not.

I want to go to the next slide please.

We commissioned a very important study that was conducted by my office, the Building Technologies Office, as well as led by the Lawrence Berkeley National Lab. You'll hear later from Mary Ann Piette and Natalie Mims Frick, two of the lead authors on this, as well as The Brattle Group, looking at the national opportunity.

I got to say this, I don't typically comment on DOE reports, I think this number is too small. I think it's bigger than $100 billion to $200 billion. I'll tell you why. Because when we did this we were not working on the same assumptions about how quickly the U.S. power grid would be decarbonized. And we can have a nice, fun discussion over a glass of wine how fast the grid will decarbonize. But I think we will agree it's happening faster than any of us anticipated, even in California. And so this value stream is at least this much, if not bigger, as we rely more on renewables.

If you would, next slide real quick?

This is just a breakdown. And if you want to see the numbers, they're national numbers. We didn't have the resources to do it at a state level. These are different scenarios. I'm just teasing you with that.

But if you could go to the next?

I'm going to use my last few minutes going through it. We have 14 pillars of recommendations, and a bunch of specific recommendations within that. I'm not going to -- I'm going to save all my remaining time for the fourth pillar, so pillar -- third and fourth. We can do more on R&D collectively, DOE. And I think the Energy Commission and the utilities in California, obviously, are active in R&D. So pillar one, we need more R&D.

Pillar two, please, is how do we explain and advance the value stream of grid interactivity to end users and to utility companies. And, you know, in California, you may sometimes forget, most consumers in the U.S., electricity consumers, 95 percent of U.S. electricity consumers don't see time sensitive retail tariffs, but that doesn't mean -- retail tariffs are only one way to demonstrate the value, there are many other ways, even though that's a familiar one and one, of course, at the CPUC and the Energy Commission and people engaged with it.

Pillar three includes several suggestions on how do we deal with end users and people who operate the systems, whether, again, they're commercial, an office space or a restaurant, or an apartment building, whatever it may be? How do we give them tools so that they can understand and effectuate this?

Let me just turn to pillar four, and that's the policy one. And again, here, we were bold enough to make suggestions to others. We are doing it at our end and need to do more. And we hope you will consider adopting these policy measures as you advance this, leading by example, with your own government facilities, expanding funding and financing opportunities.

Many GEB technologies are low-capital cost, they don't need a lot of financing, but some of them certainly do. The storage ones tend to be more capital-intensive than the controlled ones. And, of course, there's different innovative financing, whether it's PACE or on-bill financing, there's a whole host of choices.

Codes and standards, and you've already led the way with Title 24 here, we are working at a national level with the states that -- the other 40-x states that use the IECC as their model code, and 90.1 is theirs. So we have a very ambitious program at DOE to allow the codes to voluntarily adopt grid interactivity and photovoltaics, and electric vehicle charging for those jurisdictions that want to embrace it, as California already is.

Appliances Standards, again, Commissioner McAllister referenced this, you all are taking leadership there. And we have a federal responsibility on standards and how they can help with demand flexibility, especially ones like water heaters and the other thermal loads.

And finally, one that really is a statewide thing, is how do you include demand flexibility in state targets and mandates? Some states have peak reduction goals. Others have demand response goals. Of course, half the states have some kind of efficiency goal.

I would like to see, personally, this is just my own personal view, when you look at requirements for the utilities, every kilowatt hour saved at 3:00 p.m. in Irvine, in August in Irvine, is much more valuable to the system than at 3:00 a.m. in October in Barstow. That's simple math. That's not a statement of geography. That's a mathematical statement of that evaluation that you might want to consider, whether you look at your savings regimes in that light.

The final thing I want to say, I have one more slide that just repeats everything I said, and that is we are, at DOE, slide 16, looking at a goal of tripling efficiency and demand flexibility, which is part of our overall goals.

But the final slide is the most important one and that is, I just want to restate, we want to work with you, we want to work with the Energy Commission and the PUC, the State of California. We can't do it alone and you can't.

And the last slide is our contact information and some other resources.

And I would have shown a picture of Humphrey Bogart and/or Rick Blaine and Captain Renault walking into the rain in Casablanca, but it's not the beginning of a beautiful friendship, it's the extension of a beautiful friendship. And I hope we stay connected.

Thank you. Thanks for having the Department of Energy today.

COMMISSIONER MCALLISTER: Thank you very much, David, that was great. And I want to just be mindful of time, but very content-rich. And I just want to congratulate you and your team on the GEBs Report. I really want to commend you on that. And it's really changed the conversation nationally, and so I want to acknowledge that, for sure, and just all the leadership. And then just the alignment across the whole administration, and together with California, it's just great to see that.

You know, we all have our fingers crossed, collectively, in California to see who -- how the awards in the Connected Communities decisions, how those come down. So, hopefully, some of California's bidders will be participating in that. But it's great that LBNL will be involved, regardless.

And just so -- you know, there are many things we could talk about in terms of how we're already working together. David, for your information, and everyone's, there will be an en banc, a public meeting between the Public Utilities Commission and the Energy Commission, on our research program going forward this coming Friday. So it's about the EPIC four-year Investment Plan that's under development, and there are some really exciting initiatives in there, and I think you'll see a lot of familiar themes in there, David, you brought some of them up, and really focusing on flexibility in buildings and end-use distribution-level resources. And I think there's just a lot to -- a lot of exciting work ahead in the R&D, not just on sort of the technology widget front but on the integration and execution and implementation front, as well. So I think that will be really interesting to get your viewpoints on as well.

And then, also, just thanks again for all the leadership in taking the advance water heater -- water heating initiative forward and making that a national initiative. I think that's going to bear a lot of fruit, including for load flexibility and grid interactivity.

I wanted to just ask anybody if they had --

MR. NEMTZOW: If I could just say, real quick --

COMMISSIONER MCALLISTER: -- any questions for David?

MR. NEMTZOW: -- Commissioner?

COMMISSIONER MCALLISTER: Yeah, please. Please. Yeah. Go ahead.

MR. NEMTZOW: Even Albert Einstein couldn't come up with the unified field theory. So all I want to say is I'm glad you're doing the en banc, I'm glad you're doing everything you said and we said, but let's not assume that we need to have a unified field theory for all of this. Let's advance that way without waiting for that angle.

COMMISSIONER MCALLISTER: Absolutely.
MR. NEMTZOW: That would be my --
COMMISSIONER MCALLISTER: Absolutely.
MR. NEMTZOW: That's how I tackle this.
COMMISSIONER MCALLISTER: And also, you know, there's a lot going on at the local levels, and we can learn a lot from them, as well, as a state and as a nation. So I think, you know, cities and counties that are doing innovative things, as well, really feed this discussion in positive ways.
So I see that Commissioner Shiroma has her hand up, so go right ahead. Oh, and also Commissioner Houck after that.
COMMISSIONER SHIROMA: Thank you. Quick question.
Thank you, David, so much. I look forward to continuing to work with you and the federal government.
My question is, it's relevant, is you mention the microgrid that supports the Alabama Power neighborhood, the solar and backup with natural gas, was that developed together? And does the microgrid, is it operated by the utility or a third-party? Or, really, was it developed

together?

MR. NEMTZOW: Yeah, it was. It was developed --the whole thing was developed at one time. It was a greenfield and it's a new construction, so it was all developed together. And, yeah, so it is Alabama Power that operates the microgrid and the backup to optimize. But, partly, it's a utility; right? So they're very interested in how these 62 homes behave as a neighborhood and what that means for their grid, so, yes.

And the other one, the one in Atlanta, as you can tell, isn't a microgrid. And microgrids are, you know, are appealing here but they're certainly not necessary. It could go either way.

COMMISSIONER SHIROMA: Okay. Thank you.

COMMISSIONER MCALLISTER: Commissioner Houck, yes, go ahead, please.

COMMISSIONER HOUCK: Yes. I just wanted to thank you for this great presentation. It is so good to see that we're moving in the same direction. And your challenge for this friendly competition, I think, is great that we're doing it together and we're all moving in the same direction. So I just really want to commend the work that DOE is doing in such a short period of time since the new secretary has been in place with the new administration.

And as the Lead Commissioner at the PUC on Distributed Energy Resource Planning, our high-DER rulemaking that's just opened, I'm really looking forward to the potential and future partnerships we can have with DOE on the projects you described here and looking at how we can be innovative and working together on moving all of this forward.

So I just want to really thank you. This was very inspiring to see this shift in our relationship with the federal government.

MR. NEMTZOW: Thank you, Commissioner Houck. And, of course, just to get on record the obvious, whether the issue -- I got buildings, on the demand side, I got, but whether it's solar, fuel cells and hydrogen, battery storage, thermal storage, buildings, vehicles, whatever it is, sign us up. And, you know, I trust we're being responsive to your needs. And, you know, anytime we're not we'll connect the right people at your end with the right people at our end, but the whole gamut.

COMMISSIONER HOUCK: That's great to hear. Thank you, again, so much.

MR. NEMTZOW: Yeah. Yeah. Thank you.

COMMISSIONER MCALLISTER: Commissioner Gunda, did you have a question?

COMMISSIONER GUNDA: Yeah. Thank you, Commissioner.

I just wanted to thank David so much for that presentation, very helpful, like really kind of amazing to see the progress that we're all collectively making in making sure the buildings are really a resource for the grid.

So I have one quick question. I know we're running out of time. But something that Commissioner Shiroma raised at the top in her comments, as the federal government is looking at investing in these projects and such, David, is there -- could you kind of elaborate or comment on how equity is playing into the thinking at the federal level, especially as you fund these projects and can learn lessons from it? Anything that you can share will be really helpful.

MR. NEMTZOW: Yeah, absolutely. The shorter answer is a lot. And equity -- well, first, let me just personally note as an analyst, equity has -- I think we use it in two different ways in clean energy. One is for the benefits of clean energy reaching all segments of the American population, the benefits, clean air, more reliable power, more affordable energy. The other part are the clean energy widgets, shiny objects, reaching all sorts of populations; right? The programmable thermostats. The EVs. So I just want to just make that, you know, economical.

Now having said that, it's a key priority for this administration, for our department, and for my office. And, you know, the proof is in the pudding, of course. Words are cheap. But when you see the new the new -- I think when you see the President's budget request for the coming year, I'll let you read it for yourself, I think you'll get a very encouraging answer there. And I'll let the President speak for himself.

But when you see the projects that we selected for our Connected Communities, you will see, I think, again, without getting ahead of myself, you will see equity. You will see affordable housing and multifamily, and I know multifamily is the same as affordable, but you will see affordable housing, multifamily housing, different kinds of neighborhoods there.

So the answer is we're very committed to it. And we're learning how to do that; right? Because we have to walk and chew gum at the same time. You know, I think it feels to us, and I know it feels to you, like, you know, the Cat in the Hat in the Dr. Seuss with the, you know, the spinning plate and the goldfish bowl, and that's what it is, it's the carbon challenge, the equity challenge, the affordability challenge.

So sorry. The answer is, yes, and we're very committed to it.

One final thing is we all know that energy efficiency if done right and done cost effectively makes housing or transportation, whatever it is, more affordable; right? But you have to have the money in the first place. We are also shifting our R&D program to look at first costs, price compression, so that the first cost bite is more modest, whether that's heat pumps or programmable thermostats. So I just want to say, there are a lot of elements of that very important issue.

COMMISSIONER GUNDA: Thank you so much.

MR. NEMTZOW: Thank you, Mr. Vice Chair.

COMMISSIONER MCALLISTER: Great. We could ask a lot more questions, I'm sure, David, but we will see each other again because we interact frequently. And just look for more opportunities to involve you and to be involved, you know, whether it's in the appliance, whatever the rulemaking is, or the particular theme is that the federal government, you know, appliances regulations and the like, building codes, we'll look forward to. And we already have a very robust relationship, so look forward to --

MR. NEMTZOW: Great.

COMMISSIONER MCALLISTER: -- continuing that --

MR. NEMTZOW: And one issue --

COMMISSIONER MCALLISTER: -- and I appreciate it.

MR. NEMTZOW: -- one issue we haven't talked about, it's a little less sexy, is the role of analysis. And I think that's another one that the Commission --

COMMISSIONER MCALLISTER: Yeah.

MR. NEMTZOW: -- both Commission, Commissioner McAllister, and my office, is really important. And it also has a lot of free riders in a good way. The analysis we can do together, I think, will help the --

COMMISSIONER MCALLISTER: Yeah. We will hear --

MR. NEMTZOW: -- local jurisdictions out a lot.

COMMISSIONER MCALLISTER: Yes. Thanks for bringing that up. If I had asked a question it was going to be about sort of the data regime and how --

MR. NEMTZOW: Okay.

COMMISSIONER MCALLISTER: -- we sort of get our -- how we utilize it for good and, you know, protect ourselves appropriately. And I think that's a conversation we absolutely need to have and, luckily, have in our next panel, as way of segue, so thank you, David, in our next panel we have some real experts on that front doing some great analysis on, you know, really the load-shape impacts of many of the things we're talking about and just the highly analytical perspectives on this topic, and so I want to move on to our panel on the Value of Grid-Interactive Efficient Buildings.

And, Heather, I'll just pass it straight off to the moderator.

We've got a great lineup, six terrific speakers with different perspectives, and moderated by Tiffany Matero, our very own from the Energy Commission.

So, Tiffany, take it away.

MS. MATERO: Thanks Commissioner. Yeah, I will just get jumping in right here.

Our first panelist, Mary Ann Piette, Senior Scientist from Lawrence Berkeley National Lab.

Thanks for being here, Mary Ann. It's to you.

COMMISSIONER MCALLISTER: Thanks Tiffany.

I just want to invite our dais members, if they feel more comfortable turning their cameras off, that's okay during the panel, and we can chime back in for questions at the end. If you're more comfortable doing that, that's what I'm going to do, so thanks everyone. And we'll get going on the panel.

Thank you, Tiffany.

MS. PIETTE: Wow, I just want to say hello to everybody. It is a great pleasure to be following David Nemtzow.

David, thank you for the introduction on GEBs and the national and California perspective.

I'm going to be talking about grid-interactive efficient buildings, also, and talking a little bit about technology, a case study at UC Merced, and the Demand Response Potential Study.

I'm Mary Ann Piette and I'm the Division Director of the Building Technology and Urban Systems Division at Lawrence Berkeley National Lab. And it is such a pleasure to have all three of our key sponsors on today's agenda. So I want to give thanks, again, to the U.S. Building Technologies Office at DOE, thank the Public Utilities Commission. I'll be talking about the Demand Response Potential Study. And then I'll be happy to announce, this month we are kicking off the California Load Flexibility Research and Deployment Hub. And I have just a short mention of CalFlexHub. But this session is about the values.

Go ahead to the next slide.

Everything David mentioned is embodied in this slide here. Looking at the oil embargo was what really launched the field of energy efficiency. So when we invest in grid-interactive efficient buildings we're importing less foreign oil, so that was a major motivation. We're seeing lines in England again where we have gas shortages. So resilience and energy security is still an important agenda for the energy field and GEBS.

Air quality. We need to make sure that we're delivering healthy buildings. And we need to understand things like urban heat islands. It's getting hotter. We have fires. We have smoke. So we have a lot of challenges when we think about GEBs. So while we're developing efficient interactive technology, we have to make sure that the people are healthy, we want to integrate with the renewable grid, and we want to ensure that these technologies are affordable and they're providing value to the disadvantaged communities that have historically not have had much -- as much advantage to these technologies. So just kind of an overview on what we think about in building technologies and all the things we have to keep in mind.

Go ahead to the next slide.

So just to remind everybody, we start with efficient components. We have a long history in LED lighting, better windows, more efficient HVAC systems.

Go ahead to the next slide.

But we want to integrate those at a whole-building level, so we want the facade and the HVAC and the equipment to be integrated. And that's going to help us to integrate with the grid.

Go ahead to the next slide.

So a grid-interactive efficient building starts with efficient components, integrates systems, and interacts with the grid. And I think everybody on today's agenda, and most of you listening, are familiar with the duck curve. In 2019, on Memorial Day, 16 percent of the renewables that we generated could not be used, so we want to soak up that clean power in the middle of the day. And that's a big challenge because we've spent decades working on energy efficiency and now we're looking at how we can actually change the electric load shape of the building, making sure it's efficient, but also dynamic. So for a clean grid we need grid-interactive efficient buildings.

Go ahead to the next slide.

So I'm going to spend a moment talking about these technologies. So this is a slide from the GEB Roadmap. And I want to thank David for his leadership in thinking about the fact that DOE had a role in creating the agenda for the GEBs, that's the grid-interactive efficient buildings. On the very bottom in red is thermal energy storage. We can build thermal energy storage systems that use less electricity and are more efficient than electric batteries. We have today some district energy systems. I'm going to talk about TES at UC Merced. We can better integrate thermal energy storage with HVAC, with refrigeration, maybe in the building envelope, and doing new materials.

On the left of this curve is more available technology. And on the right are things that are more in development. So we have thermal energy storage systems that are providing more value.

And then in orange are the physical systems. You all know about heat pumps and water heaters. But window attachment are important, as well as dynamic glazing, and combination systems.

So the bottom line is that we want to continue to improve the affordability and lower the cost to both the hardware costs, as well as the software costs, to deploy these technologies.

And above the line are local control. We have a lot of that today. We have smart thermostats. We're doing better with connected water heaters. We still don't have a lot of them. But these demand flexibility enable technologies that are integrated, like a SHAM, so smart home automation, or a building energy management, or predictive control. That multi-building control that David mentioned with Connected Communities, we're only starting to figure that out. And for speed and scale we need to work with groups of buildings and not just individual buildings.

Go ahead to the next slide.

I want to spend a moment talking with you about some work that we've done at UC Merced. This is unprecedented. Merced has a 2 million gallon thermal storage tank. It's got chilled water in it. It's got four megawatts of onsite solar. It's got a big solar farm. For the first time we actually used the megawatts from the solar to charge the thermal energy storage. Historically, you charge the thermal storage at night. We were actually looking at their own duck curve that Merced has and they were selling excess power back to the grid.

So by using -- by doing what's called model predictive control we would use the energy costs, the greenhouse gas signals, and the utility tariffs to try to actually take some of that solar and charge the storage at different times of the day. We did that while reducing the peak demand charges. So that saves money for Merced and reduces the carbon footprint of the campus. We got about one metric ton of carbon per day. That's about equivalent to a car going over 2,000 miles.

So it's quite an impactful examples of a connected community technology because this is the entire campus cooling system in that chilled water tank. So we're really excited to be bringing that technology to you.

Go ahead to the next slide

I what to share with you a little bit about the California Demand Response Potential

Study. I want to thank the Public Utilities Commission. This work was started in 2015, so it's been ongoing for several years now. We've had three phases of work. We have four grid services that we call shape, shift, shed, and shimmy, and this is the GEB shindig.

So we have shape which is modifying the load shape from tariffs. We have shed which is the traditional hot summer demand response. And we're going to start looking at the cold winter demand response. Shift. Shift is a very important concept of acting like virtual storage, so moving loads and being able to soak up more of that clean electricity and use less around dinner time or early in the morning. We do not have a lot of shift in the field today. We need more of it. And then shimmy is like a fast-acting ancillary services. I'm going to be speaking mostly about shed and shift.

The Demand Response Potential Study helps us understand how may gigawatts are available, where in the state, when, and at what cost. So we actually had a model from over 300,000 load shapes and 11 million files of all the customers, so we do all loads, EVs, residential, commercial, industrial. I'll just talk mostly about buildings. But this model helps us look at what demand response is available at what costs. And we had about two gigawatts from buildings. We had about four gigawatts total but about two gigawatts for 2025 at $200 per kilowatt levelized costs. I'll talk a little more about how we came up with those numbers.

But right now we're working on what's called Phase 4. And I'll give you a little bit of a glimpse of what some of that data looked like. So we're very interested in understanding where geographically these are, so we have it by zip code throughout the state, by sublap, by sector, and you're going to see by end use. And we're trying to understand how to bring the costs down and how to increase participation.

So shift can play an important role but we need more shift resources. And we need to bring down the cost and get things like that, thermal storage, and using the mass of the building.

Go ahead to the next slide.

So in my modeling the loads and the energy efficiency and bridge shifting strategies, we look at the cost of installing technology, we look at the cost of operating it. So we look at smart thermostats. How much does it cost to install them? How much does it cost to maintain the communications? What's the speed of the response? And the persistence of savings is an extremely important one. So when we think about the value of GEBs, and we want them to be grid-interactive, we need to understand, when we invest in a control system it's not like putting in a more efficient HVAC system. We need to make sure those savings are persistent and that the communication investment has some value over time.

Go ahead to the next slide.

This is an example of a shift supply curve. I have a dashed line there at about $150 per kilowatt hour. So we compare the shift from building loads. This particular one has residential, commercial, and industrial loads. And we can get about four to six gigawatt hours of virtual storage from behind-the-meter from loads that compare -- that's cheaper than behind-the-meter batteries, and about 40 percent of that is from buildings, so we have a lot in process loads. But that number is based on historic participation rates in demand response. So the critical thing is to get more participation. We're looking at electrification, of course, with space heat and water heat. And we're modeling that in Phase 4.

It's important to understand that about -- in 2017, if we shifted about one percent of the load, that would have gotten about half of the curtailment that we saw in that year. So, in general, we want to reduce that duck curve problem by using load to soak up more of that clean energy.

Go ahead to the next slide.

This is quick look at pool pumps, space cooling, space heating, water heating. The space cooling and space heating is residential. And you'll see this is -- these lines are from -- all the different dots are from actual customers. And we calculate how much heating and cooling is present at an individual building from regression curves, from utility data. And then we look at what would it cost to put in a smart thermostat? And how many hours a year is it available to shift load?

So you'll see, commercial building HVAC, that one in the very middle, is more cost effective than the residential, but that's because the participation rates have been small in the residential programs. So, in general, we want to work on both the technology costs, bringing those costs down, and allowing customer adoption by getting the information out to customers.

Go ahead to the next slide.

Now I'm going to give you three quick slides before my final slide because I know I'm almost at time.

This is what a load-shape cluster looks like. I'm excited to show you this, what's called a double peaker. This is a residential cluster with almost 3,000 customers in it. And it has seasonal changes and it has HVAC end uses. And this one shows a morning peak and an afternoon peak.

Go ahead to the next slide.

This one is a daytime occupant. And we heard earlier Commissioner Gunda mention the concept of people staying at home, so residential load shapes are changing. And we could actually increase clusters like this one. When we look at what demand shift or demand response is available, we can look at what are the types of load shapes we see in different customer groups? This cluster has about almost 2,000 customers in it. This is a cluster, what we call Cluster 10. We will have thousands of -- we will have about 4,000 different clusters. And we look at when are they heating and when are they cooling? And what climate zone is this in?

And go ahead to the next slide

This one is what an EV rate responder looks like. So we know from the files who has an electric vehicle. And you'll see there at the top of that slide that this building is using a lot of electricity from midnight to about 5:00 a.m. and it's charging their EV. And we put these different load shapes together to try to understand the most cost effective way to improve demand flexibility and GEBs and increase the potential of buildings interacting with the grid.

So I have one last slide. Oh, two last slides.

So this one, this one I'm excited to share with you. Here we have, in the end-use load clusters we're developing for the Demand Response Phase 4 that we're doing right now, in Phase 4 we're going to be looking at shedding and shifting loads. And we have all these new end uses in red. The end uses in red have the potential -- now, you can't shift indoor lighting but we could shed indoor lighting.

So in Phase 2, you can see in black under the commercial sector, end uses. We had indoor lighting as a demand responsive shed capability. Thermal systems you can shift. You can shift spa heaters. You can shift spa pumps. You can't really shift televisions. So we characterize what each of these end uses can do.

The ones in green there, heating and water heating in residential, for the first time we modeled electrification scenarios. We are modeling out to 2040. So we're saying, what's available today? And how do we invest in this -- these technologies to enable these end uses to provide these shape and shift and shed and shimmy services? So we're doing a higher resolution model with more building types, more end uses, and trying to understand, how much does it cost to enable a dishwasher to receive a signal from the grid?

Go ahead to the next slide.

This is my final slide. So grid-interactive efficient buildings are critical for decarbonization. Right now, electric load shapes in buildings are not as flexible as they should and could be. To allow us to have a decarbonized grid, we need buildings to interact with the grid. Some of the key technologies I mentioned are electrification with heat pumps.

Envelope. We want to put in a good envelope. That allows us to downsize the heat pump. We put in a smaller heat pump with better windows and a cool roof so we can make sure that those hot days are -- the loads are reduced and a heat pump can manage the load.

Controls are critical. Controls are critical to do things like we did at UC Merced.

Communication technologies. Next year is the 20-year anniversary of OpenADR. And we're going to continue to work with California to innovate on communication technologies. And we want to make sure that these technologies can communicate with EVs, with both thermal and electric storage, and that we understand how to integrate the local photovoltaics like we did at Merced.

The bottom line is we need more customer engagement, so we need to continue to work on the ways to communicate with customers about the value.

And I’m excited that this October we are kicking off the California Load Flexibility Research and Deployment Hub. CalFlexHub is going to be testing the state’s load management signal and the concept of using dynamic prices in a machine-readable format to send signals to devices so a thermostat, a heat pump, a pool pump, and even the big systems at UC Merced can receive their tariffs in a digital form, whether it’s a real-time price or a time-of-use price.

And the Hub portfolio monies that funnel there is the annual process that we will be going through to make sure that we can look at what technology -- we have 12 projects that we’re starting with, and whether or not -- how are they doing? Do we need to reprogram our annual deployment cycle and annual lab cycle to make sure that we’re investing in the most important things? And we have a broad system of stakeholders that we'll be communicating with to make sure that the DOE and the CEC and the CPUC funding is realized and the Hub is taking advantage of what we're learning from the projects with the GEB Roadmap and DOE's leadership, with the DR Potential Study which will be the foundation of our modeling, and the EPIC, California Energy Commission-funded CalFlexHub.

So I want to thank everybody. Look forward to the discussion. Thank you.

MS. MATERO: Thank you, Mary Ann.

And the next speaker, we have Javier Mariscal, Senior Advisor for Strategy and Business Objectives at Southern California Edison.

MR. MARISCAL: Thank you. Why don't we just jump to the first slide?

So I want to just start by saying that grid-interactive efficient buildings offer utilities a comprehensive grid value proposition for optimizing grid planning and operations. It can shed load during peak hours. It could shift load to off-peak hours when clean energy is most plentiful. It could provide frequency regulation and voltage control.

But can utilities trust that GEBs will perform as promised? For us, for utilities, I think more planning studies are needed to address how to reliably interact with GEBs. Already, there are significant changes in greenhouse gas policy, customer programs, load profiles, and grid planning and operations that's already taking place now that will help us manage this potential new fleet of flexible demand resources.

Next slide.

So just quickly, you know, as I said, policies are evolving. In 2006, Assembly Bill 32 codified an emissions target of 1990 levels by 2020. Ten years later, in 2016, Senate Bill 32 went further. It required including a target reducing emissions to 40 percent below 1990 levels by 2030. And in 2018 there was an executive order that established a statewide goal to achieve carbon neutrality by 2045.

So in response, in 2019, Southern California Edison published a white paper titled Pathway 2045 which identifies a feasible and economically route to achieve climate neutrality by 2045. Some highlights from that study, Pathway 2045 concluded that a feasible and low-cost decarbonization can be achieved through powering customer energy needs with carbon-free electricity, electrifying transportation, and electrifying buildings. Specifically, the white paper found that emissions from buildings today are dominated by natural gas for household and commercial business use, such as space heating, cooking, and hot water or steam generation.

So in order to achieve an 85 percent reduction in GHG emissions from buildings, Pathway 2045 concluded that approximately one third of building space and water heating will need to be electric by 2030, and almost three-quarters of these by 2045. So electrifying these systems not only would significantly reduce emissions but it also provides an opportunity for managing load demand to avoid peak times and reduce grid costs.

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So customer programs are evolving. Achieving customer conversion from natural gas to electric technologies will require new outreach programs to help customers understand and realize the benefits of electrification. We will need new workforce development programs to train technicians on how to install and maintain these new systems. And most importantly, we'll need to introduce new easy to access and inclusive financing, incentives, and optimize utility pricing to help offset the initial cost of conversion to electric and provide ongoing affordability. Now these efforts are going to require collaboration with the California Public Utilities Commission to identify opportunities for layering incentives from various complementary programs, such as TECH, BUILD and SGIP, while avoiding duplicative incentives.

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At the same time the Energy Code is evolving. The California Energy Commission recently adopted the 2022 Energy Code, effective January 2023, which focuses on three key areas in newly constructed homes and businesses. The first is to encourage heat-pump technology for space and water heating. The second would be to establish electric-ready requirements for single-family homes to position owners to use cleaner electric heating, cooking, and electric vehicle charging options. And then the last would be expanding solar photovoltaic systems and Battery Storage Standards or multifamily projects over three stories, restaurants, schools, and other select businesses to maximize onsite use of solar energy and avoid electricity demand during peak periods.

Next slide.

This has been talked about but, again, it's worth repeating, load profiles are evolving. Already, we're seeing our customers adopting new technologies that enable them to take control of how and when they use, manage, produce and store energy. With the growing digitizing of work and electrification of transportation, heating and industrial processes, we anticipate significantly higher use of electricity in the future that will be offset with increasing adoption of onsite solar energy generation with paired battery-energy storage.

Customer expectations for reliability and resiliency will steadily increase due to this greater reliance on electricity for a wider range of critical and everyday activities.

So next slide.

So in response, our grid planning and

operations are also evolving. To meet these higher expectations for reliability and resiliency, we will need to optimize the bidirectional delivery of electricity for better utilization of the grid and customer DER assets. In other words, we need to interact with our customers as grid partners and find new tools and processes for integrating their assets, their DER assets, I should say, into our grid planning and operations.

How the grid is operated will undergo a significant evolution. It’s going to require substantial advances in grid management system technologies which will help us communicate and interact with, potentially, millions of nodes across the entire grid, including at customer locations. The traditional approach to grid management will evolve into a more decentralized operation of grid assets, with edge computing helping solve localized issues.

As we move forward in implementing our reimagined grid, our key decision making will be based on the following guiding principles. First, affordability, safety, resiliency, and most important of all, customer choice.

Next slide.

So our grid capabilities are evolving as well. So as we reimagine the grid, we seek to address how the grid must change to support California’s greenhouse gas reduction goals as laid out in Pathway 2045.

At a high level, our systematic approach begins with understanding what the grid challenges are, what our customers will need from the grid, and how the supply mix will evolve, as well as the regional climate change effects that the grid will need to endure. It’s going to require rethinking various aspects of the grid with a long-term lens, as well as increasing cooperation with multiple stakeholders to evolve the grid and advance our Pathway 2045 goals toward enabling a clean energy future.

The grid, it’s going to require new capabilities to sense, communicate, analyze, and respond in real time to dynamic load and equipment conditions. As a result, advancers and sensors, high-speed/high-volume communications, edge computing, predictive analytics, and artificial intelligence are all needed, as well as transmission and distribution planning, design, construction, and operations, they all must evolve to remove barriers to decarbonization, as well as to support customer adoption of new technologies and renewable resource development.

Next slide.

This is my last slide. So as we move forward, at Edison, we are moving forward and taking the first steps in making the reimagined grid a reality.

The first is we are refining what we call our forward radar. And that means we are improving our understanding of where, when, and why customers will be adopting DERs and load-control technologies and what new grid technologies are on the horizon.

We identifying and accelerating critical technologies. This means including fast tracking the development of technologies required for the deployment of foundational capabilities.

We are future-proofing current grid initiatives. This requires ensuring that ongoing grid modernization and resilience efforts are designed to handle additional complexity expected and/or are able to be upgraded in the future.

We are engaging stakeholders. This means collaborating and engaging with customers and other stakeholders to align what needs and challenges will arise, and what are the right solutions and standards for the industry.

And we are also implementing required changes to our planning processes. This includes exploring and adopting new methodologies and tools to make more adaptive grid planning decisions in the future.

In summary, we can't do this alone. Achieving a reimagined grid that interacts with grid-interactive efficient buildings calls for a collaborative industry-wide approach to be most effective and less costly to implement. And it's going to require all parties, policymakers, innovators, customers, utilities, working together to shape the policy and technology landscape and transform how we plan, design, build, and operate the grid.

Thanks for your time and having me participate on this panel. Thanks.

MS. MATERO: Thank you, Javier.

Next speaker, Carmen Best, V.P. of Policy and Emerging Markets at Recurve.

MS. BEST: Thanks. Again, thanks for the opportunity to join today.

You can go to the next slide. Next. Can you advance? There we go.

So I just wanted to step back a little bit and make an observation. Many of us have been around to see all of these policies evolve. But if you just start from 2006, which happens to be when I came to the Golden State to start a career in clean energy, the number of bills and regulations and initiatives that are dedicated to clean energy in California will make one's head spin. And indeed, I think the Commissioners' intro statements also added at least two or three more proceedings that I need to chase personally in my role. And while I think all of these have been well intentioned, I think they've also had the effect of having some unintended consequences of pulling everyone in multiple directions and, potentially, creating competing priorities and, sometimes, counterproductive rules because it really is impossible to synergize so many siloed initiatives.

So this barrier for delivery of demand-side management, I think, has been noted over and over again, the challenge of silos. But it does seem like each new bill or proceeding does run the risk of making it worse.

We need to bring a sense of urgency for resolving across these silos, especially given the momentum of existing interests and business models that respond from kind of our historic policies. And I'm really encouraged by the new comprehensive DER proceeding that the Commission has taken up. But we also need to grapple with scale because the hamster wheel of these existing and isolated practices are otherwise going to keep us in a box and they will keep us from achieving these ultimate goals.

So in my presentation today, I would like to step back and take a look at one possible strategy to help reconcile these policies across a common sense of value and a common framework for tracking progress.

Next slide, please.

And a little thunder was stolen, I guess, but we need to consider adopting a new construct. And I would asset that we already have a unified field theory, as it were. It turns out that the first successful classical unified field theory was actually from Michael Faraday, making the observation that time-varying magnetic fields could induce electric currents. And before that the phenomenon were considered unrelated.

I'm no Faraday. But I think that the unified field theory that I think would orient us in the right direction really starts with the recalibration of the value derived from demand-side investments. Yes, this is part of our policy considerations today. And we're pretty lucky in California that we have the avoided cost calculator which is a great source and kind of a comprehensive price signal that's coming from the CPUC. That, coupled with other price signals from CAISO or other markets, can really be complementary.

But what we need to do is put this value at the core of our considerations across resources and in the context of new business capabilities for deploying these resources. Luckily, California has made significant investments in AMI. And we the capability to use it to focus our attention on driving this maximum value. So these two things, while we have all of these silos, they may not devise every detail and eventuality of program interventions. And, with a common view of value, we'll be able to sort through those different situations.

Coupling the -- next slide please.

The second part of the unified field theory is, of course, NMEC. Normalized metered consumption was adopted in California legislation via SB 350 in 2015. And it's operationalized over the past five or six years. Thanks to support and funding from the CEC and DOE and others, NMEC has really created a means by which we can assess the common view of impact or performance relative to our common view of value and understand more effectively the interventions on the demand side across these different silos.

This group has probably heard of CalTRACK and the OpenEEmeter. They are open source code bases that are available to quantify the awarded energy use at the meter. And it's grounded in LBNL's time-of-week and temperature model which was originally devised for demand response by Mary Ann and here team. But it also is fully applicable to time-based energy efficiency.

Last summer, GRIDmeter was the addition to that sweet that Recurve worked on with the peer-review process and really enables a scalable way to use comparison groups to look at impacts relative to the overall grid and understand incrementality in a more meaningful way. When you couple this with differential privacy and other ways to protect customer data, it's now conceivable to expect that non-participant comparison groups can be part of a counter-factual analysis of performance and not just wish for it.

Next slide, please.

So when you look at this combination, you can kind of think of it as maybe a flex meter. We, at Recurve, have been able to unpack this value stream to look at the long-term interventions, like energy efficiency, versus the more event-based interventions, like demand response, very much like what Mary Any was talking about in the Demand Response Potential Study. But we're breaking down this key silo of performance of measurement and the potential competing baseline issues that otherwise exist for deploying energy efficiency and demand response in the same space.

So the hourly methods that we're

leveraging are working for both monitoring increases in energy consumption, like with electrification, and also monitoring decreases in energy consumption, which is kind of the traditional use case. And we're leveraging this technology, both in the California Clean Tech Initiative. And it fits in very well with a wide range of capabilities that are going to be surfacing with GEBs.

The measurement and verification solutions help us align our policies for scale. And having this unified field theory, which I would argue already exists, grounded in a common value, and the avoided cost calculator is on the way there, and consistent measurement and verification, we can really drive the scale we need to achieve our ambitious goals and make demand-side management part and parcel of how we run our economy.

Next slide, please.

So stepping back, the operation of the economy and the grid is really a balancing act. Customers are going to be leveraging GEBs as an important part of finding that balance part. How are they going to relate or interact with the grid? And at the end of the day, that interaction is ultimately summarized at the customer's meter.

Recurve is primarily focused on settlement at the customer meter because, in many ways, that's where the authority of the utility maybe should stop and where others are well suited to bring solution forward. I like to joke, you know, what happens behind the meter stays behind the meter. But I think it's a foundational question that we're going to need to grapple with of where market competition should appropriately begin and end, and where partnerships are also going to be beginning and ending for these types of programs.

Next slide, please.

It's no surprise over the last 20 years that utilities do benefit from demand-side resources. And we've established that in California quite clearly. We recognize the utility demand -- that utilities benefit from demand-side resources for a long time. And the more expensive demand-side values are represented in the avoided cost calculator that's developed and approved by the CPUC, at this time it's one of our best resources for a common value stream, at least for the utility side of the fence. And it can actually accommodate several social benefits, as well, as we've seen the addition of refrigerants, GHGs, et cetera. And, potentially, equity and resiliency could be included in those avoided costs.

Recurve has taken the time to operationalize this publicly-available ACC so that market actors an really use it to support decisions for installations and performance in a tool we call the FLEXvalue calculator.

Next slide, please.

When we look at -- it's important that market access can see how their interventions are playing out relative to what regulators want. And FLEXvalue helps them do that. They can manage load more effectively to deliver what's needed and make sure that the impacts are showing up on the grid and are affecting -- reflecting reality. With FLEXvalue, we can also show aggregators how they're actual performance is aligning with the avoided cost calculator and pay them directly for the system benefits that they're delivering.

When we live in a traditional sense of using deemed impacts, they tend to have rather farcical shapes that are nice for planning but, inherently, they are wrong. And if they're not being trued up with actual results from the field they can ultimately be missing the opportunity to align incentives for market actors and reward the type of energy management that's valuable the grid and also valuable to customers.

Next slide, please.

And actual performance can translate into real differences in value when the measured impacts in this scenario are delivering more than, say, a deemed assumption of what those impacts will be. And this is not always going to be the case. The inverse could also be true. But what the point is, we want to be assessing what we're really getting and align that with what we want as policymakers and regulators.

The CPUC has put a ton of effort into devising the avoided cost calculator and making it public. However, it's almost entirely invisible to implementers and aggregators that are devising projects in the field because they're mostly paid on average deemed values, not performance, as this point in time. For the most part, they're paid to install technologies and that's it, and that doesn't really help us in finding this right balance point on price or technology combinations that are going to drive the type of value that they're looking for.

Next slide, please.

And customers have choices too. They benefit from demand-side resources in unique and varied ways. And I would assert that they're buying something quite different than what the utility is buying. When we allow aggregators to interact with a customer and have the flexibility to offer them goods and services that they want, because the aggregator is aware of the grid value for a particular intervention, they can seek out the appropriate balance point for price to get any given customer to say yes, and get the project done that's going to deliver both on their needs, as well as the system needs. That type of price discovery is really difficult at top down.

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This model, really, is also a way. By focusing on value is another way that we can really be focusing on the other objectives and goals that we have for these investments to address equity, et cetera. There are fascinating business models that are ready to tackle multi-headed challenges. And all they need from regulators is incremental price signals to tap into that value stream. By layering a value signal for equity and market support goals, we could be delivering greater flexibility for folks to respond to and, ultimately, more ideas could be tested in the market to deliver on the multifaceted objectives that we have and drive more actors to join the industry as it evolves.

Next slide, please.

Because, again, we're really trying to build a bridge of value, on the one hand we have customers who have their own interests in investing in their buildings, on the other hand we have the grid that is really dependent on customer engagement to optimize its performance. So customers have their needs and systems have -- the system has its needs. And the value is really landing in the middle of each of these.

The undergirding of this whole thing is the performance. And that's where GEBs really synergize, in my mind, by creating extra intel and information for building owners and those interacting with building owners to drive value on both sides of the bridge.

Next. Next slide.

So we've operationalized at Recurve this theoretical construct in the demand-flex market. Right now there are two versions of the FLEXmarket, one for peak demand response and one for long-term load reductions called Energy Efficiency. For peak flex, MCE has a pool of aggregators that are providing regular peak savings at a fixed rate. And the Commercial FLEXmarket is an energy efficiency program that has both a fixed rate, and also a time-valued component to ensure that load shift and load shaping is also being incentivized.

And since I'm at time, the last slide is really about, again, coming back to this value bridge. This is how the different market actors are interacting in this model. And it's really a procurement model. It's not a program. It empowers and enables aggregators and building owners and customers to optimize all kinds of DERs with a common value signal at the core.

I think the industry is ready, it’s simply bursting with creativity, and I think this model is a way that we can harness the ultimate value to really achieve our biggest goals.

Thanks. I’ll take questions at the end.

MS. MATERO: Yes. Thank you, Carmen.

Next up we have Carl Linvill, Principal at the Regulatory Assistance Project.

MR. LINVILL: Good morning everyone. Can you hear me okay, Tiffany?

MS. MATERO: Yes, we can hear you.

MR. LINVILL: Okay. Great. Thank you so much for inviting RAP to participate today. This issue of value from combinations of DERs has long been of interest to RAP. You probably remember that, in 2013, RAP came out with a publication called Teaching the Duck to Fly, that tried to illustrate how combinations of DERs could take on the duck curve from a system perspective. More recently, we have a piece with NREL on using combinations of DERs to provide customer and grid value.

And you probably know that we’ve spent a lot of time thinking about beneficial electrification, smart rate design, smart rate design both for residential and nonresidential buildings. All these, you know, feed into today's topic of value of grid-integrated efficient buildings.

I anticipated, in thinking about a focus for our presentation today, that others would have the technical chops to do just what they have done so far, which is to lay out the opportunities for value through markets, through the distribution system operator, as well as through the wholesale market. And I think those are a very important set of values for us to consider, and that grid-integrated buildings bring value to the grid, to the distribution system and to the bulk electric system are very important.

However, not all values are necessarily mediated through those markets, through tariffs, or through those prices. And we know here in California, I live in Davis, we know here in California that those equity and resilience values that we're seeing today, particularly with the power system shutoffs, are of high interest.

And so what I want to focus on today is how grid-integrated buildings can bring capabilities for community equity and community resilience.

Next slide, please. Next slide. Thank you.

To set the stage, I want to start by noting the connection between grid-integrated efficient buildings and a recent RAP publication on renovating regulation.

Next slide, please.

Many of today's policies were implemented years ago. They help to enable cost-effective energy use. But in many cases, historical policies actually limit or narrow our choices when it comes to energy use in buildings and in other parts of the economy.

Next slide, please.

In short, regulation needs renovation. Today, new priorities and the availability of new efficient electric technologies are pushing a need for changes in regulation. Regulation needs renovation which is the primary focus of RAP's paper.

Next slide, please.

We all recognize that building emissions are not going down. In fact, they've been creeping up slightly. In comparison, emissions from electricity are down by about a third since 2007.

Next slide, please.

We also recognize that fossil fuel dominates space heating and water heating, as illustrated here by EIA's Residential Consumption Survey.

Another important category, gas for cooking, is also visible in the other bar here in this chart.

Next slide, please.

In sharp contrast, there are numerous opportunities that Mary Ann went into in detail, and we'll hear more about, to get our energy and end-use needs met in a more efficient, less costly and cleaner way, and to help buildings be a part of a dynamic 21st century power system.

Next slide, please.

And this is also true in the commercial building sector, as shown in this nice ACEEE graphic illustrating the many technologies that can be applied to commercial buildings.

Next slide, please.

So the challenge for policymakers and

regulations is to ask whether the existing policies and practices help us and our economies or are they barriers to available improvements? This paper touches on a number of areas in which barriers currently exist, barriers to achieving the values that electrify buildings and grid-integrated efficient buildings have to offer. A number of the barriers are enumerated in this slide. While these barriers apply to electrification of buildings generally, they also stand in the way of grid-integrated efficient buildings values being fully realized.

Next slide, please.

So this is our publication. I invite you to look at it. These are some of the topics that we cover in our publication.

But now I want to turn to my focus for today. My focus today is on community value. Community equity value and resiliency value are largely ignored. I know we have very good intentions. I have very good intentions. I largely ignore them as well. I think when we look through the lens of the market that grid-integrated buildings invites us to look through we do see that market clearing, value, and price, but sometimes we don't remember that there are other values offered in the grid, or in parts of the grid, that are not explicitly captured through those prices.

So grid-integrated efficient buildings can contribute to community, equity, and resiliency in ways that are incremental to, maybe in parallel to, the market clearing prices on the distribution and wholesale grid.

Next slide, please.

So first, let's turn out attention -- oops, we lost the slide. Yeah. I am on, let's see, I am on slide -- the beginning of section two with my presentation on achieving community equity value. I'll just begin speaking again while you're finding that. So let's turn to achieving community equity value. Almost there. Next one. Next one. And next slide. And now we're caught up. Okay. Oh, last slide, ensure access to equitable grid electrification and grid-integrated electric buildings. These slides are just running through.

Can I ask for direction? Do you want me to just keep talking and ignore what's going on with the slide or shall I wait? So I --

COMMISSIONER MCALLISTER: Yeah. Sorry about this, Carl. Let's try to get you the right slide here.

MR. LINVILL: Okay. This is slide number 13 from my deck. The heading of it is "Ensure Access to Equity Building Electrification and GEB." It's a couple back from that one. No, you've gone forward again.

COMMISSIONER MCALLISTER: Okay.

MR. LINVILL: No, you're going forward again.

MR. TAYLOR: It looks like page 75.

MR. LINVILL: It's okay.

COMMISSIONER MCALLISTER: Sorry.

MR. LINVILL: Don't sweat it, guys.

COMMISSIONER MCALLISTER: Sorry about that.

MR. LINVILL: We have to -- we all have to be flexible on this new flexible grid we live in.

COMMISSIONER MCALLISTER: Well, yeah. Well, hopefully, maybe the presentation can go offline and they can figure out where you are and then reshare.

COMMISSIONER SHIROMA: I think --

MR. TAYLOR: We got it.

COMMISSIONER SHIROMA: -- I think we can see. We can see.

MR. TAYLOR: Yeah.

COMMISSIONER SHIROMA: Maybe there's a little delay in being able to see. I can see the slide.

MR. LINVILL: We're there. We're there. We found our way back.

COMMISSIONER MCALLISTER: Oh, great. Okay.

MR. LINVILL: Great.

COMMISSIONER MCALLISTER: Great.

MR. LINVILL: Yeah.

COMMISSIONER MCALLISTER: Okay. Thanks Carl.

MR. LINVILL: Okay.

COMMISSIONER MCALLISTER: All right.

MR. LINVILL: No problem.

COMMISSIONER MCALLISTER: Please go ahead.

MR. LINVILL: Thanks again. Okay, so now I'm going to -- and I'll go quickly here, for once, because I don't want to have us off time.

But anyway, first, I want to dive into

achieving equity value in the community. Equity in building electrification comes up throughout the RAP paper. There are considerations for equity in all policy decision being made. The paper includes a section that highlights, in particular, the challenges that historically disadvantaged communities, communities of color and low-income customers, have I accessing potential benefits.

If our goal is to ensure that all customers could access the benefits of building electrification, we have to first recognize there are multiple persistent barriers in making that a reality. In concrete terms, how easy is it for a low-income family to move in from a drafty apartment with natural gas amenities to a rental with electrified space conditioning and water heating?

There's also what we sometimes call the -- and equity -- challenge. It's critical to recognize that equity considerations should not be an add-on, something bolted onto the tail end of an already designated or designed process or program. We tried in our paper to consider equity in all facets of the policy discussion.

But at RAP, we also recognize that we have a lot to learn in our own understanding of the top priorities and needs of communities.

As noted in my opening statements, regulators can benefit from endeavoring to reach out and better understand communities. And PUC processes are working on and becoming more accessible in California.

Next slide, please.

Putting a focus on equity starts with regulators giving their attention to several key areas, determining how well programs are working for everyone, assessing their effectiveness, revisiting and improving opportunities for engagement, and endeavoring to design building electrification programs that recognize and incorporate the needs of a diverse public.

Next slide, please.

Appreciating community equity value requires listening from the start and throughout. And here are a few suggestions that I would like to offer, and there are many more but, you know, I know that regulators in California are already seeking to pursue. But as we seek to capture and understand what equity value is for the community, understand how grid-integrated buildings can contribute to that equity value, perhaps by providing services that aren't currently available, then by pursuing some of these actions and many more we can improve the recognition of community equity value which may not otherwise be represented in the prices that we see clearing the marketplace.

Next slide, please.

Now let's turn ourselves to resiliency value. Resiliency value is clearly a value that's seen from the eye of the beholder. And that's best illustrated by just digging right in. Let's just start with the next slide.

Resilience includes the ability of energy systems and operations to minimize service interruptions during extraordinary events and threats, robustness, ability to recover, ability to continue operations, and ability to adapt are all important dimensions of resiliency.

Next slide, please.

But it doesn't take you long to realize that resilience is a matter of whose resilience are we talking about, and from whose perspective are we looking at resilience? It's common to think about the perspective of the customer because the customer is a common, you know, entity on the utility system. It’s possible to think about resilience from the perspective of the grid, and grid’s recovery, and the grid’s ability to withstand events.

If you can’t -- if you haven’t picked up on it yet, I’m kind of leaning towards an observation about what’s missing from our usual conversations about resilience. And you’re going to find that community is that thing.

Next slide, please.

When we think about definitions of resilience we can think about it from the perspective of the customer, we can think about it from the perspective of the grid, and we can even think about it from the perspective of microgrids. But none of these quite hit the nail on the head in terms of addressing community resilience. Think of the PSPS events, for example. There are discrete groups of customers that are affected by events. They have discrete interests, discrete values that are most important to them in recovering, avoiding PSPS events. And those aren’t quite represented in this set of activities.

So what I'm encouraging today is that we think about these community values, community resilience and community equity value, these values that are often invisible and behind the grid.

I'm running short on time, so I'm going to quickly go through the next two slides.

You know, we too often revert back to the conception of the grid that, at least I grew up with. Since I'm old, of a one-way grid.

Next slide, please.

You already heard, Southern California Edison, Javier's, nice explication of Edison's efforts to create a more two-way system. And yet, many of our considerations of value seem to revert back to this one-way vision and not to hone on community value, and not to ask the question: How do we figure out what community value is? How do we effectively engage communities in understanding what community resilience value is?

Next slide, please.

So here are some examples of some things, some conversations that I've had recently about what community resilience values grid-integrated buildings can help provide.

Centers for energy resilience within each community to ensure access to essential services during disruptions and recover, local economic integration and resilience that provide local jobs and income, and local energy integration resilience to coordinate local energy resources for local benefit are each things that somehow we don't quite get to.

Next slide, please. So my takeaways -- and next slide. Okay. Next one after this one is the final slide, regulation -- oh, previous one.

So I'll just read it, it's not up right now, but regulation requires a renovation. Regulatory frameworks need to evolve for the benefit of grid-integrated buildings, as well as electrification in general. Community equity value and community resilience are often ignored, despite our best intentions, so we need to make regulatory forums more accessible, provide direct funding for community-based organizations, and aggressively seek community-driven input from the start and throughout our planning processes.

Thanks a lot. Thanks, again, for inviting me.

MS. MATERO: Thank you, Carl, an apologies for the slide mishap.

MR. LINVILL: No problem.

MS. MATERO: Next, we have Natalie Mims Frick, Energy Efficiency Program Manager at Lawrence Berkeley National Lab.

MS. MIMS FRICK: Thanks Tiffany. Can you hear me okay?

MS. MATERO: Yes, we can hear you.

MS. MIMS FRICK: Awesome. Hello Commissioners and everybody. Thanks for the opportunity to speak today. I'm going to present research from Berkeley Lab on estimating the value of demand flexibility from grid-interactive efficient buildings, or GEBs, in utility planning. And I also should thank David Nemtzow and the Building Technologies Office for supporting this work.

Next slide, please.

So last year, my colleagues published a report called Determining the Utility System Value of Demand Flexibility from GEBs, and what's shown on the right side of the slide. And there's a link to it at the bottom of the slide as well. And my presentation today is mostly based on the methods to value demand flexibility in buildings that's discussed in that report. So be sure to take a look at it if there's anything that is say that piques your interest. And there's also a lot more content in there that I don't know if I can cover today.

We also published two other papers two other papers as part of the state and local Energy Efficiency Action Network GEB Series. And I have links and descriptions to them on this slide, too, if you want to take a look at them. The first one is an Introduction to GEBs for State and Local Governments. And the second one is on Evaluation, Measurement, and Verification, or EM&V, of Demand Flexibility from GEBs.

Next slide, please.

So our report and this presentation focuses on methods and practices to determine the economic value of demand flexibility to electric utility systems. It's important for planners to know the value of demand flexibility so that they can design programs and market rules and rates that align the interest of customers and buildings owners and utilities. And valuing utility systems on affecting cost from demand flexibility is the foundation of many other analyses. And this report provides guidance to a broad audience on how to improve consistency and robustness of evaluation of demand flexibility to the utility system.

Next slide.

So the paper and this presentation focus on the electric utility system which is everything that's outlined in red at the top of the slide. And there's two parts of the electric system in that box, it's the bulk power system and the distribution system, and both of those are combined to produce the net economic value of efficiency and other DERs that provide demand flexibility. And there's other benefits of cost outside of this analysis that could be added in, such as customer or societal impacts, or community resilience, as Carl was talking about. The jurisdictional test from National Standard Practice Manual is one resource for figuring out other costs and benefits to include to your state.

The text box on this slide talks about

some of the grid services that GEBs with demand flexibility can provide. They can reduce generation costs, like avoided power plant fuel, operating and maintenance, and reduced delivery cost on the T&D systems, for example.

Next slide, please.

So in the electric system, there's a couple of planning challenges that I'm going to highlight today. The first one is limited analytical capability. This is a little bit of a good news/bad news problem. The good news is that DERs are declining in costs. And robust analysis of DERs that provides demand flexibility is more and more important for state energy offices and agencies and utilities, given the increasing levels of DERs on the system. But in order to do so they often need to develop new capabilities that currently don't exist so you can analyze demand-side resources in an organized and wholistic and technology-neutral manner to get the resources onto the grid and determination their generation transmission and distribution system value.

Next slide, please.

So the second challenge I'll mention with respect to planning is the lack of parity and cost-effectiveness. In the majority of utilities, economic analysis of supply-side and demand-side resources aren't comparable. Typically, generation resources are valued as part of an analysis that compare them to other generation resources, not to demand-side resources. And that often happens in the load forecast where DERs are removed from the load and then generation is used to meet the remaining need.

The lack of parity influences the cost-effectiveness and limits the type and quantity of resources that can be selected in planning. And when you limit the analysis for resources that can provide demand flexibility you may make achieving your state energy goals more expensive and your portfolio might not be optimized.

Next slide, please.

When we're talking about the economic value of DERs, the basic value of the resources of what it costs, so traditionally the economic value of efficiency in other DERs is determined by using avoided cost of conventional resources that provide the identical utility system service, which includes reliability, not just energy and capacity. The underlying principle in the value of DERs is determined by capturing the cost of acquiring the next least expensive alternative resource that provides comparable service.

Next slide, please.

So the lift here is that you have to figure out what the alternative resource is and establish it's cost, which isn't an easy task. The methods used to establish avoided costs vary across the country due to differences in market structure and resource options and costs, and state energy policies and regulatory context.

Next slide, please.

There is no single economic value of DERs for the utility system. Each unit of grid service provided by efficiency or other DERs is a function of the timing of the grid service benefit, load profile, location, expected life, avoided cost of the next least expensive resource that provides the same services. And the evaluation method that's used needs to account for all of those different variations.

Next slide, please.

So this slide has four primary methods

that are used to determine which resource a utility system develops.

So first, capacity -- system capacity expansion and market models. The most common practice is to reduce the growth or demand in the load forecast based on assumed levels of efficiency or other DERS, and then let the model optimize for the type, amount, and schedule of the new resource.

The less common practice is to allow efficiency in other DERs to compete with conventional resources. And in that approach the analyst doesn't just reduce load growth, the model runs all resources together and then optimizes all of the resources at the same time. And if that sounds interesting to you, I'm presenting on that specific topic at ACEEE Energy Efficiency as a Resource later this month, so tune into that.

The second method on this slide is competitive bidding. This is often used in organized markets where capacity -- well, sometimes capacity and energy are bid in or offered up for supply.

The third approach is proxy resources to develop economic value. And that's used pretty frequently across the country. And analysts will take a resource need that they might have, either energy or capacity, and then speculate what the most logical resource would be to supply that need if you weren't using a DER. So, for example, if a battery is what your next resource is that's going to provide peaking capacity, you'd use that as the cost to determine how much DERs are going to be cost-effective, taking into account the declining cost of your batteries and your DERs over time.

And then fourth option is to have a policy or administrative determination, such as the Clean Energy Standard or Renewable Portfolio Standard, Energy Efficiency Resource Standard, and then select your resources to meet that goal.

Next slide, please.

Our report has several examples of gaps and limitations in restructured markets and states with vertically-integrated utilities, but I'm not going to talk through them. I put those slides in the appendix. I'm going to go through each of these four examples in my next four slides if I don't run out of time.

So we can go to the next slide.

My first example of a gap or limitation to valuing demand flexibility from efficiency and other DERs is not using accurate load shapes. And so on this chart the X axis is the hours of the day. Y axis shows the percent of load that occurs during the peak. And this chart has two different load shapes on it. The blue one is a metered load shape from the Pacific Northwest. It's residential lighting. And it's the average of consumption of hundreds of different houses. And then the red load shape is a residential lighting shape that is from a model. And it's the default load profile that goes in for one of the demand-side management models that utilities use. And this kind of echoes one of the messages that Carmen was talking about in a few of her slides where deemed savings and actual measured savings are quite different.

But anyhow, in the model, consumers only have their lights on, you know, during the peak hours, and that generates -- creates a higher value. And then the blue load shape, which is much more realistic where consumers have their lights on throughout the day, doesn't have as much value. And if you assume the wrong load shape then you're not going to get the right value going into your system planning. So it's important to be thoughtful about what resources you're using in your planning. And this example is for efficiency but the same applies to other DERs as well. You know, inaccurate shapes, certainly, can misrepresent your demand, your peak productions, and your energy savings.

Next slide, please.

Oh, this is -- so, fortunately, there's a new data set that is going to be released at the end of October from a project that -- and they're end-use profiles from -- National Renewable Energy Lab and Berkeley Lab, and Argonne have been working for the last three years to develop residential and commercial end-use load profiles that are representative of the U.S. building stock. And they will be available at many different levels of time and geographic granularity. And I'm happy to talk about that more offline or whenever.

Next slide, please.

Now, back to my gaps or limitations, so the next example that I have is valuing -- is a gap or limitation when you're not accounting for all of your value streams.

So this is a chart from a report that Tom and I -- Tom Eckman and I worked on a few years ago. The X axis is four different regions of the country. And the Y axis is the value of the end-use load shape. And this one is for residential air conditioning.

So if you look at the fourth one over, Georgia, they don't have publicly-available avoided distribution or transmission costs. And so when you compare the value of their residential air conditioning with the other three regions, if you look at the very top ledges of the stacked bar, the light purple and the light green, you can see that those add about $20.00 a megawatt hour of value. So if you don't account for those, then you're undervaluing your resources, and it can be quite significant, depending on the timing of when your savings are happening.

Next slide, please.

My third example of a gap is not analyzing the interaction between DERs. And this slide focuses on interactions between efficiency and demand response. And it shows the outcome of an analysis that was done for the Northwest Power and Conservation Council's seventh power plan.

So on this slide the X axis is time, Y axis is capacity developed by the capacity expansion model. The dotted line represents demand response capacity that's developed by the model. And the solid lines represent efficiency that's developed by the model under different avoided costs. So the green lines are long-run avoided costs. And the red lines are short-run market prices.

So if you look at the short-run market prices you can see that less efficiency is selected and more demand response is selected. And then if you look at the green lines that are using the long-run prices it tells the opposite story. More efficiency is being selected and less demand response is being selected.

So this really illustrates two different concepts. First, the interaction between the efficiency and demand response and how, when you choose one resource, you're going to impact the quantity of other resources that are being selected. And then second, you know, using different price forecasts is going to result in very different resource selections.

And considering the resources together in your capacity expansion model, or just through your analysis, is going to allow your planners to see how these resources influence each other, which will have a more robust analysis.

And then if we can go on to the next slide, please?

Similarly, failing to analyze the potential interaction between your DERs and your existing and future supply may not give your planners the best either. So treating efficiency and demand response as selectable resources allows for optimization across both your supply and demand-side resources and modeling.

And so this chart shows the quantity of natural gas capacity that the model chooses to develop under different levels of efficiency and demand-response assumptions. This is also part of the Northwest Power Council's seventh plan. X axis is time. Y axis is gas megawatts developed, the model selected. The blue line is efficiency at the long-run avoided cost with demand response. And it has the lowest quantity of gas capacity that’s developed by the model.

The Yellow line is short-run market price, efficiency up to short-run market price with demand response. And it has new gas coming online in 2022. And then the red line is long-run avoided costs and its efficiency without demand response. And the gas capacity, the model brings that on in 2017.

Next slide, please.

So there are seven recommendations from our report. And states and commissions can consider them as they are determining their electricity planning requirements or upgrades that they might want to make to them. Utilities can consider them as they plan. The first one is to account for all impacts, account for when demand flexibility occurs, account for the impact on distribution before transmission and distribution because impacts multiple through your system, account for location, your interaction between DERs, your full lifetime of your resources, and then also between DERs and other resources.

And then if we can go on to the next slide, please?

This is my last content slide. This is a summary of the report overall. And it has the recommendations down the left side. And then across the top what electricity planning sector they're planning to, so distribution, generation, and transmission. And the recommendations are listed on the left. And the circles where the enhancements have the most impact are shown, and they're like kind of Consumer Report-type circles. Full circles indicate where the recommendation is most applicable.

So if you look at the first line, looking at all impacts is important for generation, transmission, and distribution. But if you look down at number four, location, it matters a little bit less.

So if we can go on to the next slide?

These are resources. I do, also, want to mention, I didn't get to include this in my deck, but we have technical assistance available through our National Association of State Energy Office, and National Association of Regulatory Utility Commissioners GEB Working Group, which California is a member of. So please, let me know if there's something that you saw that you think would be interesting we can help you out with that. And then we also have technical assistance funding available for this report that I've been talking about on the economic valuation of energy resources. And then, also, on creating energy efficiency supply curves for use in long-term planning

So I will take questions at the end. Thank you so much for the time.

MS. MATERO: Thank you, Natalie.

And next up, and to round out the panel, we have Brett Webster, Manager at RMI.

MR. WEBSTER: Hi everyone. Thanks so much for having me. It's really a pleasure to be here and to be part of such an excellent group of panelists.

So grid-interactive efficient buildings are something that we've been excited about for a long time at RMI and have been working in seriously for about the last four or five years. And I'm excited to share some of our learnings and work over that time.

Next slide, please.

Here's what I'm planning to touch on today.

Next slide, please.

So why are GEB important for decarbonization? I think by this point in the panel, pretty much everyone's got a pretty good idea around this.

Next slide, please.

But I'd like to start just by contextualizing GEBs in the larger effort to decarbonize the building environment. I think this is probably a very familiar list of ingredients to many folks but I think an important context to keep in mind, that each of these pieces in the equation needs to happen to create a future of carbon-free sustainable, resilient buildings. So to the extent that efforts to integrate GEBs can mutually reinforce and scale other parts of the equation, those are the ones that should be prioritized.

According to our estimates at RMI, in order to stay aligned with a 1.5- or 2-degree future, by 2030 half of existing buildings and 100 percent of new construction need to exemplify these -- need to have these five ingredients in buildings.

Next slide, please.

So focusing in on the grid-interactive and efficient piece, this is DOE's definition of GEBs that David Nemtzow covered in the keynote this morning. And I think, you know, we, in talking with people, often get the question around how GEBs differ from demand response? And I think demand response is a great step but there are sort of two key ways that we think about GEBs going beyond DER. The first is that they are a continuous tweaking of demand-side profiles rather than responding to a few key events per year. And the second are that GEBs can optimize for cost and carbon, whereas DER is often utility cost and capacity driven. And so I'm really going to be focusing on this carbon piece in my talk today.

Next slide, please.

So what can GEBs do? Here is a familiar graph as part of this whole workshop. This is an example load profile from an all-electric office in California for a single day in the spring.

Next slide, please.

With energy efficiency, that load profile maintains its same shape, roughly, but drops its energy consumption across all hours.

Next slide, please.

And then if we layer in these gray bars, they represent the hourly carbon intensity of the electric supply to this building from the grid, so you can see the dip mid afternoon from all the solar on the California grid. And similar to cost of electricity operations, the carbon intensity is variable, and often there can be up to ten X differences across a single day.

Next slide, please.

So with a flexible and efficient load profile this building can shift its consumption to utilize more energy during those low carbon-intensive periods and less as the carbon intensity of the electric supply gets higher. You may look at this red profile and think about demand charges for a commercial building that, shifting in this way, may lead to a more expensive solution in terms of operating costs.

What we have found is that it is possible to co-optimize for cost and carbon. And some recent work from our colleagues at WattTime and Enel X found that there could be up to a 30 percent reduction in carbon for less than one-percent difference in cost. But that if you only optimize on one or the other you lose the combined value proposition.

Next slide, please.

So what is the value proposition of GEBs to building owners and occupants?

Next slide, please.

In 2019, we did a study for the GSA Portfolio, assessing the value potential for GEB measures in existing buildings across the portfolio of the nation's largest landlord and found that there are substantial benefits today. For the GSA's Portfolio, we found the opportunity on the order of $50 million a year in savings, representing about 20 percent of the annual energy spend, with most of the measure bundles delivering a sub-four-year payback.

We also found that by investing in demand flexibility measures, GSA would position themselves to be able to easily adjust to future rate structure changes as it would often just require a reprogramming of the controls logic.

Next slide, please.

Here's a deeper snapshot of the California location, in Fresno for this study, showing the NPV of individual measures for that location. In general, we found, and I think as David Nemtzow alluded to in the keynote earlier, that GEB measures can have a high net-present value and short payback periods driven by low first costs. And you can see that more than half of the pie here are controls-focused measures, things like staging HVAC equipment, lighting fixture controls, and temperature setbacks, which don't often have a high up-front price tag associated with them.

The best returns were from locations with high-demand charges and time-varying rates. And the value to the grid and society, as other panelists have alluded to, depends on the alignment between these rate structures, grid operations, and carbon intensity. So one of the primary saving streams that we found in this analysis was through the demand-charge management. And to the extent that individual building peaks align with high-priced periods of grid operation, and those periods also align with increased carbon intensity, we can capture the full value stack. But individual building peaks don't always match grid peaks. And, fortunately, in California the correlation between grid operating costs and carbon intensity is pretty strong.

Next slide, please. And next slide, please.

So GEBs can reduce greenhouse gases in a variety of ways. They can reduce them directly through grid carbon alignment, which is the example that I showed at the beginning of this talk, which can lead to less runtime for dirty peakers and higher utilization of renewables, reducing CO2. GEBs can also help reduce greenhouse gases through enabling electrification.

There's two pathways here. GEBs can flex to mitigate the needs for infrastructure upgrades, both capacity expansion and distribution system upgrades in the electric system. And GEB measures can help reduce the capacity of electrified heating systems which can further enable electrification and drive down CO2.

Next slide, please.

One more point of emphasis on how GEBs can enable electrification. You know, the spark spread is still a barrier to electrification in many places. This chart shows the balance point between gas and electricity rates with a heat-pump water heater versus a gas-tank water heater. And then the region of gas and electricity prices, retail prices from PG&E, overlaid in red there.

Additional revenue streams from demand flexibility can help improve the cost-effectiveness of electrification. And I think that is a key way in which GEBs can help reinforce another piece of the equation, which is -- of the decarbonization equation, which is in getting fossil fuel end-uses out of buildings.

We need to ensure equitable access to these value streams and electrification incentives. We need to expand access to retrofit funding for low- and moderate-income folks, and to ensure bill protections to help mitigate the risk of increased operating costs.

Next slide, please.

Here is a deeper look at carbon alignment potential for GEBs. This is from a study we recently completed for NYSERDA looking at the possibility of carbon-based load shifting to provide a compliance pathway for Local Law 97 in

New York City. We examined, in this study, we examined a series of proxy grids to help understand possible future emission scenarios. These proxy grids were based on actual historical marginal emissions rates in other regions. And the solar-dominated grid here in the middle is using data from CAISO territory where we found the ability for the GEB building to reduce emissions by 11 percent on a shorter-season day.

I would note that the annual savings percentage is likely quite a bit smaller. But as the grid continues to decarbonize the savings potential grows. And in this study we found that that estimate was up to 40 percent savings as there's more carbon-free resources on the margin.

Next slide, please.

As part of this work, we dug into how a carbon signal might influence the emissions savings opportunities. The first piece is focused on the type of signal. So here we're looking at the differences between an average emissions signal which shows the carbon intensity of the mix, the entire mix of generation resources operating at a given moment, and a marginal signal which shows the carbon intensity of the generator on the margin, which is actually what's impacted as load shifts.

To get the right response we found that a marginal emissions signal should be used, and that by using an average signal there is potential to greatly reduce or even (indiscernible).

Next slide, please. There we go.

The level of advanced notice and the signal timestep will both influence the behavior of a building. And this table on the left shows the efficacy of a carbon signal to achieve the carbon savings potential as you vary the level of advanced notice and signal timestep. Unsurprisingly, real-time communication and a granular timestep lead to the most savings potential. And in reality, there's going to be a tradeoff between the level of sophistication and cost of building equipment and a granular signal, so there would be identifying a sort of sweet spot to maximize emissions savings from this type of load shifting would be the goal.

Next slide, please.

There are also beneficial equity impacts of aligning building response with the carbon signals, so this is from that same work, the study. By aligning building demand with carbon intensity you can reduce the peaker plant runtime and affect the local air quality in neighborhoods occupied disproportionately by low- and moderate-income folks.

Next slide, please.

I think many folks are aware of the GridOptimal Initiative, which is a joint initiative being led by New Buildings Institute and the U.S. Green Building Council. Their work has been to identify a set of metrics to better harmonize building-grid interactions. Those metrics that are now available for a LEED pilot credit are shown on this slide. This is pretty similar to a lot of the demand management emphasis in the most recent Title 24 Code cycle. And I, actually, probably could have included a screenshot of those here as well. But the point I want to highlight is that, you know, there's a lot of work going on in this area. I think there's a clearly recognized need to better harmonize building demand and grid operations, but that alignment across these various initiatives will really help in furthering the integration of GEBs. So between codes and standards, national metrics, and policies and programs at the state and local jurisdiction, so the extent we can align, we think we can help accelerate GEBs rollout.

Next slide, please. And next slide, please.

So just to highlight a few key takeaways, policies and programs should be designed to capture the cost and carbon value of GEBs, and we can't leave out the carbon piece. As we've seen with other examples, like the SGIP program, you know, we need to explicitly think about the way that demand flexibility is impacting carbon intensity.

Alignment between rates, wholesale market programs, and carbon intensity is critical to maximizing the benefits of GEBs.

The carbon signal is important. Type, timestep, and level of advanced notice are all important features to pay attention to.

Bundling GEBs with electrification efforts can reinforce value propositions. And we need to consider things like incentive adders for smart and connected electric equipment.

And then the last piece is that GEBs should be thought of as an arrow in the quiver of building decarbonization, not a standalone objective.

Next slide, please.

This is my last slide. I've just left some additional resources for areas I was referencing during this talk.

And next slide.

Thank you very much.

MS. MATERO: Thank you, Brett. And thank you to all of our morning panelists.

So we'll open up discussion from the dais. If the Commissioners and panelists can turn on their videos if you wish? That keeps you still muted --

COMMISSIONER MCALLISTER: Thank you very much.

MS. MATERO: -- unless you speak (indiscernible).

COMMISSIONER MCALLISTER: Thank you very much, Tiffany. Thank you, Tiffany. I really appreciate your facilitation. And that was a great panel, huge content, and we're running overtime on the presentation, so we don't have a whole lot of time for Q&A.

I just wanted to highlight every one of you in different ways who said the huge potential, just highlighted in detail the huge potential for grid-interactive buildings as a project to really benefit, have multiple benefits, and help us in the transition to renewables and enhance reliability at the same time, and I really appreciate all that.

So I have one question. And I guess, Natalie, you highlighted this, but interested if other people have any opinion. So, you know, we have a pathway for procurement. And, Natalie, you highlighted that that is a pathway to, you know, procure DER-level, you know, demand-side resources and really incorporate them into the stack organically, you know, alongside other supply. I guess, you know, that's a way to bring resources to this sector, you know, by paying for it. So we have energy efficiency, we procure it, and that sort of -- you know, that comes from ratepayers and that's how we fund it.

You know, the investment in buildings, particularly existing buildings, is less clear. Like, you know, it's going to take a lot of money to get into those existing buildings. And many of you, I think all of you in some way, emphasized community, especially you, Carl. You know, ideas about how that value can actually be monetized, I think, would be something we all need to think about going forward. And I don't know if anybody has any models that can help do that. But in California, you know, it's going to take $100 billion to get into even just our low-income buildings and do what's necessary there to electrify and decarbonize.

So you know, what -- does anyone have a vision of sort of what that would take to channel that level of resources? You know, are we really talking about including it in rates and ratepayers or, you know, do we have other big buckets of funding that we could go after? And I guess, you know, that becomes a broader conversation, so I'm really kind of asking you to talk about the policy element here.

MS. MIMS FRICK: I guess I'll go first. And then other people can certainly come in with a lot more than what I can add.

COMMISSIONER MCALLISTER: It was a long question.

MS. MIMS FRICK: Well, that’s good because I get to answer it however I’d like.

So I think, you know, what I was talking about a lot today was around valuation of DERs and, you know, they’re in buildings, and thinking about how those can be rolled up and then considered on a level power system, and also the distribution system. But I think that one element of the policy side of things is thinking about how to appropriately value all of your DERs, and it’s not easy. And there’s lots of challenges with figuring out what the distribution system value is and how that transfers over to your bulk power system and looking at it from, you know, a high-level perspective, how many resources you can have online, and whether or not that’s going to increase or decrease your total system cost.

And so, you know, thinking about that perspective is going to be important as well. And California has obviously made lots and lots of steps forward to achieve that. And I think there’s still a few that need to be made but I guess that’s my plug for more excellent planning. So I’ll let someone else chime in there.

COMMISSIONER MCALLISTER: Thanks very much.

MR. MARISCAL: Hi. This is Javier. I'll tackle it, I guess, from a utility perspective.

I think one of the main points I wanted to make was that in order to take advantage of this, of GEBs, which are basically a big resource, it's a fleet of resources out there, ultimately, it's tied back to the utility, the grid, it's our ability to interact. And in order to do that, we're talking developing new capabilities.

So indirectly, Commissioner, it's, yeah, I think the ratepayers may have to pay. There's going to have to be big capital upgrades for the grid to be able to interact with these buildings in a way that we don't today. And so one thing that we're going to need to be aware of is, you know, what new markets are going to be created? What are the rolls of, say, an aggregator if they want to aggregate these?

So there's a whole new market question that needs to be talked about and how that fits in with today's regulations, et cetera. And I'm glad to see that CPUC is part of this conversation, as well, because that's going to have to -- we're going to have to address that.

So I do agree, it goes beyond just incentives, it goes beyond retail rates. I do think that there's going to have to be huge capital upgrades to develop the new capabilities we're going to need in order to interact and fully take advantage of what GEBs can offer.

MS. BEST: I just wanted to add one other thing. I think it's, you know, related to GEBs but, also, just the model that I was kind of outlining of being flexible and how we approach flexibility. I think there are ways that we can streamline the channels by which other funding sources could be comingled with the ratepayer funds.

So as Javier is pointing out, too, like aggregators could be a good conduit for being able to capitalize on streams of funds that may be coming from private equity investment or other objectives. I can think of one business even that is an aggregator in the demand flex market that is it's objective is to do micro -- working with micro businesses utilizing a workforce that is coming from formerly incarcerated individuals and turning that around using the On-Bill Financing Program, actually, to get these micro businesses to do retrofits, et cetera.

So that sort of kind of multifaceted business model is, I find, very inspiring and is, with proper access to kind of the ratepayer flow of funds, plus other capital that can be aligning these objectives, I think that there's a pathway to be scaling all kinds of different interesting and innovative things that we can't even conjure up right now sitting in this room, box room.

COMMISSIONER MCALLISTER: Great. Thanks. Thanks for those answers.

I want to respect everyone's time, we're already a little bit over, but tons to think about.

And I think, Vice Chair Gunda, did you have some comment or question?

COMMISSIONER GUNDA: Yes. Thank you, Commissioner McAllister. As I noted at the top of the meeting, I was a little under the weather but this really helped, this panel. This is -- I mean, this is one of the best panels I've ever heard, I mean, in terms of the substance and the clarity of thinking wholistically. I just wanted to note some of the key points that each of you raised in terms of, you know, in (indiscernible), kind of focus on kind of the load-shape clusters and the work that LBNL is doing, and the insights we can, you know, gather from there, I think.

And I really appreciated Carl's focus on equity and resiliency, specifically the idea of the resiliency hubs and the importance of moving that forward.

Carmen, you had an excellent presentation. I really liked the question you posed on the DER, and then the broader integration of where the markets start and stop. I think that's a very, very important question.

And kind of Natalie's broader challenge to everybody to better model the DERs and some of the constructive lessons we can take from this study.

And I really appreciate the idea around bringing metrics together. So, Brett, thank you for raising the issue of thinking through metrics more wholistically, taking the carbon, as well as rates, into it.

And, Javier, you know, thanks for your call on kind of posing the question of how do we collectively design, and we can't do this alone. We all have to come to this discussion. I think my kind of like takeaway from this panel is that I need to probably spend half a day with each of you on your presentations and learn a little bit more.

I just want to put a plug that next year IEPR, we are thinking about launching a complementary, you know, track to Commissioner Houck at CPUC specifically focusing on DER analytics and analysis, so I really hope we'll all engage together. And we want to particularly think about how do we not think of equity as an element of the design but (indiscernible) that all the programs are designed around it.

So I hope to engage with you all and continue with the conversation. And excellent presentations. Thank you so much for your time and your expertise.

COMMISSIONER MCALLISTER: Thank you very much, Commissioner -- or Vice Chair Gunda. I really appreciate that.

And I think our challenge, just the big takeaway, our challenge as to how do we create markets that complement the traditional utility procurement in ways that are aggressively time based and create value for the customer? Some, largely, intermediary is going to have to figure out how to provide those services to the customer and create -- and save the system money or bring additional capital from somewhere from the system, and so that has to look like a seamless activity to the customer. And I think that's where, often, efficiency and, certainly, multiple programs targeting one customer has kind of tripped up, wrapped itself around the axle a little bit in terms of delivery.

And so we really do, I think, need to continually work better, work together, and to try to -- and I think all of you really mentioned this, described it in one way or another -- to help markets engage and deliver these grid-interactive efficient buildings, in particular touching, you know, the 130 million buildings in the nation and roughly, you know, 15 or so in California, a big job. And we need kind of all of the capital coming to this as we possibly can.

So the analytics, the reason we wanted to do this panel was because the analytics began to actually create a roadmap to help us understand where we need to target and, you know, ultimately influence from the distribution grid all the way up to the bulk power market and create value for the ISO.

So really great stuff.

And I want to ask if we have any Zoom questions or public comment?

MR. TAYLOR: Commissioner, this is Gabriel Taylor. We have two questions in the Zoom for the panel. And then we have two requests for public comment.

COMMISSIONER MCALLISTER: Okay. Great.

MR. TAYLOR: The first question from the Zoom is from Tanya Barham. It's directed to Carl Linvill. And she says, "Thanks very much for your written response in the Q&A." And also asks if you'd like to speak a little bit about how we can flex the top-down process to accommodate the time and flexibility needed to bring communities along?

MR. LINVILL: Well, Tanya, I'm just going to say back at you since we don't have very much time. Just say that I think that the Climate Center's Community Energy Resilience Initiative is a really important conduit for bringing communities together to build local resiliency and equity. And I think that, ultimately, the input that that, and I know you're involved in that, but I think, ultimately, that is building the information flow that we need from the communities to the regulators and to the utilities to, you know, clarify because people want to help.

Thanks for the question.

MR. TAYLOR: Thanks so much, Carl.

One more question from the Q&A. Tristan from SkyCentrics asks, I'm paraphrasing here, and then Tristan, I think, wants to speak in the public comment, but he says, "How can we overcome the decades of inertia focused on energy efficiency programs and shift those to time efficiency or connectivity?"

That's an open question to anybody on the panel, including Commissioners, of course.

COMMISSIONER MCALLISTER: I think this goes to the existing building conundrum; right? And Tristan's sort of setup there was that we don't have the grid connectivity in the end uses across our commercial buildings. And, really, I think we could be more broad than that, even, but he was focusing on commercial buildings.

So, yeah, so how can we rapidly overcome the inertia? The army of utility executives and program implementers that now still only think in terms of efficiency instead of interactivity, so this is a program challenge.

MR. TAYLOR: Commissioner?

COMMISSIONER SHIROMA: I want to point folks to this afternoon's discussion at two o'clock where CPUC Staff will be talking about some ongoing proceedings that will also get at this question.

COMMISSIONER MCALLISTER: Thank you, Commissioner.

MS. PIETTE: Yeah. Commissioner McAllister, I'd also like to offer --

COMMISSIONER MCALLISTER: Go ahead, Mary Ann.

MS. PIETTE: -- that we have made progress as a community in developing open standards and requiring them in some of the building codes. SB 49 and other things like that are exploring the requirements for technology that's sold in California to be required to have the capability to receive a signal. But at the same time, we need to help work with the utilities to have a signal for them to listen to, whether that's a tariff signal or an emergency demand response signal.

So we need to better understand what is required to increase the uptake, as Tristan is saying, for installing common communication technologies and requiring some consistent investment in ensuring that they persist because the savings don't persist if the controls and the communications aren't used and tested over time.

So we don't really know what that looks like. We know a little bit but not at scale. So I think that's an important comment that he made.

COMMISSIONER MCALLISTER: Great. Thanks. Thanks very much.

In the interest of time, I think we're going to move on.

Gabe, maybe you can ask --

MR. TAYLOR: Yeah.

COMMISSIONER MCALLISTER: -- the beyond-Zoom questions from the audience?

MR. TAYLOR: So we have two requests to make public comment --

COMMISSIONER MCALLISTER: Okay.

MR. TAYLOR: -- before we break for our lunch break. And the first up, I believe, is Tristan. And so he can -- he has another question in the chat but I think, maybe, we could just let him speak?

MS. AVALOS: Tristan, this is --

MR. DE FRONDEVILLE: Yeah. I apologize.

MS. AVALOS: -- the Public Advisor's Office. Go ahead.

MR. DE FRONDEVILLE: I raised my hand and then realized I could ask the question. So I appreciate everybody's time. I don't want to add anything more except that our experience is people are paying for heat pumps to go in but not, frankly, $5,000 to $7,000, for example, on residential of layered incentives, and then an inexpensive cellular full-time real-time control which a number of the panelists have said is much more valuable than a time-of-use six-month schedule change but a flexible daily, 24 hours ahead, or real-time response to carbon signals. You can look at Cal ISO curves and you will see that they change quite a bit day to day, week to week, as opposed to six-months schedules.

And I'm panicked that the inertia of

time-of-use schedule is going to make us lose another ten years before we really have real-time or 24 hour ahead cellular AMI mesh and other methods of connecting to building equipment, both residential and commercial. It takes a real mind shift. And I'm afraid that we are so easily bound by the inertia of what we've done and how program implementors, for example, have made money for so many years. And I'm just not seeing the urgency to figure out how to incentivize and promote controls. Ninety-eight percent of commercial buildings are not connected in any way to receive signals. I'm just concerned.

Thanks.

MS. AVALOS: Thank you.

Our next commenter is Barbara Conti.

Please state your first and last name and any affiliation. Go ahead. You may need to un-mute on your end, Barbara. Go ahead. Barbara, your line is open. Again, Barbara, you may need to un-mute on your end by --

MS. CONTI: Yes.

MS. AVALOS: Okay. Go ahead.

MS. CONTI: I attempted to lower my hand so that -- this is Barbara Conti at the Minnesota

Department of Commerce. Thank you for the presentation. I actually did not have a comment. I inadvertently raised my hand, so --

MS. AVALOS: Okay. Thank you.

COMMISSIONER MCALLISTER: Thank you for being with us, Barbara. I really appreciate that from other states. We'd love to work with you on some of this.

MS. AVALOS: Okay. And just a reminder for those that are Zoom, you can use the raise-hand feature if you have questions. I'll give it just a few more seconds and see if anyone else has comments. Okay.

COMMISSIONER MCALLISTER: Very good.

MS. AVALOS: Tristan, you have your hand raised. We allow one comment per organization.

So I'm going to go ahead and turn to you now, Commissioner McAllister.

COMMISSIONER MCALLISTER: Great. I think we've had a lot of great conversation here. We could, I think convene again and spend another whole half a day here on these issues and more.

But I really want to thank the panelists from David in the morning all the way through all six of you on this panel. You know, your expertise and insights are just really terrific.

And I want to remind people that comments are due in a couple weeks, October 19th. We'd love to hear anyone's comments on how to really push this forward with the urgency I think that we've heard from all of our speakers and, certainly, that we feel at both Commissions to really create solutions, enable solutions, and really get the marketplace humming on these technologies and get our buildings really be able to be all they can be to both help the grid and be really driving resources for the citizens and residents of California.

So with that, I think with my colleagues permission, maybe I'll just wrap it up there. We're already quite a bit over time. So is that okay with you, Commissioner Shiroma? I'm seeing yes. And I think it's okay with Vice Chair Gunda as well.

So with that, thanks so much, and tune in this afternoon at 2:00. We'll get started on our afternoon session about load flexibility.

All right. Thanks everyone.

(Off the record at 12:47 p.m.)

CERTIFICATE OF REPORTER

I do hereby certify that the testimony in the foregoing hearing was taken at the time and place therein stated; that the testimony of said witnesses were reported by me, a certified electronic court reporter and a disinterested person, and was under my supervision thereafter transcribed into typewriting.

And I further certify that I am not of counsel or attorney for either or any of the parties to said hearing nor in any way interested in the outcome of the cause named in said caption.

IN WITNESS WHEREOF, I have hereunto set my hand this 27th day of December, 2021.

MARTHA L. NELSON, CERT**367

CERTIFICATE OF TRANSCRIBER

I do hereby certify that the testimony in the foregoing hearing was taken at the time and place therein stated; that the testimony of said witnesses were transcribed by me, a certified transcriber and a disinterested person, and was under my supervision thereafter transcribed into typewriting.

And I further certify that I am not of counsel or attorney for either or any of the parties to said hearing nor in any way interested in the outcome of the cause named in said caption.

I certify that the foregoing is a correct transcript, to the best of my ability, from the electronic sound recording of the proceedings in the above-entitled matter.

MARTHA L. NELSON, CERT**367 — December 27, 2021