QUADRENNIAL ENERGY REVIEW

PUBLIC MEETING #5:

Electricity Transmission,

Storage and Distribution - West

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Daniel Poneman, U.S. Deputy Secretary of Energy

James Robb, CEO, Western Electric Coordinating Council

Steve Berberich, CEO, California ISO

Patrick Reiten, President and CEO, Pacific Power

Elliott Mainzer, Administrator & CEO, Bonneville Power Administration

Carl Zichella, Director of Western Renewable Transmission, Natural Resources Defense Council

Joel Bladow, Senior Vice President, Tri-State Generation & Transmission Association

John Savage, Commissioner, Oregon PUC and Chair, Committee on Regional Electric Power Coordination, Western Interstate Energy Board

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Patricia K. Vincent-Collawn, Chairman, CEO & President, PNM Resources Inc. and Co-Chair, CEO Policy Committee on Energy Delivery, Edison Electric Institute

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Geisha Williams, Executive Vice President for Electric
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Arlen Orchard, General Manager and CEO,
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Steve Klein, CEO, Snohomish County (WA)
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P R O C E E D I N G S

MODERATOR KELLEY: We'll go ahead and get started.

Well, good morning. I would like to welcome those of you in the room to the Quadrennial Energy Review public meeting in Portland, Oregon here at the beautiful campus of Lewis & Clark College. I'd also like to welcome those of you who are joining us via live stream on the web.

My name is Chris Kelley. I'm with Energetics. We are a support contractor providing support to the Department of Energy on this QER effort. I have the distinct honor of being today's facilitator. We're going to be hearing from a number of speakers today, three different panelists, but before we get started, I'd like to share with you a few housekeeping notes.

The QER Task Force welcomes comments from the public. If you'd like to make a comment and have not yet signed up, please do so at the front desk. And for those of you who are joining via live streaming, you can email your comments to QERcomments@hq.doe.gov.

We have an outstanding set of speakers today. Their comments and presentations can be found after today's session at www.energy.gov/qer.

So before we get started, I have to read a short statement about the purpose of today's meeting.

Pursuant to the Federal Advisory Committee Act, the purpose of today's meeting is to ask for your individual input or your organization's input regarding electricity transmission storage and distribution with a particular focus on the Western United States and provide a forum to exchange information.

To that end, it would be most helpful to us for you to provide these recommendations and information based on your personal experience, your individual advice, information, or facts regarding this topic. The object of the session is not to obtain any group position or consensus; rather, the U.S. Department of Energy is seeking as many recommendations as possible from all individuals at this meeting.

So with that, allow me to introduce Dr. Karen Wayland, Deputy Director for state, local, and tribal cooperation and for stakeholder engagement at the Office of Energy Policy and Systems Analysis at DOE. Dr. Wayland will introduce our next speaker.

DR. WAYLAND: Thank you, Chris, and thank you all for coming. This is a very important part of the Quadrennial Energy Review and the fact that Presidential Memorandum spends quite a bit of time directing us to engage in a significant and robust stakeholder engagement, of which this is one of 16 meetings that we're doing around the country, so I appreciate we have a very high level of caliber of speakers and I'm very excited to hear what they have to say. We learn something new at every one of these meetings, so it's quite exciting to be here.

And it's a privilege for me to introduce Deputy Secretary for Energy, Daniel Poneman, who will be concluding the longest run as Deputy Secretary in the history of DOE, which is a feat that we attribute to his Iron Man training, and he'll be finishing with us in September.

He told me not to read a standard bio, so I'm not going to, but I did a little research and I found an article in New York Magazine about one of his four rock and roll bands that's called Coalition of the Willing. And, it described the Deputy Secretary as "having a glittering lightning bolt on his guitar strap and office-neat hair."

In fact, in one of his recent meetings at BPA, he ended a jam session, but I don't know if we'll get any of that today. He's also the guy you'd most want to be on your trivia team, having won $10,000 in Jeopardy in 1990.

But in all seriousness, sir, you are going to leave a huge hole at DOE, and your bio is not something's that's boring and should be glossed over. Since you're going back to academic oblivion, I'm going to just give some points about your career.

He'll be leaving us to go to Harvard, where he got a degree, as well as at Oxford. He's the author of three books, one of which received a distinguished writing award. He was Special Assistant to the President, Senior Director at the White House National Security Council, chief U.S. negotiator in talks with France, Russia, and Iran over Iran's nuclear enrichment program.

DOE is losing a very dedicated public servant who has a quite accomplished career. He helps steer the Government response with a steady hand through the Fukushima disaster in Japan, Super Storm Sandy here in the United States. He helped oversee the Department's massive and historic new investments in the development and deployment of clean energy technologies, both here and around the world.

So it's a great pleasure for me to introduce Deputy Secretary of Energy, Daniel Poneman.

DEPUTY SECRETARY PONEMAN: Thank you, Karen. I guess I'd better go out and clean up

Google or something. I didn't know it had all that stuff out there, but I still have that lightning bolt, by the way.

And what you didn't hear from Karen is that that jam session included Elliot Mainzer's mean saxophone playing on Junior Walker & the All Stars and other kinds of songs.

But, look, first of all, it's great to be back in Portland. It's such a critical part of our energy infrastructure. And I want to put this in a little broader context, and I don't want to talk long because as I always tell my kids, I can't talk and listen at the same time. And as you just heard from Karen, this is really about us hearing from you what the issues are, what your insights are, and how that can inform this QER. But let me just talk a little bit about the QER, its genesis, where it comes from and how this all fits together.

It was really just about a year ago today, and a sweltering day, you couldn't have sort of scripted better just when you think about the overall dramatic challenges that we face in terms of climate change, President Obama went to Georgetown University and laid out an ambitious Climate Action Plan. It's really a call to action. It's facing the reality that we are courting disaster potentially if we don't get our arms around the critical moral, environmental, technical, and political challenge of climate change.

And in presenting this, he presented three pillars. The first pillar of it was mitigation. It is absolutely essential that we continue the strong efforts that we have begun so far to bring more renewable and clean sources of energy to the floor. The President has challenged us to come up with a doubling of wind and solar and storage resource and we did so from 2008 to 2012. In the Climate Action Plan, he called on us to double it yet again by 2020. He called upon us to double down and improve our energy efficiency by 50 percent by 2030.

And just yesterday, I had the privilege

to go down and meet with some of your colleagues and other people down at Lawrence Berkeley National Laboratory where they're opening a first-of-a-kind, a one-of-a-kind facility, the FLEXLAB, which will now have the opportunity to integrate multiple systems, HVAC systems, window systems, different plug loads, all very finely censored so that people can know as you're building and as they're retrofitting buildings what precisely the energy efficiency savings are going to be and they can plan accordingly.

The President built into the Climate Action Plan a second pillar, an essential pillar on adaptation, because as everyone here knows, we are already suffering the effects of climate change. The drought in California, Governor Brown has declared a state of emergency because of the threat posed to the systems down there.

Obviously, we all suffered through and watched the response to Hurricane Sandy, over 8 million customers out of power. And I have to note that the West Coast stepped up to the plate in a very big way. And I see our friends from PG&E are here. We were on the phone with Tony earlier. We were on the phone with Ted Craver, and we were on the phone with our BPA colleagues at the time. And everyone provided bucket trucks; they provided linemen; they provided trimmers, and it really was an inspiring sight.

But it shows that you are going to have local and dramatic climatic effects, but it's going to require a national response because we're all in this together, whether it's the drought in the Southwest, the storms in the Northeast, and every part of the country has been inflicted.

You know, we had the propane shortages in the upper Midwest. And so it's going to be critical that we understand how all of these systems fit together. And that is really the essential reason for this Quadrennial Energy Review.

A few years ago, the President's Council on Advisors on Science and Technology, which is led by the President's Science Advisor, John

Holdren, and at that time included a very thoughtful energy expert on it, Professor Ernest Moniz, came up with a concept that really -- it's not a novel concept when you talk about a Quadrennial Review.

The Pentagon has been doing Quadrennial Reviews for a number of years, and it's based on a very simple premise. When you have a major problem with extraordinary complexity that's going to require marshalling of resources, it's going to require many different stakeholders to understand, come up with solutions and execute those over a long and sustained period, it will not due to just kind of gloss along from year to the other. You've got to stop. You've got to take a long over-the-horizon look. That's what the Quadrennial Energy Review is all about. That's what the President's Council on Advisors and Science and Technology recommended, and that is what President Obama put into the Climate Action Plan that he announced in Georgetown last year.

Now, I want to be clear, this --

although the Department of Energy, obviously, and you know from Karen, that we're doing these 16 sessions, we are working very hard to support the Quadrennial Energy Review. It is not a Department of Energy review. It's mandated by the President. It is co-chaired by the Domestic Policy Council and the Office of Science and Technology policy in the White House, Dr. Holdren and Dan Utech right now. And we are involving all of the other Federal agencies who are involved in energy. And we are coming out here, and we're talking to the communities, to the stakeholder, to the utilities, to the RTO's, the ISO's. I promise never to get into the alphabet soup, but you know who you are. And it's critically important that we get the input that you've got to offer.

Now, when it comes to energy, the question, it is such a leviathan, it is such a massive, complex, interactive situation for all people. All Americans are affected. Frankly, all citizens of the world are affected. Where do you begin?

We've got power generation issues. We've got a vast number of new and interesting opportunities and challenges presented by the profound transformation that our energy economy has been experiencing over the last 10, 15 years, where the hydrocarbon production of this country has just actually skyrocketed. We hit 8.4 million barrels of oil production per day in the month of May. We're now the leading natural gas producers in the world. Our shale gas share of our national economy has increased from 1 percent in 2000 to over 40 percent today out of a 23, 24 trillion cubic foot annual gas economy. So it's a profound moment of change.

But we're starting with infrastructure. And the reason why we're starting with infrastructure is because that is where all of these different systems come together. That is where we need to really take a grid that is dated in the 20th Century, and mid-20th

Century at that, and transform it to a grid that is suitable to the challenges of the

21st Century where we're moving from a system of one-way transmission of electricity to a system in which you have two-way communication flows from the consumers back to the grid and from the generators into the grid, electric vehicles that will be putting charges into the grid and all of the balancing challenges as you have:

increased distribution of distribution generation, the new challenges that that presents in terms of terra structures. This is an incredibly complex and incredibly important and incredibly burdensome issue for all of us because we're talking about trillions of dollars of investment that are going to be required in the years to come, and we're talking about the deep interstices that exist among energy systems.

Karen was talking in the introduction about Hurricane Sandy. I'll tell you that one of the first big insights that we had we was I think many of us did not realize how deeply intertwined the fuel side and the electric side were with one another. In some -- the most production ways like getting diesel fuel into the trucks to repair the lines and thousands of other connections besides. We need to understand how all of these connections work, and frankly, we need to understand where they don't work.

And so it made sense that in this first instance to take this huge energy challenge, break it into constituent parts and start with that, which is really essential to all systems: the infrastructure, the transmission, the storage, the delivery -- on the electric side, on the fuel side, gas, and oil and refined products.

And so that's why we called you all together here. We are very, very interested in what you've got to say. And as Karen has told me and as Melanie Kenderdine, who is spearheading our efforts for Secretary Moniz inside the Department of Energy tells me, every one of these sessions has produced new insights, new understanding. And this is the time when we are most plastic in terms of taking all this data, shaping the thoughts that are going to inform this review, and this review we hope will then inform the country because it will be a national dialogue that's going to be at the federal, state and local level.

Believe me, we understand that the assets that are being talked about here are largely in private hands. Two-thirds of the assets are in private hands, and we have dealt with that in a number of vectors. And we also have to understand the interactions, not just among the different energy forms, but between energy and telecommunications and other systems of transportation: trucks, railroads, barges. It's an enormously complex system.

We'll learn a lot from this session here today. We'll take it all down. I will bring it back to our colleagues in Washington. We will come back to you, and I'm going to be true -- I hope to my word of not going on too long -- and I'm going to stop there.

But before I sit down and listen and take notes, I'd be happy to entertain any questions from you. But the main thing I've got to say to you here today is we are very, very grateful. We are deeply aware of the expertise that's represented here in this room. And we want to thank you very, very much for taking time out of your very busy schedules to share this time with us, to share your thoughts with us, and to help us put together what we hope will be -- it certainly will be a first of a kind, I think, comprehensive look at energy that takes an over-the- horizon look and one that I think will help us create the kind of world that we want to leave to our kids with the prosperity and the jobs that come with a dynamic energy economy and also to work on the future that we're all trying to build to save the planet from what could be otherwise a catastrophic climate change.

So thank you very much for being here and I look forward to the discussion.

MODERATOR KELLEY: Thank you.

Any questions from the audience for Deputy Secretary Poneman? If you have a question, please stand up. Matt's got a microphone here, and he will bring it to you. Any questions? Don't be shy.

DEPUTY SECRETARY PONEMAN: Didn't put anyone to sleep I hope.

MODERATOR KELLEY: It's early, yeah.

We have a question over here.

MR. KAMATH: Hi. I'm Haresh Kamath from Electric Power Research Institute. And so -- just a general question on funding levels for the Department of Energy in general for research, especially in some of these same areas.

Given the current legislative climate, it looks like there may not be the same level of budgets that we had in the last few years, obviously, in the post-recovery -- in the recovery period for the same kind of investments in demonstration projects and the like. How do you see this playing out over the next few years, and do you think that -- that it's likely to hold up through the research that we're going to be doing?

DEPUTY SECRETARY PONEMAN: It's a great -- it's a great question. I will tell you the sort of commonplace comment that we hear around government, not just in energy, but among the agencies is: "Flat is the new up."

And so in one of our early sessions of the President's Management Council where we're trying to bring in CEO's from private companies and help bring some of those best practices and disciplines to government, the watch word of one of them was to try to do more faster with less. And in some respects, we're trying to do that.

But look, actually, within the parameters of that very constraining budget environment, Department of Energy has not done badly. We have very substantial resources, and we're still the largest funder of the physical sciences in the country on the order of $5 billion a year. We still have very important investments taking place through our Energy Efficiency and Renewable Energy Office. But I would say the following.

We have, in the form of the Recovery Act, a one-shot opportunity to take those resources, in the case of Department of Energy, and there were $35 billion, and try to do some very important work with them. But it was work that was consciously -- some of it was consciously just to get people to work again. But some of it was a down payment on things that we understood would have to be taken up by the private sector.

For example, the Loan Guarantee Program. We deployed capital that itself, our loan guarantee capital of $30 billion has leveraged another $50 billion of investment, and we have to show for it the first five ever grid scale affordable tariff projects in the country. We had zero. The private sector then, having seen that these are actually financeable deals, they're backed up by long-term power purchasing agreements, they've come in and financed the next ten.

I have now seen that that model's actually beginning to translate overseas. We have one of -- right here in the Pacific Northwest and I visited Caithness, one of the largest wind farms that's been developed with loan guarantee funds.

We have significant geothermal. We have significant biomass refinery, and we have Ivanpah and others, very major concentrated solar power, concentrated solar thermal as well.

So one thing that we've done is try to take those down payments from the Federal Government, and then we're trying now to work with companies and say, hey, now that we have developed this class of now operating, in this case, generating assets, can we somehow scale that kind of investment and find ways to, for example, standardize power purchasing contracts so that it would be easier to secure ties for those loans? Why? Because, when it comes to the deployment -- the increased deployment of renewable energy, it's going to be very, very important to lower the cost of capital, especially for things like wind and solar where the commodity is free, effectively, as long as the wind blows and the sun shines.

So that's the kind of thing we're trying to do. And we had $4.5 billion, of course, we've put through the Office of Electricity, bought a lot of synchrophasors with that. And that in turn has stimulated a lot of activity in the private sector in terms of taking the data from that and trying to help people improve.

Just the very modest investment that we made yesterday, $15.8 million in this FLEXLAB down at Lawrence Berkeley Laboratory is already collecting sponsorship. And you may hear from Geisha Williams here later today about their work down there to find ways to bring cheaper, better energy solutions to the PG&E clientele and their customer base. And once that's done and demonstrated there, it becomes something that can be replicated in Omaha, in Detroit, in places right across the country.

So we're trying to be smart about the investments that we place. There's still significant resources. We are now in the second round of Energy Frontier Research Centers. We're still seeing, I think, good uptake on the grants that have been given to ARPA-E where you're still having significant private investment follow for every dollar that we've put into ARPA-E that goes out. We're finding multiples of that coming back in terms of private investment.

And so we're going to try to make the strategic investments in some of the seminal technologies, battery storage and so forth, in some of the homes, and then try to do this in a way that we fill a gap, one of the sort of, you know, sort of a valley of death, for something where we've got to go from something that is still so far away from commercial realization that it's not reasonable to expect private investors to take that risk and bring them to a level of maturity where it's less risky and therefore starts to attract more private capital, because at the end of the day, our job is not to displace private capital but rather to capitalize it and bring much more of it into the picture because we're going to need vast, vast resources to make that kind of investment work.

MODERATOR KELLEY: Thank you, great

question.

We have time for one more. Any other questions from the audience? No? All right.

Well, thank you, Deputy Secretary Poneman.

(Applause.)

MODERATOR KELLEY: So at this time, I'd like to ask our first panel to join me up on the stage and we'll be getting some name cards set up.

And while we're setting up, I just want to remind everyone, if you do have some comments as Deputy Secretary Poneman mentioned, we're very interested in hearing from the public. So please do note on the sign-in sheet that you would like to provide some commentary.

And for those of you who are joining via live streaming, you can email your comments again into QERcomments@hq.doe.gov.

(Panel 1 takes the stage.)

MODERATOR KELLEY: So while we're getting settled in here, I'll just note that we have a tremendous group of panelists here today.

We've got CEO's, presidents, directors, administrators from here in the Pacific Northwest and from all over the West.

Our first panel has been asked to address: "Transmission - Can We Build and Operate the Appropriate Amount for Future Needs?" We'll hear prepared statements from all of the speakers, but I ask that you please hold your applause until the end.

I'd also like to share with you that the views expressed by panelists are their own views and not the views of the U.S. Department of Energy.

So our first panel includes Jim Robb, CEO of the Western Electric Coordinating Council; Steve Berberich, CEO of California ISO; Patrick Reiten, President and CEO of Pacific Power; Elliott Mainzer, Administrator & CEO of the Bonneville Power Administration; Carl Zichella, Director of Western Renewable Transmission, Natural Resources Defense Council; Joel Bladow, Senior Vice President of Tri- State Generation &

Transmission Association; and John Savage, Commissioner, Oregon PUC and Chair, Committee on Regional Electric Power Coordination, Western Interstate Energy Board.

And I think I covered everybody.

So we'll go ahead and get started with Jim Robb, if you'd like to start us off with your comments.

MR. ROBB: Sure.

MODERATOR KELLEY: I need to -- before you do, just let me note to all the speakers that these microphones are automatic. So, we are listening.

MR. ROBB: Does that mean we don't have to be close to them too? Can you hear me okay? Okay, fine.

So, thanks, Chris.

I thought maybe what I would do since I'm the first up would maybe just to -- kind of set the table a little bit for the West.

Let me first explain who the Western Electricity Coordinating Council is for those of who aren't familiar with us. We're the regional entity responsible for compliance, monitoring, enforcement of NERC reliability standards in the West. We also do a substantial amount of reliability assessment and planning activity for the Western Interconnection.

We're unique in the West in that we're the only entity that actually looks across the entire Western Interconnection. So we have the 14 western states, BC, Alberta, as well as Baja, California. That gives us a relatively unique lens into the industry in the West.

In our planning activity, we execute that through a stakeholder committee, which we refer to as TEPPC, the Transmission Expansion Planning Policy

Committee. And that group has produced over the last three years two long-term transmission plans, a ten- year plan, which is a deterministic view of the industry that looks at committed resources, committed transmission projects, and seeks to the answer the question:

will there be adequate generation and deliverability to meet load under reasonable scenarios?

And then we also do a 20-year, which is a much more scenario-based view of the Interconnection, looking at plausible resource mixes and load mixes against a series of internally consistent scenarios and seeks to the answer the question, you know: can we build a system that will remain policy compliant and meet the resource needs of the region?

One thing I would say about WECC is that we are an independent organization. We underwent a fairly substantial restructuring earlier this year.

We do not own, operate, develop, or invest in transmission assets nor generation assets. We do not compel anyone to build. We look at the industry through the lens of electric reliability and really are trying to answer the question: will the bulk power system be there when the region needs it?

There are four, and I think important, considerations as you think about the Western Interconnection that's very different than the East. And I think it's important to lay out for the Department of Energy because from our view, and from my view, a substantial amount of national energy policy is heavily influenced by the structure in the East. So let me just kind of lay out a few things that are important to bear in mind.

First of all, the Western Interconnection does not have an organized -- a uniformed organized market across the Interconnection. We do have a well- functioning market in California and in Alberta, but beyond that, it's a series of traditional vertically integrated utility markets.

There is a very active wholesale trading market in the West and has been for some time. But in general, planning, development, and so forth of transmission and generation assets tends to be done at the utility level, not at a regional level.

The second point is that the West is extraordinarily diverse. You know, we have a large number of IOU's, a substantial presence of public power, two very large public power marketing agencies, a number of rural co-ops across the region that creates an extraordinary diversity of interests and biases towards what's important as it relates to energy, and I'm sure you'll hear plenty of that from my colleagues on the panel.

The West is also extraordinarily politically diverse. I don't need to say anything more than we have, you know, Utah and Arizona sitting next to California, Oregon and Washington. So the political ideologies and how people think about the tradeoffs between economics and environment are going to be very, very different as you go across the West.

One other point I think it's important to bear in mind about the West is that the Western Region, much more so than the East, has grown up around resources. In the West, we generate power for the resources and we wheel it to load. It's very different than the East where the vast majority of electricity comes from fuel, which is transmitted to the load pocket and generated locally. That gives us a transmission system which can be characterized as having very, very long lines, bringing resources from the Pacific Northwest, from Wyoming-Montana Coal, from Southwest Solar to load. So the importance of the transmission system here is very, very different and the stability of the system because the length of the lines is different.

And the last point I would make before I hand this over to Steve is that the fuel mix in the West is extraordinarily dependent on weather. Twenty- seven percent of the generation mix in the West is hydro, wind, or solar. If you throw in natural gas as a weather-dependent commodity, which you have to in the West as we've had interruptions in gas supply to power plants when it's been cold, like 65 percent of our fuel is not secure in the typical sense of having a uranium pile, a coal pile -- or uranium when it's coal piled in front of a solid fuel plant.

With that, I'll pass it over to Steve.

MODERATOR KELLEY: Thanks, Jim.

Steve?

MR. BERBERICH: Thanks, Jim.

I'm Steve Berberich. I'm the CEO of the California Independent System Operator. We're responsible for the bulk power system reliability as well as operating the markets in California.

I applaud the Department of Energy for taking on this task. I know it's quite a task to listen to all these various inputs. But what I'd like to do is to kind of take an overall view from California, which I think is a microcosm, perhaps, of things to come for the rest of the country.

Certainly transmission spurs more emotions than a number of things associated with the NIMBY issues, the costs and siting issues, and then obviously, we have to apply the reliability and economics on them. And it's long been a challenging element for development now, but we are in a position where we are going to have to build new transmission to bring reliable power into load centers.

In California, to set some stage here, we spent approximately $7 billion in the last several years on transmission development, but much of that has been to bring the renewables to market.

And to give you some flavor of that, on our 50,000 megawatt system, solar has grown from 1,000 megawatts about 18 months ago to about 4,700 megawatts today that we see on peak. Another 3,500 megawatts is coming in the next 18 months. We now have wind of about 4,500 megawatts. And some days we see total renewable energy of about 10,000 megawatts, almost a third of our system on many a days now. So transmission has been critical to welcoming those renewables on the system.

In addition to that, San Onofre Nuclear Plant in Southern California has really driven home the point of the need for speedy and agile transmission development, words that aren't often associated with transmission development. The need to quickly respond and maintain renewable power in such massive population centers in Southern California was critical and the ability to site and upgrade the transmission system in short order was necessary to make sure we maintain power down there. So speed and resilience is -- speed and agility is critical.

You know -- and with the caveat that we need to modernize and invest in the system, a couple of other thoughts.

First, the growth in consumer-produced energy is clearly going to have be something that we take into account. We see a number of consumer-owned systems that are partially or fully insulated from the grid. Many of them are reluctant though to actually cut their power or their link to the system.

But we have a question I think before us now, the balance that we're going to have create is how can we build -- it's no longer how do we build enough transmission, but how do we strike the balance between avoiding transmission that gets stranded and stranded assets in the face of new grid models while we continue to build a grid resiliency?

An example of that is I recently asked our transmission planners to look at how the system would operate with 20 percent distributed generation on the system. That may seem a lot, but I can tell you in San Diego, as an example, they add 1,000 new rooftops of solar every month. It's growing in exponential rate in Southern California, obviously because it's very sunny down there, and we're going to have to take that into consideration in our transmission planning.

The loads are rising, renewables are growing, the system is changing.

So we need to certainly be dedicated to rebuilding our systems, but we also have to be careful not to over-build our systems too. We're going to have to take these new paradigms into account. Regionalism has got to be an important factor -- a more important factor on that. We can no longer operate 38 balancing authorities in the West. It's not efficient. It's not effective. It's not reliable. So we're going to have to take that on as well. Most importantly, we need to remain nimble.

And with that, I'll turn that over to you, Mr. Reiten.

MODERATOR KELLEY: Thank you, Steve.

Patrick?

MR. REITEN: Great, thank you.

Secretary Poneman, really appreciate you being here. You've assembled a wonderful group of folks. I appreciate being asked to participate along with them.

I'm Pat Reiten. I'm the President and CEO of Pacific Power. We are the western distribution part of PacifiCorp which serves 1.8 million customers across six western states.

I also have responsibility for the systems operation and transmission system for

PacifiCorp as a whole, that comprised of 16,000-plus line miles. We're interconnected with 13 other balancing authorities. We touch some parts of 10 western states.

And we're also an originating partner of the recently FERC-approved energy and balance market in partnership with the California ISO, and so -- nice to have my partner in that, Steve, here this morning.

As an integrated utility, we share a lot of the issues you'll hear about from other panelists, but obviously want to focus my remarks on transmission.

Certainly, the Nation's bulk electric transmission system is subject to changing landscape and roles, and so I'd like to start there.

As I mentioned, or as I should mention, PacifiCorp is the largest subsidiary of Berkshire Hathaway Energy. And we have a sister subsidiary called MidAmerican Transmission. They are a merchant independent transmission company established in 2011, run by my former transmission VP John Cupparo, and established really as a result of evolving markets and the way transmission in some sectors of some parts of the country is being constructed.

So speaking on behalf of the holding company, I'd like to make a few points on their behalf.

Incumbent transmission providers like PacifiCorp will always have a significant role, but we do expect independent transmission to have a growing role in future transmission development due to competitive processes that are in part a result of FERC's Order 1000, and as vertically integrated utilities seek complementary partners. In a world where we have evolving regulation and competition for scarce capital that may create difficulties for integrated utilities, independent companies do have the ability to provide flexible financing and structure and ownership options, can dedicate capital to longer term transmission development cycles, and I think also can play a constructive role in regional planning processes.

It's worth noting that MidAmerican Transmission has been most successful actually in organized markets -- ERCOT, the California ISO, SPP -- that have allowed for partnerships and appropriate cost allocation.

Turning to transmissions siting and permitting. Simply put, we need federal agencies to truly work together to assure consistent application of permitting requirements. And we have a lot of experience permitting and now building segments of our energy gateway transmission project. We rolled that out in May of '07, 2,000 new line miles, eight key segments. We've actually constructed two of those and are substantially under construction on the third. We're 1.3 billion into a $6 billion set of projected investments.

The obvious lesson so far: federal permitting has proven to be very time intensive. We need clear communication requirements between field and state and D.C. offices prior to the start of permitting processes.

Unlike the East, as is obvious, many of the states we operate in are more than 50 percent owned by the Federal Government. We deal with multiple agencies across multiple states. Things work best where we have a single agency as a lead permitting agency, where we have a single project coordinator on the Federal staff side, where we have clear guidance from D.C. on the need, and where we have strong interagency coordination. You know, lack of those factors in some instances have cost us years of delay on some of the segments we've been involved in and has really huge implication in terms of the ability to site new renewables, use resource diversity to meet load without siting new thermal plants closer to load, and sometimes actually on reliability.

So while we're not looking to cut corners, we know that siting has to adapt to public need and the prospect for lengthy siting delays, coupled with rapidly changing policy landscapes, reduces the incentive for companies to commit capital to develop new critical infrastructure for fear of stranding cost in the middle of the process.

We have a good example: Hemingway to Boardman, which is a project spanning Idaho and Washington. We're now three years past the initial draft EIS issuance, which is just the first critical step in the NEPA process.

So the stakes are high. Lack of the ability to site that and access the Mid-Columbia market may require building new thermal plants closer to load.

So, you know, just a final set of thoughts. You know, as we deal with the evolving policy landscape, Regional Haze, statement over portfolio standards, 111(d), those will drive changes in the generation portfolio. And we will have to react to those from a transmission perspective, both in terms of adding new infrastructure investment to maintain grid stability as well as new infrastructure in order to deal with the intermittency of new renewable

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resources. And, you know, those -- that policy agenda is changing very, very rapidly and so does not accommodate a 7- to 10-year design, permit and build schedule.

So, just in conclusion, you know, the ability to be more nimble, to have clear guidance from the D.C. side all the way down to the field office is imperative if we're going to be able to maintain voltage stability and a bulk electric system that can accommodate the kind of challenges I think you're talking about in this process.

So again, appreciate the opportunity to be here and lend our thoughts.

MODERATOR KELLEY: Thank you, Pat.

Elliott, your five minutes.

MR. MAINZER: Yes. Good morning, everybody. I also really appreciate the opportunity to be here today.

Transmission has certainly been an important topic in the Western United States for the past decade. And I think we've made some significant progress on multiple fronts. At BPA, we operate over 15,000 miles of high voltage transmission lines and play an important role in maintaining system reliability in the Pacific Northwest. In recent years, through our experience planning, financing and building several new high voltage transmission lines and integrating over 4,500 megawatts of wind into our grid, I think we've learned a few lessons that I'd like to share this morning.

Certainly, transmission investments are very capital intensive, and they must be based on a solid business case with clear cost recovery and cost allocation mechanisms.

This means carefully understanding current and future demand and identifying creditworthy counterparties who can provide the necessary financial security to bear the cost of construction over the long term. Regulators and policymakers who want to see the grid expanded can certainly help support the necessary investments by providing their utilities with appropriate cost recovery assurances and mechanisms.

At BPA, we're now in the process of constructing two new 500 kV transmissions lines from the Columbia and Snake Rivers and permitting another in a very densely populated Interstate 5 corridor. The siting and permitting challenges are enormous. I would say it's unequivocally the responsibility of utilities to work closely with affected communities, sovereigns and stakeholders to ensure that new transmission facilities are sited with minimal impact to local resources. But we also need the same type of increased coordination between federal, state and local permitting organizations that Pat talked about in order to build the necessary infrastructure to maintain reliability and integrate new resources in a timely and cost-effective fashion.

Now, the traditional transmission planning paradigm has focused on building new facilities. I think we've also found that non-wires solutions can be equally important in certain circumstances and the use of demand response and distributed generation to manage grid congestion can also help to make best use of existing transmission resources.

Entities such as NTTG, ColumbiaGrid and WestConnect provide very valuable coordination among and between the members to help plan the grid on a one-utility basis. WECC also provides a very important overall planning look at needs and impacts across the entire Interconnection. I think we definitely need to continue to improve coordination among utilities, subregional entities and WECC.

Back in 2002 at BPA, we had 175 megawatts of wind energy connected to our transmission grid. Today we have 4,500 megawatts and our partner utilities in other parts of the West are experiencing similar growth in renewables, especially solar.

So while providing zero-carbon energy to the system, wind and other variable energy resources increase the demand for system flexibility. And whereas traditional resource adequacy planning has focused on capacity and energy, that third dimension of flexibility is now equally important to overall system reliability. Like other parts of the West, utilities in the Northwest must now ensure that their new capacity resources can also operate flexibly in tandem with variable energy resources.

Operation of coordination among utilities is as important today as it has been in the past. Coordinated balancing authority operations can help spread volatility over a wider system footprint, which can help reduce the overall demand for system flexibility and make best use of existing resources.

At BPA we've been working with our colleagues at PacifiCorp and the California ISO to help them implement their new energy imbalance market while also ensuring that there are not negative operational or economic impacts on Northwest customers.

I think we're learning quite a bit through this partnership and hope to apply these learnings to our work on market design through the

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Northwest PowerPool. Building on the legacy of regional coordination that goes back to the 1940's, we're developing new reliability tools and exploring a potential sub-hourly market within the Pacific Northwest that will address longstanding concerns about governance and local decision-making.

A couple last points. Real-time situational awareness is another critical requirement for today's transmission system. Working with our colleagues at DOE and other partners in the West, BPA has installed the largest network of synchrophasors in the country, giving us much-enhanced ability to anticipate and respond to grid disturbances.

We're also working closely with the West's new Reliability Coordinator to develop new tools to forecast and respond to actual flows across the Northwest's transmission system.

I think it's for certain that technology innovation will be an important driver as we continue to modernize the transmission system.

BPA is part of the $178 million DOE-funded Pacific Northwest Smart Grid Demonstration Project. Through this collaborative effort, we've been testing distributed generation, storage and demand response technologies with the potential to increase transmission system reliability, integrate renewables and lower costs for customers. And BPA's own $17 million a year Technology Innovation Program has also discovered breakthrough technologies in voltage stability and demand response.

So I think the western United States certainly faces significant opportunities and challenges in designing the future of its transmission system. At BPA, we're certainly pleased to be working with our colleagues at both the regional and subregional level to further enhance the reliability, flexibility and technical sophistication of our transmission system.

Thank you very much. Good to see everybody.

MODERATOR KELLEY: Thank you, Elliott.

Next we have Carl.

MR. ZICHELLA: Thank you. Before we started, we were sort of joking that we could shuffle each other's presentations around, and certainly a lot of what I was intending to say has been said, so I'm trying not to be too repetitive. In fact, Elliott's presentation, a lot of it, I can just go, "What he said," because it's right on the money.

The electrical system is undergoing historic change. We haven't seen anything like it in many decades. The changing resource mixes is occurring very rapidly, a combination of things, including lowering resource costs for renewables, and gas I might add, but also this new characteristics of operating system that has a lot more variable generation in it.

The very changes that we have to make to incorporate this clean energy to deal with the climate change issues that Secretary Poneman so articulately set forth are the very changes we need to make the system more reliable. So there's a really -- a good payoff here as we get more flexibility in our system, as it can operate more quickly, as we can schedule and dispatch power much more quickly, as we coordinate and consolidate between and among our balancing area authorities in the West. That's all good news for reliability as well.

The very situational awareness we need to integrate renewable energy resources is the same situational awareness we need to help bring the system back when there are disruptions and to avoid disruptions in the first place.

Flexibility, resilience, and security are the most critical needs for the system going forward. More consolidated, better coordinated systems, a less vulnerable system. I think we'll hear more about that in other workshops. I won't go into that too much here. But the whole cyber security and physical security questions confronting the grid are also important.

I think the key environmental perspective I'd like to bring to this, it does echo some of the things we've already heard -- but really revolve around efficiently using the system we have, building what we need and not building what we don't need. Looking at the non-wires alternatives that Elliott was just talking about is a key component of that.

But in order to really understand what it is that we need and what we don't need, I think we have to answer a few simple questions.

The first is, how do new investments reduce greenhouse gas emissions? This is the unavailable reality, the inconvenient truth that we're all confronted with right now. Future generations will continue to endure the consequences of the actions we take today. It is one of the key drivers. Polling across this country have shown people are extremely concerned about that.

And that leads to the second question, of what we -- what we build is -- and how we modernize the system is: what does the 21st Century consumer want? Of course, they want reliable service at a reasonable cost, but they also want a system that's clean. In the polling that we've seen across the country, and actually in a poll released yesterday about the Pacific Northwest, indicates strong majorities into the 70th percentile really supporting strong, clean action on climate change.

So I think we're seeing, and people are voting with their wallets in large parts of the West as they integrate renewable energy onto their own homes and businesses in record amounts, as Steve Berberich indicated, that that's clearly a key preference.

So there's transactional relationship between consumers and the utilities. It's a new development. It does influence the grid that we have on the distribution grid. And the line between the distribution system and the bulk electricity system is blurring. How we control the distribution grid will influence how we operate the bulk electricity grid in the future. Some posit that the bulk grid may once -- one time become a backup system for the distribution grid. I believe that because of the climate challenge, we're always going to need a very robust bulk electricity system. Our best renewable energy resources are not close to communities. We have an unparalleled richness of renewable energy resources across the West.

So taking advantage of those will require a well-thought through, planned bulk electricity system. That means justifying those decisions of what to build very clearly and relying on and expressing how we've considered non-wires alternatives as is required by FERC Order 1000, but, as Elliott mentioned, is part of the business plan for how you set the case for your new transmission.

I think, clearly, the footprint of new resources and minimizing that will help enhance the acceptability of it to most consumers and the stakeholders who are affected by those resources, so it's going to be important to make the case.

And Bonneville over the years, by paying attention to non-wires alternatives, as Elliott mentioned, have been able to build transmission in some tough places. And I think that's a lesson the rest of us can observe about how to make that case.

So build what we need; don't build what we don't need. Let's use resource zoning for resources to help optimize the locations of transmission. That's something we haven't done yet. It's a big gap in how we approach the overall system.

Steve Berberich mentioned how balkanized the system has become in the West with 38 balancing area authorities. It makes it difficult to look about where you would look at locating resources so that wind power in one part of the region supports and compliments wind power in another, and similarly, you have more geographic diversity and less interruptions in solar resources when you may have clouds passing over part of the system and another part of the system is operating even in a surplus capacity.

So I'll stop there. I think a lot of what I intended to say, my predecessors have already said. The grid's got to be faster. It's got to be more flexible and resilient. It's going to be accommodating a much more diverse fuel generation stack. It's going to be much more renewable.

And it's supported by the public. That's the good news. This transition, people want it, and it is actually happening. A lot is occurring. A coordination of federal agencies and state agencies, and even local authorities -- because some of the western states, siting is done by counties, as in Colorado, for example.

This level of coordination is something we really have to continue to focus on. We're not standing still on it. The Administration has set up the Rapid Response Team for Transmission to try to focus on ways to facilitate that coordination.

Frankly, we have a lot more to do in that space. They are the correct first steps. But I think as other panelists have mentioned, we don't get to the finish line on the right decisions for what to build and how to modernize the system if we don't involve all of these key stakeholder groups.

So I'll stop there.

MODERATOR KELLEY: Thank you, Carl.

Joel, you're up next.

MR. BLADOW: All right, thank you.

Joel Bladow with Tri-State G&T, and we're -- you may be wondering what am I doing here because I'm not from the West Coast. But as Jim mentioned, Colorado is part of the Western Interconnect. So what Steve does down there in California does impact us in Colorado along the eastern side of the Western Interconnect.

I have to disagree with Carl right off the bat when he said there's not many communities that have wind or solar next to them. In fact, when you look at our territory for Tri-State, we cover an area the size of Colorado -- or the size of California, but we have 5 percent of the load they have in California.

And most of the loads in our areas are served, Denver Metro, Albuquerque, they're served by others. When you look at the couple hundred thousand square miles, we have a rich ability to have renewables out there, but there are very small communities. So, Carl, there are communities that are right next to a lot of these wind farms.

And that's one of the things that we have a challenge -- I'd want to emphasize a little. I don't disagree with what others on the panel have said, but when you look at rural and spread out as we are, cost is a big challenge for us. How do you deliver reliable power? As Deputy Secretary pointed out, when the power goes out in our small communities, the schools shut down, can't do business, the stores shut down; everybody is connected nowadays. And that's really an important thing.

Also, I would caution, I think the grid has done an incredible job of adapting over the years. And we used to have different generation.

We moved through nuclear. We moved through other types of resources. And although it takes some time, given the size of the investments, I do not think having a little bit of a lag there is necessarily a bad thing. I think it's important to move forward but to be somewhat cautious.

I think Deputy Secretary did a good job of pointing out the complexity of this. One of the things when I look at how complex this is and, you know, what do we -- how do you move forward, what I really think about is some key fundamentals.

One I have just mentioned is cost. Not every great idea is economical. There's lots of great technology that somebody says, "This is going to be wonderful." And companies can move very quickly, put that in place. But when you're looking at a public asset or a public good, which we tend to serve when we have the utility or responsibility, you have to remember that somebody is going to pay for that in their bill. And if you miss it by a wide mark, they still have to pay for it in their bill.

And turning over assets every two to three to four years like you can do in a private company in a high tech, typically isn't what you do. We tend to be a little on the conservative side and that's because if the lights go out, we hear it very loud and clear. If the costs get too high, we hear it very loud and clear. If we build or try to build stuff over the top of sensitive areas, we hear it very loud and usually aren't able to do it. So there's a lot of challenges we have.

Another thing I would say is whatever we project today, we're going to be for the most part wrong. And I think if you look over the horizon, I think in my tenure in the industry, you know, too cheap to meter was nuclear. We're going to run out of natural gas. Yeah, we sure found that wasn't the case.

And I think the more certain we pretend we are about what the future is and plow ahead without allowing that flexibility, seeing the

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ideas and looking at what are some of the options, putting those pieces in place that have multiple benefits, I think is a great way to go. But we have to be mindful that 10 years from now, somebody will probably be sitting around the next one of these -- 12 years, I guess it would be -- quadrennial -- and say, Hey, boy, they sure missed the boat 12 years ago. And I think we just have to be cautious and incremental.

Some of the points have been mentioned. We're in four states, so we definitely see some of the lack of coordination from the various federal agencies. As we site and permit in multiple states, I think having the Federal Government look harder at how do we balance these various things and get a little more consistency between the agencies is an important thing.

And finally, I'll just look at some -- make one more mention. I think it's so important really that cost benefit. There's a lot of things have been talked about that we need to change, should change, will improve stuff, and I think we have to be very mindful of the benefits and who pays, really that cost allocation piece.

Give you an example. We're in five balancing authorities. We're not one ourselves. We're in two interconnects. We're both in the East and the West.

But when you looked in energy imbalance market, we said, Hey, that's a good idea. We're in five BA's, why don't we change and be more streamlined. We've talked to a number of our partners that very much advocated, this is something that's needed, we'll save billions for consumers, and when we talk to them about helping to pay our high transmission cost because our interstate network very much facilitates that, the answer we get from most of them is, Are you kidding? We're not going to pay anything for that. We'll figure out how to get it for free. And I think that's what builds resistance to some of these changes is not recognizing the value, who's getting it, and how we allocate that payment.

So with that, I will just end with my caution always is go slow, think about what we're doing. Things don't tend to be as bad as we think or as good as we hoped. And with that caution, I'll stop there.

MR. SAVAGE: You're a utility guy.

MR. BLADOW: Absolutely.

MR. SAVAGE: So I chair actually three Western Energy groups made up of state and provincial officials, each focused on different aspects of the Western grid, including grid reliability, grid planning, integrating wind and solar into the grid, promoting efficient use of existing lines, and advancing promising technologies and applications.

So I'm going to come at this from that broader, western perspective of my groups. And I'm going to make four points about transmission, and I'm going to cheat and talk about the grid as a whole and DOE role.

So, first point, I think we will build what transmission -- going to the question that was posed for this panel, I think we will build what transmission we need in the West. A few years ago, the amount of new transmission that was being built in the West was greater than all the other regions combined.

On top of that, I think with what new transmission that is planned and likely to be built, which is called the Common Case Line in Jim Robb's interconnection-wide plan, we could be good for a decade or more.

What I don't think -- what we likely won't see, at least in the short-term, are what I call big, long-distance lines. We polled Western utilities and Western utility players a couple of years ago and asked them about, you know, sort of, their interest in accessing remote, low-cost, renewable resources. And at that time, they expressed little or no interest. They had ample -- you know, they had the ability to tap the resources they needed to meet their renewable mandates.

Over time, I see two forces at work

here. I see forces at work for less demand for big transmission if load growth flattens, if we develop more local and distributive generation and we potentially free up existing power line capacities through a variety of means, I think the countervailing factor that could offset this trend would be if utilities need to tap remote renewable resources to meet targets.

Second point, and this is nothing new to the people in the industry here, is I think the biggest challenge for the grid is adapting to the changing mix of power resources. This could be -- I think this will be a long developing trend, and to me, obviously, it will vary from state to state. But I think in general, we're going to continue to see more variable wind and solar, more distributed, more storage, more natural gas, and probably less coal.

I see no letup in policies to encourage the development and low -- null and low carbon resources, and with the accompanying challenges that these resources pose to our power system, the proposed EPA carbon regulations being the most recent example.

So, in response, at least three things. I think we need to do. One, I still think there's a lot more we can do to effectively address ramping challenges and to bring down the cost of integrating variable wind and solar into the system, from expanding our suite of flexible resources, to shaping policies to create a western marketplace that's bigger, faster, more responsive, and more coordinated.

Second, I think we need to continually assess the reliability impacts of the changing resource mix, such as the impacts of implementing the EPA 111(d) regulations.

And three, I think recognizing the line between distribution and bulk power systems is blurring or will blur over the long haul. I think we need to better operate our visibility control of the distribution system. I think we need seamless, two- way information flows between the system. And this is -- I always get to give one provocative, I think we may need to rationalize FERC and state regulatory jurisdiction.

Third observation is that absent intervention, coordinated action, or a crisis in the rest, I think we'll under-invest in grid innovation.

Last year, we hosted a transmission technology forum in the West, and we heard from some of the best minds in the business on modernizing the grid. And one of the panels explored the many uses of synchrophasor data. They were excited about the possibility but less so that we were going to take full advantage of the technology. I don't think that we would have made the investments we did as fast as we did without the Federal funding. I think there's a lot of reasons for that, but one prime reason is I think many T&D investments have a quality of a public good. Benefits are diffused. It doesn't pay utility investment when they can't claim the benefits.

So for these public good investments, we

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either need to take collaborative action or I think we need a crisis such as Hurricane Sandy which will trigger political action, or we need the Government to step in, which leads to my last point.

Federal funding for energy projects in this region has made a huge difference and should be a guide for future DOE action. With Federal funds just recently, we made the major investments in synchrophasors, as I mentioned, and we're doing phase 2 now at peak reliability.

We created our first interconnection-wide transmission plant. We produced the first interconnection-wide assessment of the impacts of increased natural gas generation on the West. We examined the cost and benefits of a voluntary EIN market and the design of such a market, all of which led up to the first EIN becoming operational in October.

We conducted the first ever survey and evaluation of solar and moon forecasting in the West.

We investigated the use of dynamic scheduling and ways to foster greater use.

We studied the potential for demand response to provide ancillary services.

My point, and I'm going to write DOE, is keep doing what you've been doing. Drive innovation and fill the gaps and necessary analyses and projects that won't be done without your intervention.

MODERATOR KELLEY: Thank you, John.

Well, thank you all.

At this point, what we're going to do is turn to a discussion. So I've got a few questions here. Some common themes, some divergent opinions I've heard. So why don't we go ahead and get started with that.

So one of the divergent opinions I heard was that when it comes to transmission, we need to go slow and plan, think. But then I also heard we need to adapt and be agile enough to bring on these distributed generation renewables, variable generation.

So with the Federal Government here listening, what is your guidance to the Federal Government in helping you to strike that balance? And what we'll do is we'll just start at this end and kind of work our way down.

So, Jim?

MR. ROBB: Well, that's probably a better question for more the principal investors here than for me as an observer of the system.

I think the one quandary that you have in electric, and any kind of energy infrastructure, is we have a dynamic policy environment that's changing. I mean, I think directionally, thematically consistent but the specifics change fairly regularly. Technology is advancing relatively quickly, and we're still stuck in 10-year life cycle project development loads.

The challenge I think we have, and what we're certainly trying to do at WECC, is to develop, kind of, good, consistent, thematic views of how the future looks or could look so we can start to figure out which set of projects would make sense under any scenario so that those can go forward.

Yeah, I think the comment was made on the panel though that the risk of building transmission that may get stranded in the future is exceptionally high, particularly if you don't know what the long- term future -- I think even with the long-term future of the remote coal plants and so forth in the region are, with a timeframe for when those plants may eventually come out of service has a big implication for transmission investment. What they get replaced with also will have substantial implications for transmission investment.

One theory of the case is they should be replaced with gas plants on the same site that would make, you know, full use of the existing transmission infrastructure.

There's also a wonderful opportunity here to move some of those resources much closer to load, which would create a much more stable and easy to operate system.

The interplay between the replacement of those facilities and the expansion of solar and wind resources that are electrically very, very different needs to be understood and needs to be studied.

I'd echo the point that John made that the DOE, from our perspective, has been a wonderful partner in helping to fund some of the studies that we've done on these issues, and quite frankly, there's a long list of things that yet need to be studied going forward. So I'd echo the -- kind of the request for, kind of, ongoing support of the analytical agenda because we are at a period of time where the system in the West is going to be fundamentally reconceived over the next 5, 10, 25 years. And we need to be very thoughtful about the decisions that we're making around long-lived infrastructure that's going to be robust under a variety of scenarios.

MODERATOR KELLEY: Thanks, Jim.

Steve, any comments?

MR. BERBERICH: Well, I'd say this. I think everyone needs to come terms with the fact that the system is changing dramatically very fast. And I think that's what we're going to have be able to adapt to, and we're going to have to do things quicker. And we do 10-year transmission horizons. I don't see that materially changing. These are long-lived projects and big assets on big balance sheets, and we need to do our best not to get them wrong.

But as we saw now in this case, we had to be very fast because San Onofre, the nuclear plant in Southern California, retired. But it's -- frankly, it's a microcosm, I think, of things that are to come. The system -- I realize California is ground zero for this, but California is 40 some percent of the load of the West. So, so goes California, so goes a lot of the West.

And our system is transforming very fast. We're going to have to be nimble about new transmission, to bring renewables to market, and to reinforce a system where we need to reinforce a system as these flows change because the system flows are going to change and they're going to change dramatically as you see distributed generation, you see renewables, you see the retirement of plants. And I think we're going to have to factor all that in.

MODERATOR KELLEY: Thank you, Steve.

Pat?

MR. REITEN: Well, the premise was, you know, do we need to speed up the permitting of the lines once we've identified a need? And do we need to be very deliberate and certain about our planning? I think the answer is yes. I don't think those things are in conflict necessarily.

We build transmission for many different reasons. As an example, you know, I referenced the Energy Gateway Transmission Project, the first three of those originally planned eight segments were essentially reliability projects, meeting our reliability requirements and load. The rest of them are being permitted with the idea of accessing a more diverse set and of lower cost resources for customers over time. But we also have the rapidly evolving policy landscape. So we are keeping our transmission planning engineers extraordinarily busy.

On our system, we went from owning 34.5 megawatts of wind eight years ago to 1700 both owned and contracted for. Today, we have 2300 megawatts on our system. That, even outside the big segments, has required fairly substantial investment. We have a project in south central Wyoming where we're putting in a synchronous condenser at the price of about 47 million in order to deal with volatility and maintain grid stability there as a result of the concentration of wind.

On the other hand, we're taking a coal plant out in Utah, 147 megawatts of coal generation in Carbon County Utah. And we're having to invest 46 million there in order to maintain grid reliability in the absence of that generating resource. So, you know, it works on both sides.

As the policy landscape evolves and the requirements evolve, that will change the generation mix and we're going to have to stay nimble, as Steve mentions, in terms of delivering those transmission solutions. And the longer, you know, after the need is identified, that you can actually do something about it, the higher the risk is in order to commit capital.

MODERATOR KELLEY: Thank you, Pat.

Elliott, any comments?

MR. MAINZER: I think just as sort of a brief exclamation point, I think -- I agree that those two thoughts are not -- are not diametrically opposed. I think for certain we want to be planful. We want to be adaptive. We want to be flexible. We want to be mindful that the world will change. I think I've lived through three paradigm shifts in commodity prices in my career in the energy industry, so things are going to turn over.

But I absolutely agree that once we've identified a need for a new transmission line, and we've determined that reliability and resource integration is hinging on it, then it really is incumbent -- I think, certainly, as I said before, the utilities need to be acutely sensitive to the local issues, work with communities, sovereigns, affected stakeholders, but we really do need that coordination on the permitting side because the costs -- and literally you start running into significant liability risks, so I really agree with that.

MODERATOR KELLEY: Thank you, Elliott.

Carl, any comment?

MR. ZICHELLA: Yeah. There's an old saying, "Sometimes you have to go slow to go fast," and I think "look before you leap" also winds up in that same category of aphorisms. But I don't think we should have the luxury of lag. I think, as Steve mentioned, things are happening in real time. We don't have the ability to put the genie back in the bottle here.

It seems to me that we could though, and are and should be, paying a lot more attention to the full range of resources that are contributing and meeting our needs. And if we do that, we have a better justification for building what we need to build. If we can get more out of the existing system to meet our needs, that's really a benefit for everyone. It costs a lot less money; it's a lot faster. If we reconductor some lines or increase the voltage rating of a transmission asset by upgrading a substation and we can interconnect renewable resources as a result of that, well, it takes about three years to build a renewable energy project, even pretty big ones, and about seven to ten years to build a new transmission line. That's if you can even find a right-of-way.

As was mentioned earlier by Elliott about the difficulties in the I-5 corridor, Portland General Electric recently decided to, instead of building a line across the Cascades, share lines with BPA, upgrade lines together, saving their customers hundreds of millions of dollars and, in fact, avoiding environmental impacts of great consequence. They estimated they'd have to spend about $70 million just on environmental mitigation alone. So getting more out of the system, sharing resources, even between public and investor-owned utilities, we're seeing a lot more of that and it's a good thing.

So I also think, you know, we have to look at some of the lessons that we've been learning about where to put stuff.

For example, renewable energy resource zoning, the Bureau of Land Management has adopted a programmatic solar environmental impact statement that builds resource zones in which environmental review should be easier. We can design transmission to the zones to get the power to the load centers more efficiently. We can get better utilization of the lines.

We talked earlier about the coordination and balancing area of consolidation that's needed. These operational improvements make a big difference about how much we need to build. We can get a lot more out of the system.

The energy imbalance market that's been mentioned allows us to share reserves in ways that we really couldn't before because in the West almost everything's done on bilateral contracts rather than in markets. It's a very slow way to do this. It's not very nimble. It's not very flexible.

I think we have to pay attention, as John Savage pointed out, to fixing that problem -- you know, having more of a market approach, and EIN is a great start on proving the concept to people that this can be a beneficial way forward.

The Northwest PowerPool's efforts on market coordination that Elliott's helping to lead, extremely important -- getting the 15-minute scheduling, having more automation. And this leads to, I think, one of the last points I wanted to make on this topic about a role for DOE, and that is taking some leadership in the R&D space and helping with the grid control architecture. We can have great information from all these synchrophasors that we have out there. If we're not able to take advantage of that, to deploy that information quickly in a way that responds to system disturbances, we're really wasting our investment.

So I think there's more investment. I think there's a really distinguished role for the ARPA-E project, other R&D programs at DOE, to help fill that gap there.

And looking at where we put stuff to avoid environmental conflicts and cultural resource conflicts is a big part of this if we really want to build these lines. As Joel mentioned, you don't get to build them if you just go trampling over things that people care about or that are important national, natural resources.

So the zoning operations of the system, looking before you leap at energy efficiency and demand response -- let's build what we need, not what we don't need. The public will be much more willing to support that. Nobody likes transmission lines, but if people can be convinced that they're needed and the benefit towards the other things they care about, including climate remediation, I think we can build what we need.

MODERATOR KELLEY: Thank you.

Joel, care to comment?

MR. BLADOW: Chris, you must have been happy when I said go slow. I really gave you a good question.

MODERATOR KELLEY: Thank you.

MR. BLADOW: And I think the predecessor of folks have really hit it. I think there's some technology things that aren't high cost one can implement to give you benefits. But as you try to plan too broadly, you know, "Here's five lines we're going to build that's going to help so many things. Let's get going," you've got to realize, it's going to take you probably a decade to build them. Getting going on them, that's not the problem. You just have to realize you have to be willing to change your plans as you go forward. Technologies are going to change. You may find more benefits and other factors out there which will then change your plan.

And sometimes folks get locked in: "Here's what we're going to do. We're going to build all this stuff because we've got the answer." You don't even get close to the finish line, and the answer -- the goal posts have moved quite a bit in that timeframe.

So I don't think there is that much of a conflict in terms of -- we just need to be very thoughtful. And I like Carl's analogy, "look before we leap," as we move forward in these technologies because there's a lot of folks out there that have a lot of financial stake in moving quickly for whatever it is they're selling or whatever it is their products are.

And I think we kid ourselves to think that everybody stepping in is doing it for the good of the public. There's some real commercial interests that want us to go in a very certain direction. And it's happened a number of times, even on the recent FERC regulations on some of the reliability things where smaller problems have been elevated into requirements that are somewhat questionable when you really look at some of the signs behind them.

So that's enough from me.

MODERATOR KELLEY: John, any final comments?

MR. SAVAGE: Yeah, two. One is, in a former life, I staffed a siting agency. And I like Oregon's approach to siting, which has basically said, "We're going to set standards, and they're going to be rigorous. But they're going to be known the developer. You meet the standards, you get the license." To me the problem is uncertainty, you know, from many different angles. I don't know how I would build a transmission line. I don't know if I'd have the patience to build a transmission line and go through all of this stuff, just because it's -- you don't ultimately know what you need to do. So that's one.

Second of all, now I'm going to put on my Commissioner hat and I'm going to underscore what Jim Robb said, is -- this is the one of the things I like about planning is that if you have planning that looks at all the possible alternatives and shows they've got a line that's robust, a Commissioner is going to look favorably on that for cost recovery.

MODERATOR KELLEY: Thank you.

So I'm going to turn now to technology and I'll open this up to whoever would like to respond.

So several of you have commented on technologies and how DOE has provided for R&D and technology specifically. There's your measurement units that have been deployed for real-time monitoring of the transmission system. A few other technologies were touched on.

As you look forward, are there additional technologies that DOE should be looking at? Or is there a role that the Federal Government should take going forward in investing in R&D technologies? Anyone care to comment?

Steve?

MR. BERBERICH: Chris, if I could just

make one comment. I think the synchrophasors really drive home this issue.

The synchrophasors are fine technologies. Frankly, they're not new technologies for providing better situational awareness on the grid.

The question though is what do you do with that situational awareness? And I think that's the gap that we need to close first before we go beyond that because is it integrated with energy management systems to be able to move the grid around? I mean, what do you do with it? And I know we have this information on our control room floor, and I go down there and it's pretty cool to see the situational awareness. And I ask our operators, "Well, what do you do?" And from our perspective, I don't really want the operators to do anything. I'd rather technology did it.

So what -- that's I think the gap that we need to close is, all right, here's the technology. How does it integrate to better operate the system? And ultimately --

MODERATOR KELLEY: What is DOE's role though in this?

MR. BERBERICH: Well, I think DOE has an important role. It's, you know, to deploy the technology but also the use of the technology. How -- what's the use case for it? And before we go deploy the technology, I think we need to work out that use case.

DOE has had a lot of -- a significant role. I know some of the folks that have looked at, again, how energy management systems work. Energy management systems are the bread and butter of dispatching the system. We use telemetry extensively now. It feeds into these systems, these systems dispatch every four seconds to balance.

The same thing ought to happen with the synchrophasor information. And I think that's -- if I were looking for some -- it's an issue for all of us though, it's not an issue for the California ISO. It's an issue for everybody. It's an issue for BPA and everybody in the West too.

So I would encourage the closing of that gap: well, what do you do with the technology?

MODERATOR KELLEY: Great, thank you.

Yeah, Jim?

MR. ROBB: I would have two investment themes that I don't think we can spend enough money on as you look into the grid of the future. And the first, it has to continue to be to advance storage technology.

In our kind of base case, common case transmission plan that John referred to, we replaced 25 gigawatts of conventional generation with 13 gigawatts of wind and 12 gigawatts of solar. That's a lot of intermittent resource to be brought onto the system.

I'm sure you're all familiar with the duck chart that Steve and his crew have developed in California that shows the extraordinary burden that starts to get placed on the balance of the system with these resources that essentially turn on and off instantaneously. So the ramp rates and so forth that the remainder of the thermal fleet need to be able to meet are extraordinary. Storage is one way to soften that cliff and allow our resources to perform effectively. So that's got to be a very, very important part of it.

The second piece, and maybe storage obviates this, but again, I don't think we can spend -- me talking -- I don't think you can spend enough money developing safe, reliable, secure nuclear technology. You know, particularly in the system like the West where if we lose the large coal plants which provide the majority of the inertia on the system which helps provide frequency, stability, and so forth, that needs to be replaced with something.

And from my perspective, as much as I love natural gas in so many dimensions, it's not a fuel sitting in front of a power plant ready to burn. And I sure would like to see us figure out a way to make a nuclear solution that's politically and publicly acceptable because it obviously has extraordinary climate benefits to be brought to bear.

MODERATOR KELLEY: Thanks, Jim.

So we have time for a couple more brief comments.

Yes?

MR. REITEN: Yeah, I just -- Carl made a very, very important point, which is, you know, from the perspective of the environment, from the perspective of our customers, the first priority is to use what we have most efficiently before we engage in building a new power plant or building new transmission lines. But the best ones we deal with are the lines and the plants we don't build from those perspectives. We have a real responsibility to increase the efficient use of the grid. Certainly, the energy imbalance market project and the work going on in the Northwest PowerPool that Elliott is co- chairing, solidly fit into that direction.

And if you think about the impact DOE has here in the region, you know, the largest is clearly through the efforts of the Agency itself, not only as a major transmission owner but a path operator in order to facilitate the beneficial use of those paths in very efficient ways.

And so, you know, investments in -- technology investments, automating remedial action schemes, integrating models, not only for more efficient use of the past but more situational awareness from a reliability perspective -- I know those are all on Elliott's radar screen. I just speak up, you know, in support of his prioritization and efforts there.

MR. ZICHELLA: May I just offer a thought here too about the technology thing. I'm not as bullish about nuclear power. I have to be honest with you. It takes too long to build them. The technology's extraordinarily expensive. And we never calculate the back end, the fuel cycle costs, when we start talking about it.

One small nuclear power plant in Northern California that was built in the 1960's, the Humboldt Bay Plant, will cost over a billion dollars to decommission. It was 63 megawatts.

The idea that small modular reactors would have enormous cost savings, I think is a chimera. And it would take many, many years to actually accomplish because we don't have a supply chain. We don't even have a bench of nuclear engineering students to rely upon. The idea that we're going to have a big play on nuclear, I think, is maybe a little bit of a waste of our time.

I think the other areas we need to focus on are looking at some of the simpler things that get us a big bang for our buck, the idea of optimizing the system by locating your resources correctly. That's an innovation there's a gap at. We can do better at that. We tend to look at the system in small bites rather than in how resourcing in Wyoming might assist resources in Colorado or California. We have to fix that problem.

We can do some of that with forecasting. Like I say, we've come a long way with resource forecasting. I stood in the Xcel control room in Colorado and watched them turn off a coal plant in favor of wind energy based on forecasts. They're doing it now. They may be one of the only people that are. The fact is I think if they can do others can do it too.

And I think forecasting and the ability to use and deploy resources, especially in shorter term markets, as was discussed, really gives us a real advantage here to take advantage of the geographic diversity of the resources and the load shapes they have to avoid having to build additional, whether it's gas or other types of flex resources.

Again, let's build what we need. If we need some gas, let's build it. I like what's being done with reciprocating engines that can ramp to full power in five minutes. You know, there's a really valuable flex tool to help match wind in a smaller BA, for example.

Storage is a great place for DOE to be putting its attention to both in the technologies, chemistries, helping reduce the costs of particular technologies for specific needs. And we know that flywheels give us very good, very fast response time for regulation. We know we can do load following with some of the new battery technologies. There's more we can do with pumped hydro if we build some transmission. That's one of the things where transmission is a part of the solution.

Power electronics, control architectures. If we're worried about voltage stability in the system, we know that having good inverters, advanced inverters, both in the distribution system, but also at the bulk electricity system for solar installations, helps solve some of those problems for us.

The wind industry has provided new technologies and innovation and now provide reactive power at wind generators that look a lot like natural gas plants. So we're getting much better on that and automating the controls. These are the technology areas I'd love to see us put our limited resources into because the effects and the response and the rewards are immediate.

Continuing to bet on yesterday's technologies, Cold War technologies like nuclear -- unless there's some sort of major and massive breakthrough, I can't see them making a major contribution in a decade or more.

MODERATOR KELLEY: Thank you, Carl.

So at this point, we have enough time for just some closing comments from each of you. And I want to remind you: we have the QER Task Force before you. You've all provided some really good insights and input to them. But if you have a chance to give one recommendation, think about what it would be. And I'd ask that you'd keep your comments to one minute just to keep us on time here.

So we'll start all way down at the end with John.

MR. SAVAGE: Well, actually, I like Steve's comment on -- and I'll go back to my final line -- drive innovation and follow up.

MR. BLADOW: That was quick --

MODERATOR KELLEY: All right. Thank

you.

MR. BLADOW: -- and terse and pithy.

You know, the one point I would -- and it's technology, it's really the siting and permitting. To me that's such a core issue. It's political and it's local. I think whoever coined the phrase "all politics are local" probably just got done building a transmission line and experienced that firsthand.

So whatever from a Federal Government standpoint one can do to get -- kind of harmonize the permitting, and John made a great point, having -- knowing the rules, moving in so you can satisfy them and the goalposts don't continue to be moved would be very helpful.

MODERATOR KELLEY: Thank you, Joel.

Carl?

MR. ZICHELLA: I'm going to echo the great John Savage and say drive innovation and follow up. But innovation and technology, policy regulation, business models, there's a convergence of disciplines here that's occurring as part of this transition. Not all of it's in the DOE bag of tricks, but nevertheless, I think we have to keep the big picture in mind. So drive innovation and follow up.

MODERATOR KELLEY: Elliott?

MR. MAINZER: I guess for me, I'm just personally excited about the level of collaboration that's happening in the West. I think there's a lot of tremendous stuff going on. I think you can see that here in this panel. The Department of Energy has also been a big part of that, and I think keeping those relationships happening between the Federal Government and utilities, the other stakeholders, I think will be extraordinarily important as we continue to make progress in the future of the grid. So, good to be here today. Thank you.

MODERATOR KELLEY: Thank you, Elliott.

Pat?

MR. REITEN: Well, I think I've kind of made my points already, so I'm not sure I have anything else to add other than to say thank you for doing this. You know, we appreciate you being out here taking into account Western issues, which, you know, we're often fond out here of saying things are different out here. That may or may not be true, but in terms of the sheer geographic spaces in the way our markets are organized, it really is true. So appreciate you as a partner as well as through the two agencies.

MODERATOR KELLEY: Thank you, Pat.

Steve?

MR. BERBERICH: I agree with what Pat said. I think that having these conversations are really important so that we can share issues and ideas. And we certainly appreciate your support.

From a DOE perspective, I guess multiple parts. Most of it has come up. As I said, follow through on these technology investments.

Secondly, I'd echo what Jim said. Storage is going to have to be part of the solution. And we're going to have to find a way to find breakthroughs in it. We're going to have to find ways to reduce the costs of it to make it truly a viable resource on the grid. And I think the DOE can take a lead in that for sure.

So I would also -- I'm going to advocate for your power marketing agencies for a second. They need more flexibility to make the investments that they need, both in their controls' rules -- but also in their grids. So a shout out to my partner, Elliott, down there.

MODERATOR KELLEY: Thank you, Steve.

Jim, you want to bring us home?

MR. ROBB: I'll try.

MODERATOR KELLEY: All right.

MR. ROBB: I kicked us off; I'll bring us home.

Just a couple things. First, I think the technology agenda we outlined here is very sound, and I actually would push DOE to support that.

I would underscore what Pat said, but I'd make it stronger. I've worked in the other two interconnections; the West is different in a lot of different ways. And I think it's important to keep those differences in mind as you think about, kind of, national energy policy.

And then the last point is we've enjoyed, at WECC, a very good partnership with DOE with the National Laboratories. There are a lot of frontier technology questions and analytical questions that need to be asked and being able to work those in partnership with DOE is a big advantage to the West. And I hope we can, kind of, continue to do that.

MODERATOR KELLEY: Well, thank you, Jim.

Well, please, join me in thanking this great panel that we've had.

(Applause.)

MR. McGOVERN: One last thing for members of the media, the Deputy Secretary will be available to take questions from media members downstairs. Just meet back here at the back of the room, and we'll take you down. Thanks.

MODERATOR KELLEY: Okay. I'd like to ask the second panel to join me here on the stage.

So once again, a reminder for everyone,

if you are in the audience and you'd like to ask a question, make a comment at the end of the session here today, please make sure that you note that in the sign-in sheet at the front entrance. And again, for those joining via live meeting, send your comments to QERcomments@hq.doe.gov.

(Panel 2 takes the stage.)

MODERATOR KELLEY: I mentioned this to the previous panel, we do have a little Colite system here to indicate when your time is up. And if you hear me start to cough, that's usually a sign, so bear that in mind, please.

Okay. So we'll go ahead and get started here. Our second panel is on "Distribution - How Do We Cope with New Challenges and Opportunities?" So joining me here on stage we have Jim Piro, President and CEO of Portland General Electric; Pat Vincent- Collawn -- am I saying that right?

MS. VINCENT-COLLAWN: Yes, you are.

MODERATOR KELLEY: Chairman, CEO and President of PNM Resources, Incorporated, and Co-Chair, CEO Policy Committee on Energy Delivery, Edison Electric Institute.

We also have Ronald Litzinger, President of Southern California Edison; Jorge Carrasco, General Manager & CEO of Seattle City Light; Dave Markham, President and CEO, Central Oregon Electric Cooperative; and again, John Savage, the Commissioner of Oregon PUC and Chair, Committee on Regional Electric Power Coordination, Western Interstate Energy Board.

So, once again, I ask that everyone please refrain from applause until the end of the session and as compelling as I'm sure all of comments will be. And I would like to remind everyone that what you will hear from our commenters are their own views and not the views of the U.S. Department of Energy.

MODERATOR KELLEY: So, with that, let me turn to Jim.

MR. PIRO: Well, good morning, everyone.

And I want to thank the DOE for coming to Portland. This is our service territory, and we're really proud to have you here and to discuss these energy issues. It's nice to get all of the energy folks into the room and talk about some of the issues we've got ahead of us.

So PGE is celebrating its 125th year anniversary, and we pride ourselves on providing our 830,000 customers safe, reliable, affordable, and sustainable power, something we've done for a long time and something that we take very seriously. And as all utilities, we have that responsibility to provide that high reliability of service to our customers. We have an exceptional set of customers in our service area, companies like Intel, Nike, and a lot of great manufacturing companies who expect reliable, affordable power.

When you think about our company, we've had a history of innovation. And what I really want to talk about is some of the things we've done to enhance the distribution system and to provide that reliable service.

First of all, in Oregon we use what's called integrated resource planning. And I would urge all people to use that type of process because it's that integration of generation, transmission, distribution, and customers that really provides a reliable supply of power to our customers at an affordable price.

As part of that program, we have been very aggressive in delivering energy efficiency to our customers. Since 1991, we've -- at current, we've actually acquired about 330 average megawatts of energy efficiency. We've got another 350 megawatts that we plan to acquire by 2030. These are, you know, lighting, efficiency projects, many things you do to improve the use of our product.

Oregon also has Renewable Portfolio Standard of 25 percent by 2025. We are now at 15 percent. We have over 850 megawatts renewable power on our system. And, again, the need to integrate renewables with our customers is very important, especially given the variability of our resources.

We've also voluntarily decided to shut a coal plant down and trying to look at how we'd replace that plant both efficiently and effectively.

We've also deployed smart meters throughout our service territory. We're now learning how to use those smart meters and the information from that to make better decisions on the distribution system.

We have a very successful distributive generation program where we access customers' diesel generators. We have about 100 megawatts of that. We use it for reliability and reserves. And it's been a very effective cost program for both our customers and our company in accessing those distributed resources.

We have a demand response program that helps curtail peak loads during heavy load hours like we're going to experience over the next week. And we've been very supportive of the electric vehicles. In fact, Portland's been a key launch site for many of the manufacturers that are bringing their vehicles to market.

We've got a very innovative project that we're working with from DOE funding that's called the Salem Smart Power Project. It's a five megawatt battery system. So we're really trying to understand how we integrate that into the grid and create a self- healing microgrid. And so we're doing a number of tests on that project as we speak. It's been a very successful project for us, and we're learning a lot about how you integrate batteries into the grid. It's not yet cost-effective, but that's really the purpose of those pilots. And we're also doing some innovative research around biomass and looking at potentially converting Boardman to a biomass facility.

What I want to talk about now is really the process that we get there and how we get there. Because we're a utility and we have a responsibility to serve our customers, again, both reliably and cost- effective, we have to really think about making sure that these things work. A lot of people have a lot of great ideas, but, ultimately, we have to implement them in the system.

So we start by studying the technology, identifying the cost and benefits. We love running pilots to really prove out the technology, see how it works and how it affects our customers, build a business case -- you heard that this morning. We need to ensure that what we're doing is cost-effective and makes sense for our customers.

We then collaborate with our stakeholders, the regulators, our customers, the interested parties to make sure that they're supportive. We get agreement on those projects and then we deploy and implement. We find that a very proven way of doing these projects, and there's a number of examples that we've used to do that.

In terms of future opportunities where the Department of Energy can be supportive, I would suggest areas of helping us on the smart appliances. We need code changes in that area. Electric water heaters is a great opportunity for us if we can get changes to the codes to have those become smart water heaters so we can access the storage capability. Second-life batteries is another interesting opportunity to support the electric vehicle market.

You've heard about storage again this morning, both the vehicles at the grid and at the homes. We need to increase the density, reduce the weight, and lower the cost.

And finally, more help on data analytics. As we're getting more and more information from our smart meters, taking that data and turning it into useful information to operate the distribution grid more reliably is very key to us as we move going forward.

So, again, the idea is really to improve our performance and really work with our customers to make sure we provide them the reliable service they expect from our company.

MODERATOR KELLEY: Thank you, Jim.

Pat?

MS. VINCENT-COLLAWN: Thank you. And

thanks for this opportunity to participate in the Quadrennial Energy Review.

As Chris mentioned, I'm from PNM Resources. And we serve about three-quarters of a million customers in New Mexico and Texas. And I also serve as the Co-Chair for the Edison Electric Institute Delivery Policy Committee and, along with Jorge, have been on the board of the Electric Power Research Institute since 2010.

And when you look at investor-owned utilities today, we're really facilitating that transition to a more modern and integrated grid by making significant investments in the distribution system. Since the beginning of 2000, the industry has invested $275 billion in the distribution grid. Last year, we estimated to spend almost $20 billion. And by 2017, that's going to grow to $23 billion.

As I mentioned, I'm in New Mexico and Texas, and I'm going to talk mostly about New Mexico today. We're a vertically integrated utility in New Mexico, so we have generation, transmission and distribution. And, unfortunately, we are one of the poorest states in the nation. But yet, we have significant renewable resources. I believe NREL ranks the renewable potential in New Mexico as number two in the nation.

So we work very hard to facilitate increasing the balance of distributed energy, especially solar, in ways that don't impact reliability and, very importantly, do not overburden our less fortunate customers. In particular, we're shutting down about 137 megawatts of coal. And in response to that and growing demand for our customers, we anticipate putting a lot more distributed generation on the grid.

You know, our customer expectations and all of our public policies are focused on reliable, low- cost, and more environmentally- sensitive generation. And that accelerates our distribution system's transition. We ask a lot of our grid and a lot of our customers, right? We want swift, sweeping, complicated, and capital-intensive, which can sometimes mean expensive changes.

We're investing a lot in distribution system upgrades and enhancements. We're adopting advanced technologies, which I know Ron is going to talk a lot about. And we're improving our operational planning and coordination to better meet the needs of our customers and our society.

So I'm going to comment on three specific areas today: the value of the grid, the fact that the grid of the future is going to require proper integration and investment, and what the future role of utilities should be.

You know, our distribution system is a great enabler for emerging distribution level technologies. The system provides linkages to reliably and cost effectively benefit customers. Think about variable and dispatchable distributed generation, such as rooftop solar and microturbines, plug-in electric vehicles, distributed energy storage devices and energy management systems.

And not only does the grid support the value proposition of all these technologies by providing critical support systems, but it's also a system to sell power back to the grid, but it's crucial in providing power quality and reliability at all times. And all of us up here can tell you, that's job number one for our customers for us.

And at all times, that grid has to be fairly valued and compensated, and everybody that benefits from using the grid should pay for the grid. We're concerned as an industry that that's not happening. Many of you know about net metering policies where we pay customers at retail for costs that they -- or for power they sell back to us, and they're still using the grid. They're using all those fixed cross of transmission, distribution, and generation. So we've created an unsustainable subsidy that often times falls on the least fortunate.

And proper integration to the grid, and not just interconnection, is important, right? Our grid was originally designed to send power from our power plants to our customers. It wasn't designed to accommodate high penetration of distributed generation or two-way power flows.

The Electric Power Research Institute is investigating emergency technologies -- excuse me -- emerging technologies and their integration in an in- depth study. It's entitled "The Integrated Grid." And EPRI's approach is not to favor any particular technology, power system configuration or market structure. They recognize that the best solutions vary with local circumstances, goals, and interconnections.

You know, the transition of this system is going to drive investment needs. Our industry is very willing and able to make the needed investments. You hear how much we're spending. But those investments need to be well planned and the costs must be fairly shared. Our regulators can help us by providing regulatory certainty and fair and timely recovery.

As I said, reliability is mission number one for our industry. And we must ensure that these transformation efforts don't compromise reliability or the safety of our customers and the grid. Utilities possess unique knowledge and expertise in system operations, configurations, long-term planning, and local and regional characteristics. And we have a proven track record of meeting those responsibilities. Therefore, utilities should continue to plan, build, and operate the distribution system.

Utilities are there in the trenches with our customers helping to meet their reliable needs for today and in the future, and that's a great place for us, and I think we'll continue to be there.

So with that, I'll turn it over to Ron.

MODERATOR KELLEY: Thanks Pat.

Ron?

MR. LITZINGER: Well, thank you also for inviting me to share our views on building the distribution grid of the future.

By way of a little background, Southern California Edison is one of the largest electric utilities in the U.S. We serve nearly 14 million people through 5 million accounts and across a 50,000 square mile territory.

We also have a proud record and tradition as being an industry leader as innovative technologies take hold, such as demand response, electric transportation, and energy efficiency.

But as responsible leaders, we have to look forward as well. Strategically over the last several years, we've observed four trends. Demand for utility power is flattening. That translates to more self- generation and more energy efficiency. Policymakers are pushing for a sustainable energy grid. And I think it's important to reinforce what Carl said earlier, our customers want a sustainable energy grid as well, and it's up to us to figure out how to provide that. Costs for the alternatives, although high, are coming down and trending down. And, fourth, our customers are looking for more choice.

Through all of these trends, though, we

still see the distribution grid not only as remaining vital, but as Pat said, the facilitator of these new customer trends. Since 2003, we've literally invested billions of dollars per year through infrastructure replacement, upgrading our distribution grid, and adding new transmission lines to access renewable power sources.

We will continue this, but as we do so, we must modernize the grid to ensure that it is ready for a distributed energy resource future, which we think has a high potential to occur.

I'd like to take a step back for a second and look at some California energy policies that promote that sustainable energy system. California's climate change legislation and our renewable portfolio standards of 33 percent are well known. But over the last several years, the focus has gone a lot more towards distributed resources and storage and preferred resources such as energy efficiency and demand response.

Given the challenges for siting and permitting large-scale renewable generation and transmission lines, I personally don't find this that surprising. It's culminated in a requirement for utilities to file what is called a distribution resource plan by 2015. This requirement was included in rate reform legislation which passed last year.

We're developing that plan right now. We are identifying the policy and technology challenges we see ahead and the incremental investment that we see required to modernize the grid. Our engineers have also been studying this for quite some time and determined that our urban circuits are much better suited and positioned to accommodate larger levels of penetration of distributed resources at a lower price than our rural circuits, so our plan will also include optimal locations.

As Pat noted, modernizing the grid to accommodate distributed energy resources is fundamentally changing our radial system designed for one-way power flow from central resources to the customer to a more flexible system accommodating two- way power flows with intermittent power and load resources.

I liken this into converting a system of one-way streets to a system of two-way streets with intersections and what do you'd need for that? You need stoplights, preferably synchronized stoplights to control the traffic flows. And therefore, really, this is all about advanced system controls and situational awareness.

The old days of the simple switch capacitor to control voltage that switched twice a day, on-peak and off-peak, are over. We're going to need much more dynamic voltage control in storage technology going forward for the system to operate properly.

We also need much more advanced protection. It's going to look a lot more like the transmission protection systems with directional and distance relaying to properly isolate faults on the distribution system rather than the simple overcurrent systems we have in place now. Once we get to that advanced control, we'll be able to start looping and networking the distribution system more to make it even more resilient and reliable.

I'd like to close with a couple of thoughts on the utility's role going forward. Clearly, we have to plan this transition. We have to do it proactively rather than just merely reacting to increased penetrations. And our vision is more of a plug-and- play grid. We have to design the grid where we take on the excess power and supply the backup power that our customers don't have to pay that much attention to it.

There is a lot of discussions around a transactional grid, a distribution system operator, but some of the inherent scheduling and curtailments as we talk to customers, they're not really that excited about that, and they want us to design a grid where they can just plug and play.

So with that, I will stop and close it

out until we get into the discussion session.

MODERATOR KELLEY: Thank you, Ron.

Jorge?

MR. CARRASCO: Good morning, my name's Jorge Carrasco, and I'm the General Manager for Seattle City Light.

I think I'm the only public utility here, so I'd like to start by first thanking the Department of Energy for providing the opportunity to give you this input.

And I'd like to start by telling you a little bit about our utility. We're a midsize utility, unlike some of the large brethren to my left. We have been in business for over 100 years. We are municipally owned, so our governing body is the mayor and city council. We serve about 420,000 customers and a population of about -- between three-quarters of a million and a million people.

Seattle, in 2013, was the largest, or fastest growing city in the country. It's very urbanized; we're very compact, a very densely populated area. We have a very diverse customer base. And we are 90 percent hydro. And at this point, I believe we're the only utility in the country that is net carbon neutral and have been since 2005.

So there are three main points that I'd like to make this morning, and the first has to do with climate. And I'd like to take the opportunity to commend the President and the Administration for using this process to begin to advance action on climate.

Seattle is very involved and very committed to dealing with climate. Beyond the utility being climate neutral, the city has adopted a plan dated back to 2006, updated in 2013, to achieve net zero greenhouse neutrality for the city, not just for the utility, but for the city, by 2050 and to begin to prepare the city for the likely impacts of climate.

Now, you might think why are we doing this? We don't have coal plants. We don't have -- we don't even have -- we don't even generate gas,

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so why are we doing this? Well, the reason is Seattle is located right next to the Puget Sound. We are 90 percent hydro and climate is having an impact on our capacity to generate from hydro sources. So climate impacts on our watersheds, on our hydro facilities, and even on our energy delivery infrastructure are things that are of concern to us, and for that reason, we're very interested in what's done with regard to climate.

Just to give you an example, in the Skagit River Basin alone, where we have several hydro facilities located, the glacier area in the Skagit has declined by about 19 percent since 1959. So we're seeing the real impacts of climate in a very significant way. And we're also seeing temperatures being warmer. We're seeing less snow pack. We're seeing lesser flows in the spring and the summer. And we're seeing a much greater propensity for mudslides to take place. So that is an issue that is of concern to us.

And in response to the question, how can the Federal Government help, two suggestions. One is, I know that FEMA has recently proposed funding for planning and hardening utility infrastructure. If there are funds available, I think that would be a big help.

More importantly, I think, and perhaps less expensively for the Federal Government, we do think that there's an opportunity to share best practices among utilities on how to deal with both regional and national climate impacts and creating a forum to advance this type of conversation would be of great value.

The second thing I'd like to address is aging infrastructure. So one of the significant issues we face in Seattle is the fact that we have old infrastructure that needs to be fixed or replaced. Over the next six years, we plan to spend close to $2 billion on infrastructure, and two-thirds of that is committed or dedicated to distribution-related infrastructure.

And there's a great opportunity as we spend this money to do it right, and that means to make sure that where there are opportunities to make this infrastructure smarter, that we take advantage of that opportunity. And I think, therein lays another opportunity for the Federal Government to help with basic and applied research.

And then the final item that I'd like to cover because I'm running short on time here, is the issue of energy independence by our customers and greater customer choice. An, I think this is a topic that others have alluded to. But the reality is, in Seattle, customers want more control over their energy use. And, in fact, they want more control over who provides them with energy.

Solar, despite the cloudy weather in Seattle, is very popular. In fact, the payback in Seattle for a typical installation is now 4.9 years. And that is largely the result of federal and state incentives and net metering that are making that possible. And I might add that in Washington State, 25 percent of all the installed solar capacity in the state is in Seattle itself.

The second thing I would say is that energy efficiency is very popular in the city, and we have very extensive, aggressive energy efficiency programs. In Seattle, on average, we save about 1.4 percent of our load every year.

What's happened, however, is that our load is very flat even though we're the -- in 2013, the fastest, largest city in the country, and like my colleagues, we're faced with problems in terms of revenue recovery because our rates are not designed to recover our fixed costs. So many of the investments that we're making, we're having a difficult time recovering through our rate design structure, and that's one of the significant issues that we face.

I'd like to close with one observation, and that is, that if there is an opportunity for the federal government to help, I think that opportunity is the electrification of the transportation sector. That is an area that we believe offers an opportunity for more load growth, more revenue to deal with the issues that

I alluded to before and an opportunity where I think the Federal Government is well suited to helping us figure out how to develop, finance, and deploy a charging infrastructure to ensure that this electrification of the transportation sector can be successfully accomplished.

And with that, I'll stop.

MODERATOR KELLEY: Thank you, Jorge.

Dave?

MR. MARKHAM: All right.

Well, good morning, everyone. I'm Dave Markham. I'm the President and CEO of Central Electric Cooperative. And we're the distribution utility that delivers electricity to rural consumers, and that's over a 5,300-square-mile service territory in Central Oregon. And if you're not aware, co-ops, we're democratic. We're local controlled organizations, and they're -- we're owned by our consumers. And they participate in setting policies and making decisions for the co-op.

And so today, what I really -- my focus

is on is that importance of that local decision making and the local control. And since you're in the West, I'm going to try and talk to you a little bit about some of the unique challenges that we face here.

And, first of all, it's not easy to delivery electricity to rural America. And the density issues that we face, they're pretty significant. Investor- owned utilities, they serve an average of 34 consumers per mile of distribution line, where electric co-ops, we serve an average of 7.4 consumers per mile of distribution line.

And give you a little bit of a flavor for that, the vastness of our service territory, a neighboring co-op to mine, they serve 3,900 consumers, and that's over a 20,000 square mile service territory. Now, that's a service territory that's roughly the size of the State of West Virginia. And so you can see the challenges there.

And another significant challenge that

we face in the West, and I believe is this a challenge this is also encountered by the IOU's, it's maintaining our electric infrastructure on federally managed lands. And for CEC, 56 percent of our service territory falls on BLM and Forest Service lands.

And just a couple months ago in May, I testified at a hearing at the House Committee on Natural Resources in Washington D.C. And I reported on the unacceptable periods of time that it takes to receive approval from our federal land agencies to perform just routine maintenance and then other things like upgrading our system or replacing our power poles and lines.

And so we are also dealing with some issues that are related to the Endangered Species Act. In Oregon, the BLM, they're considering a proposal for protecting the sage grass. And that proposal calls for burying all the overhead power lines that are in sage grass habitat. And these are overhead power lines that have existed for 60 or more years. And for one co-operative, to bury all of their power lines, it would end up resulting in $400,000 per consumer cost.

So we need to ensure that we have common sense when we look at implementing our federal policies.

And at CEC, our consumers, they've told us that they want additional options for purchasing renewable energy. And my co-op, we're in the design phase of a community solar project, and this is going to allow our consumers that maybe couldn't participate in a traditional method of solar that they can easily be involved in this. And we really want to continue to grow the industry in Oregon. But unfortunately, the cost of developing renewable energy, it's much higher than other forms of traditional, conventional generation.

And so I really urge the Administration and the Department of Energy to continue to seek out incentives that support Electric Co-op in our efforts to deploy renewable energy.

But in the Pacific Northwest, our main

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energy supplier, I think you all know, is the Bonneville Power Administration. And their power supply resources are 95 percent carbon emission-free. And I cannot overstate the importance of the role that the Bonneville Power Administration plays in the economic vitality of the Pacific Northwest.

And we know that there was some recent hiring problems at BPA that led to some -- DOE to suspend some delegated authorities and implement some -- several top-down directives, but -- and this created a lot of concern that the independence of BPA was going to erode and that the regional decision making process was going to suffer. But we're very encouraged by -- due to the fact our Northwest delegation and our regional stakeholders, after communication, that the DOE has assured us that BPA's independence would be respected.

Now, co-ops, we have a long history of promoting energy efficiency and conservation. And we've been doing this for years and long before it became mainstream. You know, our consumers have told us that they want energy efficiency. And they also want more knowledge so that they can better control and manage their energy use and costs at home.

In co-ops, we've delivered on that request. Co-ops, we have the largest penetration of advanced metering infrastructure with 31 percent. That's compared to 23 percent through the country as a whole.

My co-op, in conjunction with AMI, we offer a prepaid electric service, and it allows our consumers to pay in advance for their electricity. And then they can use it on their own schedule and on their own budget.

And I also -- I don't want to neglect thanking the Department of Energy for their role in my utility's deployment of AMI through the Smart Grid Investment Grant Award, and that was made available through the American Reinvestment Recovery Act. And so, you know, these partnerships, they're what are really important for success for all of us.

And so just in conclusion, electric cooperatives, we're going to continue to be leaders and innovators as long as we're not burdened by regulations. Now, last year, government regulations, they impacted my utility in the amount of $20 million. And these costs, they're ultimately -- they're passed on and paid for by our consumers through higher electric rates. And that $20 million, that's equivalent to $632 per meter that we serve.

So my main message today is that I urge the DOE to work closely with the American cooperatives so that you can gain a better understanding of how your policies, no matter how well intentioned, they can come back and have an impact on the electric rates to our consumers.

And so thank you for the opportunity to participate on this panel. I look forward to answering any questions.

MODERATOR KELLEY: Thank you, Dave.

MR. SAVAGE: Okay. So when I started

out as a commissioner in 2003, we did not focus a lot of regulatory attention on the distribution system. We did our job. We wanted to make sure there was high quality service, but I can't say that we had docket after docket dealing with the distribution system.

That's been changing. Just some examples. We now require our utilities to submit their modernization plans for distribution system and hold regular briefings with them on their investments. We conducted investigation and adopted policies related to smart grid and electric vehicles. We just completed an assessment of the impacts of Oregon Solar PV programs on customers and on the system. And we're about to open a rulemaking into the use of smart invertors, which was actually something that came out of a Western Energy Industry Leader group.

What's triggered the two, I think, the change, is two things. One, we're beginning to see in Oregon the same policy cost and technology-driven shifts that are occurring in California, although on a much, much smaller scale in a much smaller timeframe. For example, the amount of home rooftop solar in Oregon has increased eightfold over the last few years.

Our big box and high tech companies -- Walmart, Staples, Facebook, Apple, Intels -- all want to go renewable either on site or by -- from nearby plants. Two, we also saw the possibilities from the new distribution automation technologies and enhanced demand response to lower cost to customers and improve system operation.

Now, I can't say -- we have -- California's leading the way. It's the microcosm of everything in this. I can't say how far and fast we'll move towards a more decentralized, more digital, or more customer- oriented system in Oregon and elsewhere in the West, but it's occurring and we should plan for it.

So, I'm going to quote from a 2012 DOE publication called "Addressing the Electric

Distribution System":

"Integration of rooftop PV, electric vehicles, microgrids, transactive building loads, and other technologies in large amounts will fundamentally change how the distribution system must be planned and operated. Increased variability from PV generation, the movement and charging of electric vehicles and the rise of prosumers, producers, and consumers of electricity will require increased system flexibility and control of building. There are also opportunities for these technologies and assets to provide system flexibility to the bulk transmission system, concurrently it is vital with the right sensor software and communication technologies are available and in place."

This is a draft plan, so I just want to be very specific -- this was a draft plan I quoted from. I think it did a good and wonky job of summarizing the challenges and opportunities that are facing the distribution system over the next couple of decades.

I think these include: accommodating

potentially large amounts of distributed generation in many areas; making the best use of technology, such as advanced meters to increase the quality, reliability, and efficiency of service; expanding the cost-effective opportunities for consumers to reduce peak store or store energy and provide good services; handling the charging of electric vehicles in a way that benefits vehicle owners and the power system; increasing operator visibility and control over the distribution system; and seeking technological breakthroughs in distributed gen, electric end-use and storage.

So I'm going to end with one suggestion for DOE action. DOE should take the long view, as you're doing, and should help guide the evolution of the grid. I think one of our needs is a roadmap for modernizing the distribution system over the long run.

And you have appeared to have a good start on one in the draft distribution system plan I quoted from, so my suggestion is: finish it.

MODERATOR KELLEY: Thank you.

Okay. So now we are going to turn to our discussion. We'll start off with, again, a common theme that I heard and probably encapsulated in Jorge's comments best was -- is that the customers want a sustainable grid, a reliable grid. But we're -- you're also faced with increased renewables and the economic and the operational impact associated with that. So what is the role of DOE here in helping you to address that issue in particular?

And I'll start with you, Jim.

MR. PIRO: Good question.

Well, you know, this whole idea of integration of renewables is becoming a real issue for the utility industry, whether it's solar, whether it's wind resources. We've got a lot of variability on the system. And so, more -- as we talked about earlier, the need for storage is really critical. But really, what we need is to have more demonstration projects where we see where there might be optimum technologies that can help and enhance the operation of the system and have them work on those demonstration projects.

I mentioned water heater load control. The electric utility industry has a tremendous amount of load in the water heater space that could be used for thermal storage, but we're going to have to convert that technology and get it so that it's connectable to the grid and get the manufacturers to put the smart chips in those, or at least the smart socket in those water heaters, as part of the standards so we can convert that fleet.

But my sense is that there are a number of tools and capabilities out there to address this. I think it's a matter of putting those together and then demonstrating them. Our Smart Power Project is another example of that where we've got DOE funding. We're learning how storage works. But ultimately, we're going to have to drive the cost down to make those cost-effective.

MODERATOR KELLEY: Thank you.

Pat?

MS. VINCENT-COLLAWN: And, I want to echo what Jim said and then add another thing.

You know, storage is the holy grail to all of us. We were fortunate at PNM to have a demonstration project with DOE where we had battery storage directly integrated with the utility scale solar to help reduce the variability of that, and that has been a very groundbreaking project.

But the other thing I would say is, you know, recognizing the role that utilities play in distribution system operations, you know, we have that obligation. We know how to do it. We're already working on a lot of technologies, invertors, things like that, that are commercially available. The storage one is not yet commercially available and cost-effective, but -- so it's helping on storage, where it just -- it doesn't probably make sense for private enterprise to put that money in and then recognizing the utility's role and expertise in managing that distribution system.

MODERATOR KELLEY: Ron?

MR. LITZINGER: I would agree that storage is a key thing, but I'm going to digress and pick up on a point that Jorge made on electrification of transportation in two reasons.

One is around, it provides you a lot more flexibility around managing load on the grid. As we evolve towards a smart grid, which I think will be cheaper in the long run than storage, not only do we need a smarter grid, but electrification of transportation not only provides you a storage resource but another way to manage load going forward.

And then, the second benefit of -- on electrification of transportation, having been around the industry for 30 years, if you had asked me 10 years ago whether I thought battery technology was going to play a significant role, I was in sort of a cost-prohibitive category. But I think with electrification of transportation, that just in and of itself, has advanced this strong, declining price trend that we see in storage technology, s, we have to stay continued focus on that as well.

MODERATOR KELLEY: Jorge?

MR. CARRASCO: So, I mentioned earlier the notion that electrification of transportation sector has multiple benefits, not only for utilities, but for our customers. And I think that that is a big opportunity that the Federal Government is well suited to engage in and help us with how best to accomplish that.

There's a lot of infrastructure investments that utilities don't commonly make. And I'm not talking about charging stations in a customer's home. I'm talking about charging stations that are going to be needed in locations where normally utilities wouldn't be placing charging stations for customers. So I would say that is one area.

And the other area that I would call attention to is the EPRI study that Pat made reference to. This whole idea of an integrated grid is really a concept that I think could have

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very positive impacts, again, for utilities and customers.

There's been a tension, at least recently, between utilities, certainly in our area, and customers over the issue of them wanting more independence and us feeling like they're not paying all the cost of serving them, and there's a tension there that we keep running into.

But if you stand back, those two things: the issues that the utility has to undertake in terms of reliability, investments and distribution, et cetera, and the things that the customer is doing to exert more independence and to, kind of, use energy in the way they want to, I think there is a tie between the two that could actually result in a win-win if the technologies can be developed and figured out.

And I think EPRI has done a great job of essentially identifying the opportunity and inviting a conversation about how best to have these technologies interact so that it's a win-win for both the utilities and the customers, and they're paying their fair share of the cost as well.

So I would say those two things would be important ways in which the Federal Government can make a big difference.

MODERATOR KELLEY: Thank you, Jorge.

Dave?

MR. MARKHAM: Yeah, my answer is along -- same along the lines, but from a co-op perspective of, you know, I believe the DOE should be involved in and investing in cutting-edge technology, but it's a lot more difficult to implement locally without assistance.

And so, I mentioned during my opening remarks, that the DOE has partnered with co-ops on smart grid. Mine was one of them and also cyber security. We wouldn't have been able to push down the road to where we are without DOE's assistance. And what it's done with our system as far as reliability, improvements, and giving our members more control, more knowledge, which is exactly what they want, has been very important.

Everybody's talked about storage technology. I believe that it has to be a high priority. And until we get there, we can't take renewables and these other issues to the next level.

MODERATOR KELLEY: John?

MR. SAVAGE: Yeah, the -- actually, I like a phrase that Jim Piro said to me before this panel started about utilities, he wanted to be a "fast follower," which I think is a great phrase for utility. That's exactly where utility should be. I mean -- so, the question is who's going to -- so, who's going to lead them? And I think that this -- you know, listening to this panel, there's some great ideas, is that DOE should work together with the industry and create a shared agenda on demonstrations and investments, you know, new technologies that should be -- applications that should be worked on. I mean, I like -- smart appliances, that has got a lot of potential. The data analytics, the EV's, the storage, this is all good stuff, but I think it'd be sitting down with the industry and creating that shared agenda, to me would be really important.

MODERATOR KELLEY: Thank you.

So with that, let me turn to another topic and that of security. So, probably, you've all touched on this a bit in terms of reliability, tangentially maybe.

But specifically, Dave, you mentioned cyber security. And I'm curious to know your thoughts on the Federal Government's role in terms of cyber security. Is it -- you know, is it a funding role? Is it an education role? Communications role? All of the above?

So, anyone. I'll open this up to whoever would like to comment first.

MR. LITZINGER: I'll go ahead and lead off on that.

There's been a lot of discussions over the last several years. Cyber security is a significant issue. And probably the biggest thing that we keep coming back to as the industry is the Federal Government has the expertise and the

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resources for intelligence. And we've got to come up with ways of sharing information. I think progress is being made on sharing information back and forth around threats, but that's probably the larger role.

When it comes to resilience of the grid, I believe the industry, you know, has a long, you know, for us 128-year, track record of that. We can always get better and improve. But I think information sharing is the key on cyber security. And I think all of these are solvable. We have certainly spent a lot of resources and time and effort on shoring up cyber security on our system.

But as we go to a more distributed and a more smarter grid, we can't lose sight of the fact that we are exponentially increasing the number of portals into the system for cyber issues. And I'm not saying that is a reason not to go there. We're fully prepared to go there. We just have to recognize it and deal with it along the way.

MODERATOR KELLEY: Yeah, Pat?

MS. VINCENT-COLLAWN: I'll echo a little

bit of what Ron said. I'd like to remind people that we are the only industry that is under mandatory, enforceable, with very significant penalty, standards around cyber security. And so I always tell my commissioners they can rest assured because when it comes out of the pocketbook and it doesn't -- fines do not come out of rate payer's pocketbooks, they come out of shareholder pocketbooks that we work very hard on this.

Part of it -- a lot of it is that information sharing and not just the Government's ability to share information with us, but the Government sharing information within its many agencies. We have a lot of, kind of, cyber folks out there in the Government. And if they can share with each other and then share with us, that is very helpful.

I also think helping to set standards for all of these folks that are interconnected with us, because, you're right, the number of points for cyber threat is just going up exponentially when they connect on the grid. So I think -- and I think helping put that discipline and possibly standards for those industries that are making and connecting with us would be very helpful.

MODERATOR KELLEY: Dave?

MR. MARKHAM: Yeah, for me, I believe guidance and information is a top priority for DOE. And internally, it's one of our higher priorities at my co-op. Everybody has said it here, but the ability to be in a position to share information, BPA has been extremely helpful for the co-ops. We have work groups, user groups, whether it be in the state or nationally. But the more information we can share the better, that we can help somebody else so they can help us. And really with cyber security, things are moving so fast that you better have those work groups set up and new information all the time.

MODERATOR KELLEY: Jim?

MR. PIRO: There's been a lot in the press around physical security of the grid. And,

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you know, the industry has gotten very close in working together on spare transformers, which is the big issue. What would be helpful from the Department of Energy as well as their other agencies is, what is the credible threat that we need to defend against? Because, you hear so much about, you know, what are we going to defend against?

NERC and FERC have started that proceeding. I think we're starting to work through that, but better clarity on what it is we need to defend against. I think we need, as the utility industry, continue need to work on resilience and using our spare transformer program is a good way to address that. And I think that's moving in good step. I think we're adding more spares to the system as we, kind of, see what the credible risks are that we're trying to defend against.

MODERATOR KELLEY: Any other comments?

Jorge?

MR. CARRASCO: So I would agree that information sharing is key and the more of that, the better.

The only other thing I would add is that there's been an extensive amount of work done by NERC and FERC putting in place protocols relating to cyber security and physical security for that matter. And I would urge DOE and the Federal Government to build on that and not to start anew additional requirements that are going to, I think, ultimately stand in the way of progress. And I think NERC, by and large, has done a pretty extensive job that we should build on rather than begin anew.

MODERATOR KELLEY: Anyone else want to comment?

John, did we hear from you?

MR. SAVAGE: Right now, in terms of us, it's whatever our utilities need and want because I look to our utilities to make sure that we're resilient. So that's pretty much all I would say.

MODERATOR KELLEY: So let's turn to a regulatory perspective here. So we did hear a bit about the challenges associated with the impact of regulation. But, maybe if we can look from a different lens, do you see challenges associated with any conflicts between federal, state, or local regulation? And is there an impact there to you? And if so, again, what is -- what should the Federal Government be doing here? What is this QER task force listening. So what should they be doing differently, maybe, that they aren't doing already?

Anyone care to take that one?

MR. SAVAGE: I could see -- I guess I'd use the phrase that I was -- in the previous panel, I was talking about the blurring of transmission and distribution, which is going to me, end up with some conflicts, and I think we're already beginning to see the conflicts between FERC and the state regulatory agencies. I don't know if that leads to joint board -- more joint boards out there to deal with some of these issues. I think the immediate one of demand response in the East in the markets and what that pace meant.

We don't -- you know, we only -- we have regulated markets in California. So -- but I can see more and more that if there's quite a bit of generation that's at the distribution level, that all of sudden you're going to get into some stickier issues down the road.

MR. LITZINGER: One thing I'd add is -- I mean, largely, you know, this panel's focused on distribution, and that's largely fallen to the state regulation and transmission to federal regulation, the previous panel. But I agree with Commissioner Savage that that line is going to be blurred.

You do have to get to fairly high levels, at least based on our studies, where distributed resource penetration on the distribution grid starts to be sufficient enough to impact flows on the bulk power system. I'm not -- I point that out only to say that I think we have time to work out that cooperation between the federal and state agencies because it likely will happen, but we do have some time. And I would encourage all regulators to anticipate it rather than react at the time when it occurs.

MODERATOR KELLEY: Yes, Pat?

MS. VINCENT-COLLAWN: Yeah, I would encourage the Federal Government as they go forward to respect local circumstances and local regulators. You know, different states have different renewable potential, even different kinds of renewables.

For example, we're in Texas where there's a great wind potential. New Mexico, there's solar potential. There's different income levels of our customers. There's different needs. There's rural locations. There's urban locations. So I think it's understanding that naturally we want to get somewhere, but the local -- the states and the local municipalities are going to get there very, very differently, so make sure there's that kind of flexibility.

MODERATOR KELLEY: Jim?

MR. PIRO: Prices are set at the local level, at the state level. So I still continue to urge the, kind of, collaborative approach at the state level, working closely with your regulators. Federal Government can set some policy and ideas, but I think as Pat mentioned, every jurisdiction is different in how it's going to work.

And I really think it's the best way to get these things implemented is to bring people to the table and have that collaborative discussion. Think about both costs and benefits because there are those two sides of it and really make sure that we balance that as we set our customers' prices and make decisions on technologies that are sometimes 10- or 20- year kinds of investments.

MODERATOR KELLEY: Dave?

MR. MARKHAM: I'm going to back first on the local control and local decision making for cooperatives, and that's what's helped us operate so efficiently for over 75 years. I'm going to jump back in real briefly on something during my presentation, what I testified at in Washington D.C. John understands that we have requirements for maintenance of our facilities. That may be replacement of poles, upgrades, that sort of thing, inspection.

When we have to wait for years to get approval for permits from our federal land agencies for us to be able to do maintenance on our systems, that creates some real issues for us, and we've got to get by that, and we've got to be able to get some streamline measures in place so that we can meet not only the best business practices that we have, the mandates by our state and not be held up by our federal land agencies.

MODERATOR KELLEY: Any other comments?

Okay. So in the last panel we talked a bit about technology and, in the case of transmission, the deployment of PMU's on the system, perhaps the analog here in the distribution world is advanced metering infrastructure or distribution automation. So I'd like to talk a little bit about just the technology you see in the future and, again, back to that federal role in helping in terms of investment, education.

We heard, I think from Dave, about your smart grid project that was funded through federal dollars. Is there -- are there other technologies that should be explored? And just to -- before I wrap up my question here just -- the initial comment I heard on the PMU's was that it wasn't necessarily a response to the technology, or not necessarily an investment in technology, but it's, how do you take the technology to the next level? So I just ask, is that where you see the next steps?

So who would like to take that?

MR. MARKHAM: I'll jump in because, you know, I'll take off here from where I left off. We had a partnership with DOE on smart grid, very successful, very good. As I mentioned, we're rolling out our community solar program. I would really like to be able to implement storage technology in with that at some point because we want -- I want to be able to pilot load shifting, see the benefits of that and that's a role that I think the DOE can really help with co-ops like mine is in storage. I'm going to go back to that and implementing these renewable energy projects.

MODERATOR KELLEY: Thanks.

Jorge?

MR. CARRASCO: So I alluded earlier to the fact that we are spending a great deal of money trying to address aging issues, infrastructure issues in the distribution system. And as we're doing that, it's a great opportunity to make sure that we take advantage of any new technologies that make the grid smarter. And while there's been a lot of talk and fluff about smart grid, I'm not sure anyone has actually operationalized that in any comprehensive way.

And I think this is an area where the Government, through perhaps investments and basic and applied research, demonstration projects perhaps, could help utilities take full advantage of whatever opportunities exist as they're updating or addressing the aging issue with new technologies that can be made a part of that investment.

I think we're all going to be better off long-term if that happens, and I think that would be an appropriate role for the Federal Government to play.

MODERATOR KELLEY: Thank you.

MR. LITZINGER: Yes. As we are preparing our distribution resource plan that I alluded to in my formal remarks, we are focused on a lot of policy issues, but we are focused on technology issues. And it's really a repeat, a lot of the technology issues that we've looked at since smart meter installations began and the focus on a smart grid began to take off.

It really comes down to inner operability standards for sensors and devices. And the key for that is that we can communicate with the customers' devices and that the communications technology is fast enough to move large amounts of information. I think the computing technology is there to deal with the large amounts of information.

We have to move it quickly, use it, and

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communicate it back to end-use devices very quickly and that's going to continue to require advancement. So the communications technology itself. We're fortunate to have a lot of fiber on our system. But the inner operability and communication protocols with the devices of customers will also be critical for this to succeed in the end.

MODERATOR KELLEY: Thanks, Ron.

Pat?

MS. VINCENT-COLLAWN: I'm probably one of the few investor-owned utilities that don't have smart meters. And in our New Mexico territory, our average -- customers' average monthly bill is $75. I can't make a business case for smart meters. When I go over to Texas, the average customer bill is about twice that. So I can make a business case for them and the regulators encouraged it. So those technologies are there and they'll get deployed when you can make a business case for it.

As I mentioned earlier, for example, New

Mexico is unfortunately a very poor state, so having the latest and greatest technology is not necessarily a great thing. We actually say in our strategic guidance that we're a "technology follower" because of that. But I think it's those places where the DOE can help doing demonstration projects so that things can ultimately make -- become commercially available. And then individual utilities can make business cases for them because customers want stuff, but we have to be careful about how much they're willing to pay.

Thanks.

MODERATOR KELLEY: Thank you.

MR. PIRO: Yeah, just a comment about electric vehicles and electrification of the transportation system. That second-life use of batteries is really critical for the auto makers because they need to find a secondary use to drive down the cost of batteries, so that research is pretty important.

And then, vehicle to grid, even though it sounds really great, I will tell you in talking with the vehicle manufacturers, they haven't done the work on that. And if that's going to make sense, there's going to have to be some significant R&D dollars. And that's based -- it has a whole lot of implications to their operations in terms of the car, in terms of how much can you cycle that battery? So battery cycling is a big deal, and some research in that area would be helpful. And I think the auto manufacturers would welcome that because they just don't have all the resources to throw at that technology.

MODERATOR KELLEY: Any other comments?

Okay. So with the time that we have left, again, I will ask you to think about your one comment or one suggestion that you have here. And I know we've heard a lot of your comments already to the DOE for the role of this QER task force and the role of the Federal Government here.

So I will go ahead and start at this end here with Jim.

MR. PIRO: Well, I sure like John's

before me because my -- he's our regulator, but -- I would add to what John said in terms of driving innovation. Really need to focus on economic value and market transformation. I think we can't lose sight that these things have to be economic for our consumers can really drive market transformation through codes and standards where it makes sense rather than trying to do it one size, you know, individually. Let's do it broadly across the industry.

MODERATOR KELLEY: Thank you.

Pat?

MS. VINCENT-COLLAWN: I would think that I would say is whether, you know, we're an investor- owned utility, whether we're a municipality, a cooperative, or a power market agency, you know, we're all in the business of delivering a public good and that safe, reliable, affordable, environmentally sensitive power. And we have to deliver it to everybody, not just the affluent, not just the urban. And that's, I think, a unique obligation and role that we've all happily taken on. And as, I think as we go through this process of looking at our electric grid, we need to keep that obligation in the forefront of our minds.

MODERATOR KELLEY: Ron?

MR. LITZINGER: As we look at a distribution grid of the future, we're really focused on two things: A) you know, the distribution grid remains vital. And it is going to take technology development going forward. And, secondly, rate design is critical. But since this is focused at the federal level, I would emphasize the technology aspect because the rate design issues to ensure that the costs are allocated fairly across all customers is more of a local issue.

MODERATOR KELLEY: Jorge?

MR. CARRASCO: So I guess I'd come back to this notion of the integrated grid and -- which I think encompasses all the technologies that we're all trying to contend with. And I think there is a great opportunity to work in tandem, perhaps with EPRI and other organizations that are trying to figure out the answers to how you can get utilities and customers to work side-by-side on solutions to this new energy future that we're all faced with.

So that would be the one thing I would say. And, of course, I mentioned earlier the electrification of the transportation sector I think is an area that -- it's kind of subset of this integrated grid concept, but a critical one for both environmental reasons and energy reasons as well.

MODERATOR KELLEY: Thank you, Jorge.

Dave?

MR. MARKHAM: Yeah, go back to our communication co-ops. We have a very unique relationship with our consumer owners. We're constantly finding out what they want and the local co-ops, we're responsive. We set policies responsive to their needs. We're walking the walk as far as renewable energy.

And, as you know, in the Northwest, just about all the new resources coming on are non-carbon emitting. And so, again, I believe the DOE can help us streamline regulations as we try and push forward with implementing technology and giving our consumers what they really want.

MODERATOR KELLEY: John?

MR. SAVAGE: Finish your grid tech team plan that I mentioned before. Second of all, work with the industry to create a shared technology, RD&D&D agenda that would be aiming, you know, that you'd be really zeroing in on stuff for the utilities. I think it would make a lot of sense. It would drive down costs, make it operational, and also bring comfort for the use of the technology.

MODERATOR KELLEY: Great, thank you.

MR. CARRASCO: Just had a thought that I've been contending with of late back home, but our industry is one of the least understood and underappreciated industries in my opinion. There's a lot that goes in to keeping the lights on that many of our customers don't understand

and, in some cases, don't care so long as the lights are on. And creative, different, innovative ways of educating people on what's behind keeping the lights on oftentimes become controversial and misunderstood.

And I think to the extent the Federal Government has opportunities to broadly educate the public on the vitality of the electric service they get and the critical nature of it and the challenges that our industry faces, I think it would be money and time well spent.

MODERATOR KELLEY: Great closing comment.

So, once again, thank you to this panel for joining us here today. I learned a lot. Thank you.

(Applause.)

MODERATOR KELLEY: Okay. So, at this point, we're actually going to be taking a lunch break. And before you head out the door and leave for good, I just want to encourage you to return because as you heard from our panelists here, a lot of interest in energy storage on their part, and that's exactly what our next panel is all about.

So, we will be taking a break until 1:00 p.m. The lunch location, there is a cafeteria down the hall, but I'm told that that -- you may have better options if you go down the stairs. And there's some students to guide you to get to the downstairs option, which is supposed to be better.

So we are going to start sharply at 1:00. For those of you who are joining us via the live stream, please bear with us for the next hour and a bit. We'll get started at 1:00. So thanks, everybody.

(Whereupon, the lunch break was taken at 11:53 a.m.)

(Meeting resumes at 1:04 p.m.)

MODERATOR KELLEY: Okay. Well welcome back, everybody. I hope everyone enjoyed their lunch. It seems like we lost a few, but not too many folks.

So we are going to get into our third panel here in a moment. Third panel is focused on storage. They're finally coming.

I'm joined up here again by a distinguished set of folks who will be providing us with their comments. Of course, we have Haresh Kamath, Program Manager, Energy Storage, Electric Power Research Institute; Carla Peterman, Commissioner, from the California Public Utility Commission; Geisha Williams, Executive Vice President for Electric Operations, Pacific Gas & Electric; Arlen Orchard, the General Manager and CEO, and Chief Executive Officer of Sacramento Municipal Utility District; and Steve Klein, CEO of Snohomish County Public Utility District.

So, again, we'll follow a similar format where we're going to hear some comments from these -- these distinguished folks. And, again, I remind everyone that if you haven't yet signed up to provide comments at the end, I encourage you to do so. You can still do that at the front table.

Immediately following this session, we

will be turning to the public comments. And then, again, for those who are joining us via live meeting, please submit your comments via email. And, once again, I remind you that the panelists' views are their own and not the views of the U.S. Department of Energy.

So, with that, let's turn to Haresh.

MR. KAMATH: Thanks very much, Chris.

I'm Haresh Kamath with the Electric Power Research Institute. We are studying many of these issues and storage is a program that I work in.

In -- to preface a lot of the remarks today, I want to remind everyone that when you look at the grid as it operates today, it was really designed to operate without a significant amount of storage. And it does, and it has operated for over 100 years without a great deal of storage on it.

There are a few storage plants out there, about 2.5 percent of the grid in the U.S. And it's comprised entirely, almost entirely, of pumped hydro units at the transmission level. So, the question is legitimate, do we really need storage on the grid?

What we do know is -- I talked to the system operators, that the amount of storage -- the storage that is out there is extremely valuable. And when you talk to them about its value in the regulated grid, they will tell you that it is very handy to have, and they would not give it up for the world.

Furthermore, we think that the need for our energy storage is going to increase as we see the challenges and the opportunities of increased penetration of variable generation as well as distributed energy resources on the grid. So the real challenge is if we can make better, or if we can make good use of the energy storage that's out there, how can it be deployed? And where are we going to get it from?

So there are a couple of things that we have to think about for the technology. And the first thing is that energy storage continues to be an extremely expensive technology and relatively difficult to implement. There are new technologies that are being developed right now. There's a great deal of research that's being done, not only that's funded by agencies like the Department of Energy, but also by the private sector.

The private sector has really taken up this challenge, not just because of the grid need for energy storage but also because energy storage is starting to become a very important technology for everything else. For example, the cell phones that you carry, the laptops that you use, all have batteries in them, and that would not be possible without a lot of the research that's happened in the last 30 years.

That research is going to ripple across into all the other industries out there. You've already started to see it make inroads into, for example, transportation, electric transportation. And now, you're going to see it really enter the grid.

That said, even for those technologies that exist today, we don't have on the grid side any really established products or product solutions from vendors that have been in operation for many, many years.

There are a few vendors out there who've developed and delivered good products. And we've seen a few in the last few years, people really making a go at it. But we still don't have an established industry. And one of the challenges over the next few years is going to be, really, to bring all the players together to make sure that industry can deliver safe, reliable, affordable energy storage products that the utility can really use.

One of the things that we've been working on at the Electric Power Research Institute in collaboration with our member utilities, as well as the Department of Energy and other stakeholders out there, is to create an Energy Storage Integration Council, which is an activity by which people can come together as a forum and discuss some of the basic technical issues in actually integrating energy storage to the grid, both from the standpoint of making very effective product solutions and from the standpoint of the utility side, knowing what to expect in terms of permitting, siting, the issues that are related to storing any products on the grid.

We just have not done that for energy storage to the degree that we've done it, for example, for transformers or for transmission and distribution.

Finally, as with any other distributive energy resource, we do believe that installation of energy storage needs to be done according to the planning and operation schedules that we've already established for the electric power industry.

So, one of the parts that you've heard, or one of the research areas that we've heard about this morning was the integrated grid. This is our concept of EPRI, of bringing together distributive energy resources into the planning and scheduling processes for conventional resources on the grid to make sure that you get the maximum value out of those distributive energy resources.

We feel that this is a really critical area for future research. And we're really looking forward to working with utilities and other stakeholders to make this possible over the next few years.

Thanks very much.

MODERATOR KELLEY: Thank you, Haresh.

Carla?

MS. PETERMAN: Yes, hi. Good afternoon, everyone. Nice to see you, and thank you for staying for our panel. You've heard a lot about storage already today, and so it's good to do a deeper dive.

I'm with the California Public Utilities Commission. And last fall, we adopted targets for energy storage for our investor-owned utilities. So we set a target of 1.325 gigawatts of energy storage for our IOU's to be procured in solicitations through 2020.

And my first takeaway I'm going to leave you with is that energy storage is just one of the tools that California is pursuing for energy management. In terms of what we want to get from energy storage, some of those benefits, we will also get some of those benefits from demand response, from better forecasting of renewables, from faster ramping natural gas plans.

But energy storage is a class of assets that we haven't invested in as much as a state, and that's why we're having this focus. But it is important to have it as one of your tools and not your only tools.

And so we decided to set targets, we were rejected by legislation in 2010, AB-2514. And that legislation asked the Public Utilities Commission, and then our publically-owned utilities, to consider setting targets for viable and cost-effective storage.

We had to determine whether we were setting targets by last year, and our publically-owned utilities had to decide this year. Our investor-owned utilities represent over 70 percent of the state load. And so, indeed -- and a really diverse geographical base. And so we wanted to be mindful of the differences in our utilities and in resources as we move forward.

So just a little bit about our targets. 1.325 gigawatts, which are spread across the three investor-owned utilities, and it's also spread around three different interconnection points, so customer side-storage, distribution storage, and transmission storage -- connective storage.

The legislation said that this storage needed to do one of three things: it had to help with greater reliability, had to help with integrating renewables, or reducing greenhouse gases. And also, as I noted, it had to be viable and cost-effective. So we spent the first two years after the legislation was passed trying to figure out what does cost- effectiveness mean?

What is energy storage?

So we contracted with EPRI and KEMA DNV to do analysis about different use cases for storage. And one of the takeaways is, there are many different types of use cases for storage and different technologies that can meet that. And these different assets have a different level of cost-effectiveness. And so it's important as you're looking at what you're trying to do in the state or nationally to really focus on what's the problem you're trying to address because a different storage technology may be able to do that.

And it was important for us to leave as much flexibility as possible with directing these targets. And so, for example, we allowed there'd be movement of target between transmission and distribution categories. We allow for multiple business models.

So the utilities are allowed to own storage at each of those interconnection levels: transmission, distribution, and customer side.

We also want to encourage competition, however. And so, we capped the overall amount of utility ownership at 50 percent. The utilities are allowed to defer up to 80 percent of the target in a given period to the next solicitation if viable projects don't emerge.

And there's also plenty for us to learn, so after three years, we're going to do a comprehensive review of the program and see what needs to be adjusted. You know, we've heard a lot of discussion today around pilots. And to put it in perspective, we just didn't start thinking about energy storage in 2010. California has been investing in pilots and R&D for energy storage for a number of years.

But you get to the point where there's only so much you're going to learn from pilots. You really have to start integrating these technologies into the system and seeing how they perform in the real world. And even with our cost-effectiveness analysis, we could have spent years doing it because, ultimately, it's really hard to pinpoint is that cost- effectiveness when you don't have operational experience.

So California is at the point where we have our demonstration projects, but we really need to get more operational data. It's important, though, to connect those pilot projects to your future targets. So we do allow the utilities to grandfather in some of the demonstration projects that will continue to operate.

The other takeaway I want to leave you with is that how effective your storage will be depends on what your rate structure is and what you're doing in other technology fields. And so electrification of transportation has come up a few times today, and we're doing a lot of the work on transportation and electrification.

We have a proceeding where we're looking at vehicle integration activities with a focus on first b1g, things like controlled charging. You know, that might be considered a demand response resource. And then eventually looking at b2g, where you're having bi-directional power flow, which could potentially be a storage asset.

There's some real questions around that about what is the asset? How do you aggregate it? And so it's important to be working on all of these things in parallel, but be having conversations across these different proceedings and among these different groups.

So I want to wrap up with about where are we now? What's been the reaction, right? We put out these targets, and we said, Okay, industry, here's your chance to show us that you actually may have something to bring. And they're coming.

So before we even set our targets, Southern California Edison was required to do a solicitation for energy storage, 50 megawatts. And they had over 500 bids with energy storage. Now, all these bids are not going to be viable. But in terms of, you know, who's interested, there was a real response.

The California ISO, which keeps the

queue for transmission projects, transmission and connected projects, has seen over 2,300 megawatts of energy storage projects come forward to get into the queue. Now, again, all of those projects won't be viable.

But there was enough projects out there that are positioning themselves to compete in our targets. Thirteen hundred of those, approximately, are stand- alone storage, and the rest are hybrid projects. And so, there's been a tremendous amount of interest.

So we're looking forward to seeing what this bid into utility solicitations. We have their applications before us. It's a very interactive group of stakeholders, a lot of new stakeholders. So if you're thinking about setting targets, you have to be mindful of, you're going to have developers who have never participated in the utility procurement process. And so it requires an extensive amount of handholding between a utility and these new providers.

And then, finally, a lot of questions

are coming up. We already want to figure everything out up front. And so we're working together as agencies to address some of these questions. One of the initiatives that's just started is the development of energy storage road map, which we're doing in conjunction with the California ISO as the lead. And they're working with our Public Utilities Commission and the CEC because there is some real questions about the interaction between the distribution system and the transmission system.

So there are storage projects who want to be able to bid into the wholesale market at some times and also serve as a distribution asset. How do you manage that? What's the right retail -- what's the right rate charge? Is it a wholesale rate? Is it a retail rate? So I think we all need to look at our own processes to be able to facilitate these resources to be more flexible, but our system isn't currently designed for that.

MODERATOR KELLEY: Thank you, Carla.

Geisha?

MS. WILLIAMS: Good afternoon, everyone. I'm Geisha Williams, and I'm Executive Vice President of Electric Operations of Pacific Gas and Electric Company. We're proud at PG&E in providing service to our customers that's safe, reliable, and affordable. We provide service to nearly 16 million people in the State of California across Northern and Central California.

Over the next three years, we'll be making about an $8 billion investment to modernize our electric infrastructure to really enable our communities in the State of California achieve as a vision of being able to provide low-carbon and have a clean energy future. Eight billion dollars is a lot of money, but not when you compare it to what the rest of the industry is doing over a decade, and that number is $1 trillion.

And I think we all are in it at the same time trying to figure out what we need to do to modernize our infrastructure to enable us to operate it in a way that we never have before. This work is truly essential. We don't often talk about how times have changed, but, you know, so must the grid change.

When it was originally designed and thought through in terms of what the grid would do, it was very much viewed, and you've heard several times today, as a one-way power flow from central power plants, leading to delivering electricity to the end- use customers at the end of power lines. But, today that's no longer the case.

And it's imperative, I think, for all of us to put together grids that are flexible so that it can accommodate intermittent renewable resources such as wind and solar while at the same time allow for two- way power flows as we see more and more solar roof topping that is coming online. PG&E has a 120,000 solar rooftops, and we're adding about 3,000 every single month. It's here; it's happening, and so we've got to accommodate. We've got to figure out how to make the grid work for all of us.

So, as a result, today, our grid

operators must rapidly increase or decrease the amount of energy that's actually on the system, depending on the demand and the supply. You know, it has to happen on a real- time basis. This is the stuff of science fiction, right, a few years ago or a hundred years ago, and yet, it's exactly what our operators are having to deal with today.

And so, although the way that we operate our grid has changed and will need to continue to evolve, the grid still has to work in real-time. As you all know, the total demand and the consumption has -- the consumption and supply has to equal -- be exactly the same, simultaneously at any point in time. Makes it a little bit of a challenge as we have more and more intermittent renewable generation entering the grid.

Storage technology, we believe, holds great promise in helping provide that flexibility, helping to provide that balance of both supply and demand. We also believe that the utility industry will play a really important role in storage. PG&E and California, specifically, are at the forefront through a combination of using tested technologies that we have in place today like pump storage and, at the same time, exploring new technologies like compressed air, batteries, and even mobile storage, the vehicles.

There are, as Commissioner Peterman said, a wide variety of storage technologies and options that are available. And I think that there are different solutions for different issues and for different needs. And I think we need to, kind of, not think of storage as a "one size fits all" option, but something that needs to be tailored to the specific needs and the specific issues that you're trying to address.

In some cases, we're looking for high energy, long durations provided by technologies such as pumped hydro, pumped storage systems. In fact, today, we have about 22,000 megawatts of pumped hydro, pumped storage, throughout the United States. Within PG&E, we've got the Helms storage. Helms is a power plant which is a pumped storage facility that allows us to have 1,200 megawatts available in storage. It's fantastic.

It can go from nothing, sitting still, you know, absolutely not generating at all to full-blown 1,200 megawatts being online in about eight minutes. That's fantastic, and it provides us a great resource to be able to deal with all the intermittency that we're seeing in our system.

Another promising, high-energy, long-disc charge technology is compressed air energy storage. And this -- we're currently conducting a feasibility study for a 300-megawatt facility. We're working with -- had great support from the Department of Energy. It's located near Lodi, California. And we're, right now, looking at permitting and what it will take to actually inject air into these -- actually, it's a former natural gas storage facility.

In some cases, however, as I said, you're not looking for long duration, high power. You're looking for, maybe, a short discharge duration, high- powered, short discharge. And it's in this category that we believe that batteries hold a great deal of promise.

Today, we're testing two such projects. We have a four-megawatt battery project near an office complex in Silicon Valley. And we have a two-megawatt battery facility near an electric substation that is right next door to a solar facility.

We're also working with VIA Motors to develop and deploy mobile storage solutions on electric pickup trucks.

So you got to look at this from lots of different perspectives and look at a lot of different options and not make a bet, but look at -- just making lots of -- taking lots of different bets and seeing what will evolve and what will work for your customers.

So, while all these technologies are exciting, and they hold promise, and we are extremely supportive of them in their development, you know, they are in their nascent stage. And I also think that there's some significant challenges to truly making them commercially viable. So I'd like to spend just a couple of moments on some of what those challenges are.

First and foremost, the biggest challenge I think to storage is economics. We have an obligation, all of us in the utility industry, to do everything we can to keep our rates and the service that we provide to be as affordable as possible. So we've got an obligation to really look at economics and make choices based on the alternatives that are out there.

The second thing that I think is a -- and I think an area in this would be the great work that I think the State of California is doing. I think Government in general can play a pretty significant role in trying to make it more affordable. So you heard from Commissioner Peterman about the mandates that we have in California.

We think this is going to cause a lot of investment, a lot of research, and a lot of activity in the State of California, and we're hopeful that with that activity will come a reduction in prices over time, not unlike what we saw with photovoltaics. That's the hope. And we're very -- obviously, very much hoping that that, in fact, will occur.

Another challenge that we have to deal with, though, is permitting. It takes a really long time to site or permit anything in the State of California and, I'm sure, in the rest of the country as well. I think the Government can help in several ways in this regard by including everything from aligning agency requirements and schedules to also allowing permitting activities to occur on a simultaneous basis instead of sequential.

We really do have to deal with a -- we heard about siting issues and permitting issues on the transmission line side, but I think we could also have some significant issues on the storage, and we've got to anticipate that and deal with it upfront.

I think another challenge that we've got to recognize, particularly for batteries, is the environmental challenges as we start thinking about long-term, the disposal and the management of potentially hazardous materials that are in the chemistry of these batteries. And I think knowing upfront what the rules are will help all of us make informed decisions to help us inform both our risks and our costs.

And, finally, I think we also need increased funding for research and understanding in terms of how to better integrate all of these different resources that we can operate them on a real-time, day-in, day- out basis. And a lot more work needs to be done, and we heard a little bit about them in previous panels that we heard this morning.

So, in short, or I guess in conclusion, I would say there are challenges ahead, no question, in terms of making energy storage viable. However, we believe that the potential benefits for our customers are tremendous. And this is an area really worth spending time and effort and money in exploring. I think that if we work together, Government and industry, to encourage both the growth and the integration of storage technologies into our integrated portfolio products that we provide to our customers, it could only be good. And we're very strong advocates of this.

So, I would just close by saying thank you for the opportunity to giving us, PG&E in particular, an opportunity to tell our story, and I look forward to your questions.

MODERATOR KELLEY: Thank you, Geisha.

Arlen?

MR. ORCHARD: Great, thank you.

Good afternoon, everyone. I want to thank the Department of Energy for the invitation to speak on this panel today.

SMUD is a recognized leader in energy innovation, and we're actively exploring technologies to make wide-scale storage a reality for the transmission and distribution grid. I also appreciate the Department of Energy including the perspectives of community-owned utilities like SMUD and Snohomish and our place to contribute to the development of the Administration's energy policy.

I also want to personally thank the DOE for helping fund our energy storage initiatives, including a -- no, I'm not going to use that; it's too long, okay, couldn't get through it in five minutes -- for helping us fund our energy storage initiatives, including $5 million for preliminary studies for a composed 400-megawatt pump storage project and nearly $5 million for our residential distributed storage projects.

SMUD has developed an integrated generation portfolio that includes renewable energy resources such as hydro, photovoltaic and wind, which meets about 50 percent of our power demand with carbon- neutral resources at this point. The remaining demand is met with utility- owned natural gas-fired generation and power contracts.

As we look to the future and the

additional de-carbonization of our supply, advances in energy storage will play an increasingly important role in reliably serving our customers.

Central to our integrated resource plan is our 688 megawatt Upper American River Hydro Project, which plays in integral role in providing some of the operational flexibility, including the integration renewables; overall system reliability; meeting emissions reduction goals set by our board and the State of California; and providing value to our consumers and our community.

In California, the majority of our future renewing energy resources will be solar and wind, which are both, as you know, intermittent and not dispatchable. As more intermittent resources are added to the grid, additional flexible generation will be needed to smoothly integrate these resources. Currently, the majority of that integration is done with gas-powered generation.

Again, in the trajectory to reduce greenhouse gas emissions, other strategies clearly must evolve. Pumped hydro generation, as you heard, is a proven storage technology that can help bridge this divide. As part of the expansion of our hydro system, we've proposed to construct a 400-megawatt pumped storage project. The Iowa Hill Project will involve the construction of a new, 6,400 acre-foot reservoir and will include three variable-speed turbines.

Value-stream modeling, funded by DOE, other proposed project, has demonstrated that it will provide significant value in terms of ancillary services, resource adequacy, and efficiently regulating and dispatching intermittent resources such as solar and wind.

With the continued expansion of wind and solar resources, we believe that hydro pumped storage can and should play an important role in bridging the gap from intermittent, renewable energy to truly dispatchable energy capacity. I would encourage the DOE to continue to look for opportunities to support the expansion of this valuable storage technology in the future.

To put into context the important role storage may play in the future, California has adopted a 33 percent Renewable Portfolio Standard by 2020 and has targeted an 80 percent carbon reduction below 1990 levels in 2050. Under any conceivable scenario, these goals will require significant expansion of a renewable generation, the bulk of which, as I noted earlier, is expected to be wind and solar.

To better understand the impacts of the expansion of the five largest community-owned and investor of utilities -- PG&E joined us in that -- in California, commissioned to study by E3. The report focused on scenarios with significant increases in solar generation. And it also examined both the 33 percent RPS and impacts of 50 percent RPS. Under the 33 percent RPS, over-generation is increasingly likely. And at 50 percent RPS, over-generation may occur in as many as 23 hours of the -- 23 percent of the hours in the year.

The report found that energy storage, flexible generation, and a locally-controlled demand response are key to mitigating the impacts of over- generation. Smart invertors to curtail and manage over-generation of localized impacts will also be an important tool. And so you're going to hear some common themes about one size doesn't fit all, and there has to be multiple strategies when you're dealing with the intermittency of renewables.

SMUD has also engaged in distributed storage projects to support the expansion of distributed generation, expected increase distributed system loading from EV charging. These projects have demonstrated that there continues to be challenges with the tested technologies in terms of communication and control of the storage systems and higher than expected O&M costs.

From a cost-competitive standpoint, again another common theme, our preliminary analysis of the distributed storage application indicates that installed costs for distributed storage generally need to drop below $400 per kWh before they'll be cost- effective. Commercially available systems are higher than that today. But there are independent forecasts that suggest these storage technologies will reach this threshold within the next five years.

We think that DOE supported distributed storage projects will play an important role in proving the reliability and cost-effectiveness of these emerging technologies. I want to encourage them to continue to support these efforts financially.

Again, I appreciate the opportunity to be on the panel today and look forward to any questions the folks may have.

MODERATOR KELLEY: Thank you.

Steve?

MR. KLEIN: I suspect I'm the last speaker of this long day because it's known that Snohomish PUD is a revolutionary utility, and this way I shock the least amount of people and about -- (laughter) -- about now, your lunch is starting to settle in, but I'm still going to try to keep you on your toes.

Snohomish PUD, the land of the Boeing Company, the largest contiguous building in the world, very thriving manufacturing and technology community. We're in the neighborhood of the 10th to 12th largest consumer-owned utility in the country, a beautiful service territory, north of Seattle towards the Canadian border, Salish Sea to the Cascade Mountain Range.

And, I have a local commission that said, in the value of the typical Northwestern citizen, "We want you to go forward and fill that deficit that we have as a growing utility with conservation and renewables." We have no fossil fuel in our portfolio, and that includes no natural gas. They said, "Go forth and develop renewables, but do not, whatsoever, add any fossil fuel."

So, with that, in less than two years,

we went from zero wind in our portfolio to eight percent of our portfolio is wind. And, at certain times of the year and the day and the month, it can actually be almost up to one-third of our operating resources at that particular time.

But, we're also having -- I say this at ACORE conferences, and so far, nobody has been able to challenge me on this -- we have the most aggressive, local-distributed solar program in the country. So, you start putting all of these things together with programs looking at geothermal, tidal, low-impact hydro, biogas and biomass, we start putting this all together, and of course, with the variability of the resources that we've added, we immediately have an impact.

Other utilities talk about it. Other utilities say it's the holy grail; it's coming; we need it. We're the living use-case today. You sit in our control room and you watch what happens when that wind comes on and within the hour that wind goes away.

So, again, without the ability, as with

most utilities today, they talk about storage, but they go out and add gas peakers in the interim. We didn't have that option. My commission did not give me that option. So going out there, we went to every utility in the country that had any experience with it. We went to all of the National Labs. We went to all of the organizations. We came to the conclusion that we -- as Commissioner Peterman -- we don't need any more pilots.

And the other thing is, is it's clearly expensive, and there are operational problems associated with it that we felt weren't being addressed. You need to drive down the cost, and you need to make them more operable. And how do you do that?

Look at any other type of industry, and I use the personal computer industry. If there was not a non-proprietary operating system, when you went to buy a home budget piece of software, you'd be buying the computer and the printer all based on that person that put that package together.

That's the battery of the storage industry today. They're empties that go buy the batteries, put them in black boxes, put a minimal amount of control logic with them. They don't talk to your Alstom energy management system or your Brown Vary (ph) or whoever else you have that's flying the electric plane, either at the distribution, transmission or structured grid level.

And so that's what we saw. So as we went around in this, people would nod the head and say, "This make a lot of sense. But we're not in the same shoes that you are. We're not burning down yet." So, so far, what we've been trying to pull together is an effort that's called MESA, and you can find it. It has a website, the MESA Alliance.

And what we're trying to do is pull together major players in the industry. We have a number of major battery manufacturers, both U.S. and offshore. We have entities like Parker

Hannifin and major equipment suppliers in the United States. And what we're seeking to do is establish standards around energy storage because if you look at any other product out there today, if it's not gone through the step of standardization and commoditization, the price does not come down.

As long as you're having people throwing batteries each time, a one-off black box, minimal control logic, doesn't talk to anything, how can the utility industry start to purchase these things in mass amounts when from one minute to the next, the next time you need to add some additional to your system, it doesn't mesh with what you've already bought or you have to go through difficulties trying to integrate all this?

There needs to be a non-proprietary, kind of, software operating system that links all of this. There needs to be standards that pull all of this together.

To give you just a few examples because I'm still on the yellow light, today you can go out and buy a community storage box that a well-known industry supplier will do, and you pay $100,000 for it. It's a 25 kilowatt-hour battery, 100-plus thousand dollars. You can buy a Nissan LEAF for 30-some thousand, and you get the car with it.

(Laughter.)

MR. KLEIN: And so, just in closing, again, there's lots we can do in investment and improving the battery chemistries. There's a lot more we can learn in terms of optimizing the placement, the algorithms and all these things associated with getting greater efficiencies and values out of energy storage. But all of these efforts, at all levels that we're talking about here, we need to as an industry and as a nation, drive towards that standardization so it can bring about the commoditization and ultimately lowering the cost of energy storage.

And thank you for the opportunity.

MODERATOR KELLEY: Thank you, Steve.

So, now let's turn to our discussion.

First question to the panel is related to -- is feeding off of some of the comments that I heard about the benefits of storage relative to reliability. I think the first few speakers spoke on that. But, as Arlen and Steve mentioned, there's also a low-carbon impact here. So, in a low-carbon economy, what do you see as the unique role of storage?

And I wonder if we could start here with you, Haresh, specifically.

MR. KAMATH: Right. So this is a really good question.

So I have to remind people, I guess, a lot of times that storage itself is not a low-carbon -- necessarily a low-carbon technology. It does not -- I mean, it's neutral, right? You can use storage, and it can be cycling fossil generation too. So, it's not inherently a renewable technology.

However, it can be used to integrate renewable technologies, and that's in fact one of the reasons why it's come to prominence these days. Historically, if you take a look at the storage systems that have been built, they have been very successful at turning base load power plants into more operative power plants.

For example, as Geisha had mentioned earlier, hydroelectric, a pumped hydro system, can respond very quickly, much more quickly than a conventional power plant. And so it can provide operating benefits to the grid that the conventional power plant can't do.

This is even more the case with renewable systems, of course, because renewable systems are not typically dispatchable. And so you can't really get more energy out of a wind turbine if the wind is not blowing harder. You can't get more solar energy out of the solar panels, if the sun's not shining more, have issues.

So storage is there to smooth that, to firm that energy, firm renewables. And in doing so, it really enhances the reliability and the flexibility of the grid.

So storage is an opportunity. It's a tool by which we can achieve more renewable penetration. It's not renewable in and of itself. But, we, I think we have to consider it as part of the whole package just as we do other assets, as Carla mentioned earlier, things like demand response, things like forecasting and other tools that can help increase the penetration of renewable energy.

MODERATOR KELLEY: Thank you.

Carla, any comments?

MS. PETERMAN: Yes.

And so, in addition to the firming potential of energy storage with renewables, it also helps you not waste renewables. So California is in a position and other states are even further ahead in this, such as Hawaii. We are seeing excess generation, you know, more re- over-generation on the system than we actually need.

And so if we're trying to reach higher levels of renewables, again, where are you going to store that excess energy. And so, the potential to use energy storage to store solar PV power during the day and wind energy at night.

And then, in terms again towards the greenhouse gases, in terms of firming renewables, historically we use natural gas. Well, we're not going to be able to use as much natural gas going forward. So, again, if you can use low-carbon energy as that alternative, there is some benefit.

And I'll just make one additional comment on customer-side storage because there was some comments about that. We've seen a tremendous amount of interest in customer-side storage, particularly paired to solar PV. So within our state, SolarCity and Tesla in particular have partnered up to start selling systems to customers.

And we have a program of self-generation incentive program that provides incentives for customer-side technologies that reduce greenhouse gases. And, over half the projects are either stand- alone storage or storage paired with PV.

So I think we're going to see a lot more adoption of customer-side storage than we might have anticipated when we set our targets.

MODERATOR KELLEY: Thank you.

Geisha?

MS. WILLIAMS: So I would just say, without storage, having to integrate all the renewable resources that we're having to do is going to require increased levels of flexible, ramping type of fossil generation, probably natural gas. And where storage can come in is it could displace some of that, some of it, maybe all of it. But in the short term, we think that there's a possibility for it to displace, at a minimum, some of it. And, of course, that goes to the issue of you're dealing then with less greenhouse gas emitting generation, which is a good thing.

MODERATOR KELLEY: Thank you.

Arlen?

MR. ORCHARD: So, just briefly, I would echo the comments of my colleagues up here.

But, you know, if you think about storage, it's really -- is about shifting the timing of the delivery of energy. And if you look at the over- generation that California is going to be facing, it doesn't necessarily coincide with our peak.

So it allows us to shift that generation which is the renewable clean generation, which is generated off-peak to reduce our on-peak which should assist in reducing greenhouse gas emissions since that tends to be the units that are on the margin and are the dirtiest of the units that we'll use to meet that peak.

So I think from that point, joining those two and time shifting of it will be where we see a big benefit.

MODERATOR KELLEY: Thank you.

Steve?

MR. KLEIN: I think Commissioner Peterman would fit in well in Snohomish County. I'd agreed with everything she said.

MS. PETERMAN: I'll come up.

(Laughter.)

MR. KLEIN: What I was going to say, and I think we are the walking, talking case of avoiding and trying to avoid adding any carbon with storage.

But one other aspect -- it doesn't necessarily speak directly to the low-carbon aspect that other folks have -- but there's also the opportunity when you have particular areas of the distribution or transmission system where you have transmission capacity, very limited period of times is not sufficient.

In order to avoid those additional environmental impacts and all of the costs associated with that storage could also fill that niche too in terms of avoiding adding additional transmission that cause some impacts to the environment, so it has that additional benefit.

MODERATOR KELLEY: Thank you.

So my next question then is back to you, Steve. You mentioned the need for standards around energy storage and your MESA effort. I'm curious, it strikes me as something that possibly the Federal Government could provide some guidance for or at least be involved in some way.

And so my question really broadly for the rest of the group is, are there other aspects like that that might be a good role for the Federal Government relative to energy storage?

And I guess, Steve, I'll turn to you just -- you gave a good example there, but I'll give you a chance to expand on that if you feel the need.

MR. KLEIN: Well, as I said earlier, the MESA Alliance will not be successful if it's just Snohomish and two or three other people. We welcome everybody. We're not even asking for money. We're just asking for people to bring their thoughts and ideas in terms of how we develop this so that ultimately as an industry we can move in a direction so that the utilities can have the confidence that what they're buying is as comforting as when we go to a catalog and we order a transformer or any other part of the system and knowing that it's going to meet the requirements that we need.

The general part of your question is also, what can the Government do? I think the kind of thins they're doing with ARPA-E and the sort of things that ARPA-E is doing with -- it's not just use cases, it's actually looking at more because, you know, use cases, does it work well to integrate resources? Does it work well to deal with oversupply?

But what I like that ARPA-E is doing, it's actually looking in to the optimization of energy storage, so it's eking out the most efficient use of it, not just the use -- the broad issue of use cases, but actually the optimization of -- placement of energy storage.

I also think, as in any of these industries whether it's photovoltaic or not, continue to support the enhancement, improvement of the battery chemistry is definitely an area that needs continued support.

So, in summary, please join us in

support of the MESA, and we're open to as many folks as are interested.

MODERATOR KELLEY: Thank you.

Arlen, did you have --

MR. ORCHARD: Sure. I would just say that DOE has a powerful role as a convener, and they've demonstrated success in any number of areas serving as a convener. Along those standards, I think could play an important role in developing that.

I also have to say that DOE funding of projects is very important from my standpoint. We have planned and have committed to do storage projects, but the benefit of the DOE's funding is it allowed us to shorten that timeframe and do more than we anticipated. So I think DOE funding plays an important role in really kickstarting the development of different storage strategies.

And then the other thing I would say is I would encourage DOE to continue to support, in any number of ways, storage along the entire the value chain from utility scale generation all the way through the end-user technologies because I think, as we've discussed, there's not a one size fits all. It's going to take everything in the value chain to make storage successful and be able to maximize the integration of the intermittent resources.

MODERATOR KELLEY: Thank you.

Geisha, did you have any additional --

MS. WILLIAMS: Well, I would just say storage is -- I think standards is a good idea, obviously. But I think storage is just one component of an integrated, sort of, solutions that are going to be necessary, including smart grid standards as well.

So I think that the issue of standards, not just on storage, but from other parts of the smart grid are -- it's the right thing to do and we've got to figure out, and I think the DOE have an important role in convening. But at the end of the day, I think industry does have to own the standards themselves. So I think that convening by DOE but ownership by the industries are.

MS. PETERMAN: So, I also strongly support standardization work that can be done. And, you know, if we look at the supply chain of energy storage, we see a lot of developers, but there's very few integrators. And so if you're really thinking about also to what extent is the private sector doing at this point, it's not as much as you would expect.

Also, specifically, I want to call out standards around safety because I think this is an area that DOE is already working in, and we continue to benefit from that federal leadership. This is the technology we're trying to deploy in different parts of the system. And if there are safety concerns, that can set back this industry, and so I would make a call for that.

And then the third one I would suggest is particularly focused on pumped hydro storage. And I call that out because our target, for example, does not allow pumped hydro above 50 megawatts. And it's not because we don't see the tremendous value in pumped hydro, it was just that when looking at all these other technologies for storage, we thought that they needed a different type of market transformation, where these other technologies such as batteries and compressed air storage don't have the same level of commercialization.

And when we looked at what are the barriers to pumped hydro storage, they were a little different. You know, cost barrier in the sense that these are big cost projects. There are also projects that may make sense to serve multiple utilities. These were also projects that can face serious siting challenges. And so we thought that our program in itself wasn't going to tackle all those issues.

But there have been some real developments in the technologies with pumped hydro storage. And so that has been an area where DOE has provided funding before. And you may want to look at, where do we need pumped hydro projects in this nation, and then what type of support can you give then into some bigger project buildup?

MODERATOR KELLEY: Thank you, Carla.

MR. KAMATH: Great, thanks.

This is a really important area as far as this. And DOE has actually taken a great leading role in terms of standardization of energy storage.

There's several different areas where we've worked together with DOE. As I mentioned earlier, our Energy Storage Integration Council is something that's gotten a lot of -- brought a lot of stakeholders together, including many of the folks involved in the MESA Alliance.

And one of the things that we've done is worked in several of DOE's National Labs to actually pull together folks from those National Labs and bring their efforts into that organization.

So one of things we wanted to do was things that arise as a part of the Council, any decisions that are made, any products that have come out, we want them actually to be published by DOE. And so we're going to try to incorporate them into the DOE EPRI "Energy Storage Handbook," which is one of the publications that we've worked with DOE on very successfully.

Another area, as Carla mentioned, is the safety aspect. DOE has really stepped up in the last few months and said, We really feel that safety is a very important issue here. And Sandia National Labs, PNNL, several of the other National Labs, have started major efforts in really addressing the safety issue with not just energy storage technologies, but actual energy storage products, which is a big, big step forward.

We've been working very closely with several different agencies, including the Office of Electricity, the energy storage program there, led by Dr. Imre Gyuk has really done some fantastic work in deployment of energy storage under the Recovery Act.

And a lot of the data and information that coming back from those projects is directly feeding the efforts that we're doing to create standardized approaches; I won't say standardized products. We're just trying to define the approaches to specification and to test plans and to functional requirements definition and so on that can be used across the industry.

So without that foundational work that the DOE is performing, all of these aspects of building the industry would be much, much more difficult. So there's no question that DOE is already playing a role in that and, quite frankly, an underappreciated role in the energy storage industry that's developing, and we hope that that's going to continue in the future.

MODERATOR KELLEY: Thank you.

So, once again, we'll wrap it up with just a -- a lot of good suggestions from you all for the role of the Federal Government relative to storage. I'd like you to hone that down to maybe your one topic, one point that you'd like to leave this QER Task Force with.

So, again, we'll start all the way down at the end with Steve.

MR. KLEIN: I guess trying to

incorporate all the good thoughts of others on top of my own.

Continue to be what you've been in the past and that's been attentive and interested in pushing us and challenging us, but also providing the support.

That probably sounds overly general, but I also like the earlier comment that -- from the representative from Pacific Gas, Geisha -- that you need to really involve the utilities because oftentimes what happens is mandates come out. And while certainly utility industry is very talented and we can try to find a way to make whatever we're told to do work, it sure works a lot better if you engage the utility industry in that, in the development of the solutions and the things that really work.

Like I said earlier, oftentimes in our scope of trying to actually move energy storage forward, we ran into problems where a lot of dollars and effort are purely around just pumping out pilot projects and use cases when you have utilities out there that are actually willing to begin to implement it operationally. To me, that's where the microscope and the attention should go. You know, while pilots and use cases can be valuable, to just keep doing the same thing over and over again and producing the same result doesn't help.

You actually have utilities out there that are willing to take that step and actually fully engage in it, integrate it completely into their energy management system and into their transmission distribution system. DOE really needs to take advantage of that opportunity and support it.

MODERATOR KELLEY: Thank you.

Arlen?

MR. ORCHARD: So I guess my suggestion may go a little more tactical. I think it is around the role of DOE as a convener. And I think I can't emphasize the importance of standards. It's not only standards around control technologies and performance standards, but the utility industry is facing a big challenge because of the numerous new technologies we're introducing into our system, whether it's smart technologies or storage.

And part of the challenge is we ultimately remain responsible for the reliability of the grid. And so one of the areas that I think hasn't been mentioned that bears mentioning is the issue of cyber security. There are no standards associated with many of these plug-and-play technologies. And those present specific challenges for utilities as we attempt to make the grid not only robust but also secure.

So I think that's another area where DOE, along with standards, looking at performance and control technologies, should also be thinking strongly about the issue of cyber standards that apply to these plug-and-play technologies.

MODERATOR KELLEY: Thank you, Arlen.

Geisha?

MS. WILLIAMS: It's three words: convene, engage, and invest. The first two, you know what I mean by that. The third, I think we can't overemphasize the incredible role that the Government can play in the research and development, particularly on chemistry and integration. And so that's what I would say are the key things.

MODERATOR KELLEY: Thank you.

Carla?

MS. PETERMAN: I think all of those are the key takeaways. And so I will just add, spend some time out West. Continue to do that. I remember when we put out our targets, I got a call from DOE, someone in the DOE, saying, We want to talk about these targets. And we were like, What? They're watching us in Washington D.C.? You know, you feel like, especially when you're in California, that you're really far away. And it is sometimes hard for us to engage as much as we want, especially as regulators in the national conversation, including limits on travel, right?

So the fact that you had this meeting out West meant that I could participate. When you hold these in D.C., it's very hard for me to get authorization and funding and time to go do that. So please continue to engage with us.

And then also, there's that convening function internationality. So I've spent some time in Germany and Spain this year because those are countries that are facing some of the challenges of renewables integration.

And they're all looking at energy storage in various different ways. I mean, a lot going on with powered gas and hydrogen, for example, in Germany. And so these conversations are starting to happen in other countries. So the extent that DOE can use its existing relationships to get best practices from elsewhere and not only think about standardization nationally but internationally, I think it would yield benefits.

MODERATOR KELLEY: Thank you.

Haresh, other comments?

MR. KAMATH: So, this morning, John Savage had summarized his statement in three words, which was innovate and follow through. And

I think that's really important.

But just to build on that, the follow through part is something that people don't talk about enough.

Innovate, everybody has heard innovate over and over again, and we build our society on that word. But really, everything about that is in the follow through. There's so many activities out there, including storage, that we get about halfway and then somewhere along the way, the funding stops or the effort stops or gets diluted down into something else, and then we don't know really where to go and just for lack of somebody pulling all this stuff together, it doesn't go any further.

We really need somebody out there to be able to pull together everybody on these things, really create something that can bring together a large number of entities, utilities, vendors, as well as other entities like universities and national labs and other folks in the research community to really try to address these problems.

Without that, it's very hard to see how we can succeed with the significant challenges that we have. At the same time, there are huge opportunities in this. And if we can succeed with it, those opportunities can really lead to some amazing things in the future.

MODERATOR KELLEY: Thank you.

So with that, once again a fabulous panel. Thank you so much for your time and your comments.

(Applause.)

MODERATOR KELLEY: Okay. At this point, we're going to turn to the public comments, so we're going to take a moment here to get set up.

(Pause in proceedings.)

MODERATOR KELLEY: So now is your lastl chance. If you haven't signed up to provide comments, please do so. I do have the list of everyone who has signed up so far and I'll be calling you up. We have a microphone here set up on the side. You'll be called in the order in which you signed up for comments.

And again, for those of you who are joining us via live meeting, the streaming, you can provide your comments at qercomments@hq.doe.gov.

So when I do you call you to join us and provide your comments, you have five minutes. We have this colored light. So you get the benefit of our speakers here as well where you get to see these colorful, flashing lights that tell you when your five minutes is up.

(Pause in proceedings.)

MODERATOR KELLEY: Okay. So before we get started, I'd like to welcome additional guests here to the stage. So this is our DOE QER contingent here today, who is very interested in hearing what you have to say. Really, this is quite possibly the most interesting part of the day because we get to hear from all the public.

So today joining me are Levi Tillemann; we have Matt McGovern; Karen Wayland, who you met before; Sallie Gilbert and Blair Nitsway (ph).

So our first public commenter -- and

some of you, I wasn't able to make out whether you were going to comment or not, so if you don't want to comment, just let me know.

Kevin P. Owens? Kevin Owens? You have five minutes.

MR. OWENS: Thank you.

I'd like to thank the Department of Energy and the QER Task Force for the opportunity to address you folks this afternoon.

My name is Kevin Owens. I am the General Manager of Columbia River PUD. We're a distribution utility and a full requirements customer of BPA, serving about 19,000 customers, about 30 miles downriver from Portland here today.

I'm speaking on behalf of the Northwest Public Power Association. Let me provide a little context of who we are. We are a not-for-profit trade association with nearly 150-member people's utility districts, public utility districts, electric cooperatives, municipals and crown corporations in the seven Western United States and Canada. Nearly 50 percent of our member utilities serve less than 10,000 customers. We serve 5.5 million retail customers with 22,000 employees.

The broad regional membership of NWPPA reflects the reality of a single western electricity market that promotes collaborative solutions. Public power is an integral part of the history, culture and economy of the Pacific Northwest. Columbia River PUD and its fellow members at NWPPA believe and live the public power mission to deliver safe, reliable energy at the lowest possible cost to consumers through local control.

I am here today to discuss some of the challenges facing NWPPA member utilities with regard to distribution and transmission. I'd like to suggest areas that the Federal Government can help our members meet those challenges.

As DOE is aware, distribution utilities are currently being challenged with the integration of variable energy resources at the distribution level. Figuratively, the torch has certainly been passed from the wind industry to the solar industry. That's been manifested in the form of distributed generation.

An example is the recent proliferation of community solar projects and individual rooftop solar installations in our service territories. Today, many of these projects are not paying their fair share of the costs of integration. They're using our electric systems as large firming batteries when they are not producing energy.

Those costs are being shifted to customers who are not able, or do not choose, to deploy the rooftop or community solar projects. Firming capacity for a variable resource at the distribution level is a real cost to our distribution utilities and our member utilities at NWPPA. We're concerned about cross- subsidization between different classes of customers.

We also see that we need to be proactive in developing new cost of service and cost recovery models that actually facilitate the interconnection of these variable resources while still recovering the actual costs of that firming capacity. We observed the debate over stranded investment among the IOU's during the move to deregulation during the '90s. We're not interested in going there.

DOE is in a key position to provide better information regarding best practices, guidelines, and lessons learned on a timely basis. It's a new cost shift -- cost of service paradigm shift. We need the Administration to recognize the integration of renewables has costs associated with our T&D systems. It's unfair to expect all of our customers to bear the costs of these -- to bear the burden of these costs.

NWPPA utilities -- member utilities need a seat at the table. We need a represented voice in the agenda, research, and publications of the Administration and DOE's important work in this area.

Distribution issues generally fall under the province of state regulators, in the case of IOU's and local regulators, board of directors, in the case of public power systems.

NWPPA believes the Administration and DOE should include within the QER help for these public power distribution utilities to meet the challenges that the QER envisions, specifically:

o Publish research, white papers and "lessons learned" on a more timelier basis related to these variable energy resource integration issues.

o Coordinate with other federal agencies regarding tax incentives to ensure that incentives do no harm and actually incent the behavior intended, specifically production tax credits versus investment tax credits.

o Streamline the grant processes and partnerships with National Labs.

o Continue to hold competitions, such as the recently announced Microgrid Competition, and make those best practices known and publish the self- guides for distribution utilities.

o Continue research on, and provide

grants for smart grid demonstration projects, many of which include those emerging technologies.

o Ensure that we got regional public power representation in those DOE discussions.

Let me close and just say thank you for the opportunity to address you folks today and provide comment. NWPPA member utilities look forward to working with you on these important issues in the future.

MODERATOR KELLEY: Thank you very much.

MR. OWENS: Thank you.

MS. WAYLAND: If you -- if people who are giving statements have written statements, you can give those to the Court Reporter. And it would make it easier to make sure that your statements actually reflect what you wanted to say in the transcript. And she is right over there at the table here.

MODERATOR KELLEY: So, next up we have Cameron Yourkowski -- if I'm saying that right?

MR. YOURKOWSKI: Yeah.

MODERATOR KELLEY: Cameron? Welcome.

MR. YOURKOWSKI: Thank you, good afternoon. Thank you for the opportunity to comment.

My name's Cameron Yourkowski. I work for Renewable Northwest, formerly Renewable Northwest Project. We're a non-profit advocacy group focused on the Northwest region renewable energy development in the Northwest.

Appreciate you all coming to Portland today to focus in on these issues. I'll be brief. I just wanted to highlight some of the things from my perspective that you've already heard about today, particularly, in thinking about in the Northwest region, again, focusing on climate resiliency, making the grid more prepared for the impacts of climate change, allowing more renewable energy to integrate to that grid.

For the Northwest, specifically, which is not in the same place as California or other parts of the country, the first step from our perspective is really focusing on the grid operational reforms, a 15- minute scheduling energy imbalance, market discussions going on in the region. That's really the low-hanging fruit for improving transmission resiliency to climate change in this region.

So I think you've heard quite a bit about the IM efforts in the Northwest, just wanted to highlight that as the low-hanging fruit for getting prepared for climate change, facilitating renewable energy development in the region.

Where that stands currently, as you're aware, PacifiCorp and the (inaudible) are moving forward with their effort, and then also the Northwest PowerPool effort, more focused on the Northwest alone, a great coalition of public power, private entities working with BPA to facilitate a discussion around Northwest CIM. I just want to highlight in your notes that that effort deserves your full support and attention.

Thank you for the opportunity to comment.

MODERATOR KELLEY: Thank you.

Next, we have Gerald Deaver.

Mr. Deaver?

MR. DEAVER: Thank you. Thank you for the opportunity to speak on behalf of Xcel Energy.

Xcel Energy has transmission assets through its three operating companies in both the Western and Eastern Interconnection. We are, of course, a member of WECC. We're also a member of the Southwest Power Pool and the Midcontinent ISO.

I believe we're the number one investor-owned utility, if not all utilities, in terms of adding wind capacity. And we're one of the leading solar utilities in the country. We've reduced our carbon emissions by about 14 percent since 2005. I think we're on track for our target of 30 percent reduction by 2020.

So transmission, of course, as everyone's discussed today, is a very important issue to all of us. And I just want to touch on a couple of technical issues that the DOE could, we believe, continue to help us on and also a couple planning topics.

The DOE has been very generous and very

helpful in the Western Interconnection in terms of funding and R&D support for tools that will help us improve grid reliability and efficiency. A couple of those that are particularly timely we think.

Peak Reliability and its members, which include us and other stakeholders, are currently trying to develop a situational awareness tool that is referred to as the Enhanced Curtailment Calculator or ECC. The current tool, in line with our industry's fondness for painful acronyms, is called the WebSAS, Web-S-A-S. The current tool is really kind of an antique.

The objective here for the ECC is to try to evaluate how individual contributing flows on any elements of the grid may, in turn, start to contribute to congestion or overload problems. The current tool has many limitations to it. It cannot recognize curtailment priorities. It only changes its database twice annually to reflect the addition or retirement of new or old transmission lines, and it cannot in any way reflect real-time conditions on the grid.

The ECC, as we hope it will achieve, is intended to provide a much more expanded grid topology in real-time. We hope that it will model individual contributions to flow over any grid element that either peak reliability or a transmission owner asks for within about 20 minutes.

We hope that the ECC will be able to calculate flows and possible curtailment needs over -- in between any point of receipt of energy and any point of delivery within the grid. The current tool now can only model over very large zones.

The ECC, finally, in addition to improving situational awareness, we hope will be an important tool as you've heard today, markets -- trading markets and wholesale markets to expand in the West. We hope that the QER, if it identifies or recommends any future funding opportunities, could consider the ECC as a point that it could pay attention to.

A second tool is called now a State Estimating Tool. This tool, as opposed to the ECC, looks at the entire flow, not just contributing parts, and how that impacts various parts of the grid. As the name implies, it's an estimating tool. And we're hoping that in the future, a more actual, real-time tool could be developed that would take advantage of the explosive growth of data that we're all going to have available to us as synchrophasors continue to be installed in the West, again, thanks in large part to the DOE's funding in the past.

Synchrophasor information will expand greatly, the real-time information that'll be available on the condition and topology of every point in the grid. And we think the development of an actual State Estimator Tool would be a way to take advantage of this increased information, which is then an idea that was mentioned in two of the panels this morning.

Finally, on transmission planning, the DOE has been very helpful to the West in the past

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in providing funds to WECC to enhance its ability to do a large interregional planning throughout the West. It's enabled WECC to develop 10- and 20-year plans with improved environmental assessment databases. And we think some additional planning tools that could be useful in the future would be tools that would allow planners to better tie the results of reliability planning with economic planning, again, as markets -- wholesale markets continue to expand in the West.

Transmission, as we all say from time to time, accounts for about 10 percent of the customer bill, but allows transmission owners and utilities to take better advantage of things like renewables and other generation. We'd ask the DOE to continue to consider that in the future as the QER is developed.

Thank you.

MODERATOR KELLEY: Thank you.

Next up we have Fred Heutte. I don't know if I'm saying that right.

MR. HEUTTE: Thanks. I'm Fred Heutte

from Portland, Oregon. I'm with the Northwest Energy Coalition, a Senior Policy Analyst and device to work here.

We were founded in 1981, and we're an alliance of more than 120 organizations around the region of the four Northwest states and British

Columbia, includes: environmental, civic, human service organizations, progressive utilities and others, and businesses.

And our focus is promoting development of renewable energy and energy efficiency, consumer protection, low-income energy and systems, and fish and wildlife restoration on the Columbia and Snake Rivers.

In my role, I focus a lot on transmission and renewable energy and integrated resource planning at the regional level, at the state level with the utility IRP's and so forth, including both Northwest Power and Conservation Council with WECC in the transitional planning process.

I was at one of our meetings this

morning. And we thank the DOE for supporting that process as was previously mentioned. And Larry's involvement directly in that has been very helpful.

And also, I'm involved with regional transmission planning under Order 1000 or soon to be, in terms of Columbia grid, which hasn't yet got an Order 1000 approval, but will be.

And also, I'm a member of WECC's new Member Advisory Committee for Class 4, which is end-users, industrial customers, and groups that represent environmental and other consumer interests in the region. So I have a lot of, you know, involvement in all the topics that are being discussed today.

I thought I'd take a very quick look at some of the bigger picture questions that I think we see. One is that there are really two big drivers happening right now that have been there, but they're really rising in importance. One is on the environmental and policy or, kind of, climate-driven policy as we're seeing with 111(d)

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and many other things. And the other is technology innovation, especially in the area of clean energy, covers across all the different technology areas discussed today.

So to us what the QER is really about is about providing some policy coherence in that context and to provide -- to combine response to those drivers, not treat them as separate, but figure out the best way forward in the context of climate, especially with environmental policy and technology innovation. And to capture and enhance the value of that we see, it's very important to have DOE play a convening and accelerating role in that regard and to provide for a fair distribution of methods and costs.

If you break things down a bit and look at it in detail, traditionally, we've had silos that worked pretty well for policy purposes, transmission, distribution, load-side stuff, but those silos need to come down. And also, now we have storage emerging as a factor across all of those sectors, as we've already heard today.

So on a planning basis, we also need to break down the silos between power and transmission planning. We're seeing some progress in that in this region. The Northwest Power Council and the ColumbiaGrid NTTG and the other playing bodies, are really starting to cooperate a lot more.

This is very, very important because in order to get the new resources we need, we need to have the transmission in the right place and vice versa. And it's very large investments that are involved, and it's difficult but not impossible to get the right answers. But we're, you know, kind of evolving that. So those traditional silos between power and transmission planning, which are very deep, need to bridged.

We also need to look at -- as we discussed a little bit -- the traditional silo between transportation and stationary use of energy so the vehicle electrification being the primary example of that.

And I think what we're really trying to

talk about is co-optimizing the grid, not for a single objective function like minimizing cost or whatever, but rather looking at environmental, social, and operational aspects. So a reliable grid, clean energy, and affordable. All those things have to be in our view going forward and, of course, including things like cyber security as well.

In the Northwest, you know, our focus has always been on renewable energy and energy efficiency considered together, as a combination approach to dealing with our energy needs. But I think we're all beginning to learn we've got to start paying attention to other aspects, the reliability aspects of the grid in particular, and some of the new technology aspects, the smart grid, you know, the grid-edge kind of concept. Where the action is moving is not where we've been traditionally. And I think we are also reevaluating our view of those things and hope to think about how --

MODERATOR KELLEY: Three minutes, sir.

MR. HEUTTE: Yes -- and hope to think about how our traditional focus can be even further extended in the future. So I think that's probably a good place to wrap up. Thank you.

MODERATOR KELLEY: Thank you.

The next speaker has a question mark next to her name, so I'll just announce a name: Ann Fisher.

Did you want to make a comment? Ann Fisher?

MS. FISHER: Well, as I said to one of the folks standing in line when we were eating lunch, you always get people who want to make a comment because they've heard everyone else. And I really don't have a comment to make except, of course, to thank DOE for coming out because this is important.

But it occurs to me that what Commissioner Peterman said about coming out here and engaging us with -- in the Northwest or in the West Coast, is truly important. We have a lot of enthusiastic and really heartwarming stories about supporting renewables and what we can do with storage and all these things that can happen.

But it's still kind of a blossoming idea here. There are people who are afraid of it, people who think it's unknown. And honest to God, I don't care who tells you otherwise, we do things differently out here.

Don't take a FERC term and think that's how we use it here. We're our own vernacular. And so if you were to come out more often and engage more often, I think you would have greater support, a better understanding of where we need help in the West Coast and a much more successful endeavor. That's all.

MODERATOR KELLEY: Thank you.

Next is Kelly Tilford.

MR. TILFORD: Good afternoon. My name is Kelly Tilford. I'm actually the Vice Chair for the National Hydropower Association's Pumped Storage Development Council. I've heard of nirvana in Portland, but this is my first experience. After seeing the storage panel and some of the issues that were brought to light and some of the solutions and challenges, I all of a sudden felt like I fit right in.

I want to thank the Department of Energy for a number of initiatives, including the Hydro Vision Initiative that is currently being implemented as well as the Hydrovision and Pumped Storage Development Task Force, the Modular Pumped Storage Task Force. I'm actually thinking of volunteering on both of those. I really enjoy the data and analysis that comes out of the National Labs supported by DOE.

The challenges to pumped storage development and grid-scale storage since pumped storage is really the only grid-scale proven storage technology, the DOE studies provide a lot of credibility to our industry. And the issues for our industry are, the credibility is the first thing, then the regulatory side, the support legislation that values the resource that pumped storage can bring to the grid. And then that leads right into the financial side.

And so everybody who is either an investor- owned utility, a muni, or an IPP, Independent Power Producer, understands that cycle. So the DOE's efforts to better analyze and present unbiased data on the benefits and drawbacks of pumped storage are much appreciated.

I didn't plan to give a talk. I was just going to listen, but I got so excited, I had to come up to the microphone.

AB 2514, the storage -- CPC's implementation of AB 2514 is a good start. When we talk about storage, we're really talking about two different types of storage, and I think some of the speakers mentioned the differences. One is short-term, instantaneous response type storage. And then, the other one is long-duration, high megawatt-hour type storage.

And so there's almost two different conversations here. There are megawatts of storage, and then there are megawatt hours of storage. And I just wanted to make that distinction.

You know, I don't want to beat the issues to death because the speaker panels did a great job of identifying what the real challenges and the values to pumped storage. I guess I want to encourage DOE to continue to fund research in grid-scale energy storage. I'd like to see Argonne's modeling evaluation of the pumped storage to the grid. I'd like to see that continued, taken to the next step.

I like the idea of grid-scale models that are available to vendors and to utilities to use to do some simulation on their own. And I guess I'll just wrap up with thank you very much.

MODERATOR KELLEY: Thank you.

Next, we have Roger Wood (sic).

MR. WEED: Weed.

MODERATOR KELLEY: I'm sorry?

MR. WEED: Thank you very much. My name is Rogers Weed, W-e-e-d, and I'm with a company called 1Energy Systems. We are a Seattle-based startup that provides utilities with software that helps them control and optimize energy storage assets.

So the main thing I wanted to do is kind of reinforce Steve Klein's comments about the importance of standardization to reducing costs, increasing choices for utilities as they wade into this area and simplifying the inner-operability of energy storage with other grid assets and systems.

A number of us at 1Energy are veterans of the PC industry. And I think we got that right away when we talked to Steve because we saw how USB, Bluetooth, WiFi, web standards, all allowed this kind of maturity and scaling of new technologies and allowed the industry to move forward. So I think we see very much how this is so important for energy storage.

MESA, again, is the name of the sort of effort that we have going on now to define standards for information models and communication protocols that can allow energy storage assets to talk to other parts of the grid. And you can find out more information about that at MESA, M-E-S-A, standards.org. So that's the website where you can go to get more information.

And I do think there is role for DOE and other government entities in both encouraging, but I'll counter Steve a little and say and financially supporting, you know, in a seed sort of fashion these standardization efforts because there's often a "chicken and the egg" thing where, you know, the -- especially the larger companies don't really want to engage right away because they're happy to sell their proprietary things until they are more or less forced by customers to adopt standards.

And so, you know, we've seen this in California with something called OpenADR, which was standards for demand response. And the early support from the Government in California really allowed that standards and effort to gain traction and become very important to how demand response is evolving.

So we're talking in California now about whether the EPIC Program could also identify storage standards as an important thing to

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support. And I think that makes a lot of sense for all Government entities to think about.

So I guess I would encourage DOE and other Government entities, as well as utilities, by the way, to get involved and encourage the efforts on behalf of the industry.

I think the industry has to drive the standardization efforts. It's their products and services that are going to need to comply with these standards, but encouragement and strategic financial support from the Government can really make a difference.

So I just want to make that point. Thanks.

MODERATOR KELLEY: Thank you.

So did we get any additional?

Did anyone else have any comments that didn't get on the list? No?

Okay. This concludes the public commentary portion of our meeting today. So with that, I'll turn to Karen.

MS. WAYLAND: Thank you.

And thank you to everybody for your comments and your participation. I want to let you know that the -- all of these stakeholder meetings that we're holding around the country will be documented and become part of the public record. Every meeting that that we've had so far, you can find a transcript, a briefing memo that asks key questions, video if we were able to arrange for the video, meeting summaries, as well as all of the statements and presentations given by the panelists.

And your statements, if you were part of the public comment, the open mic period, will become part of the transcript that will also be posted on the web for all of these meetings. These meetings and the input that we're getting will be essential to our analyses and recommendations.

We expect that the first installment of the QER dealing with transmission, storage, and distribution will be finalized by the end of January 2015, and we will begin at some point around there working on the second installment which will focus on generation, end-use, and production.

And the third installment, which will be around 2016, will look at probably supply chain issues. And we'll likely do an integrative report at the end of that sort of three-and-a-half to four years.

I want to thank very much Lewis & Clark for this wonderful facility and for the sun that we got today, which I know isn't normal. So I'm going to take it as a sign that the sun is shining on us.

I want to thank the DOE staff, in particular Larry Mansueti, as many of you know, is a force of nature in the electricity world; and the rising stars around me, Levi Tillemann, Matt McGovern, and Sallie Gilbert; as well as our home staff back in Washington D.C.; and the Energetics Team, who's been fabulous. Thank you very much for Chris and the team.

And with that, I'd like to again thank

you very much. I know that many of you traveled long distances. And we, by federal law, are not allowed to provide coffee and tea, unfortunately. I know the Deputy Secretary was asking me for coffee. But we want to thank you because we know that this -- that you took a lot of time to share your views and input, and we appreciate it. Thank you very much.

MODERATOR KELLEY: Thank you.

The meeting is adjourned.

(Whereupon, the meeting was concluded at 2:33 p.m.)

CERTIFICATE OF TRANSCRIPTION

I, VALORI WEBER, hereby certify that I am the Court Reporter who reported the following proceeding and that I have typed the transcript of this proceeding using the Court Reporter's notes and recordings. The foregoing/attached transcript is a true, correct, and complete transcription of said proceeding.

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July 28, 2014 VALORI WEBER
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