Quadrennial Energy Review

Second Installment

Electricity: Generation to End Use
Stakeholder Meeting #5

May 9, 2016

Austin, TX

University of Texas
Peter O' Donnell, Jr. Applied Computational Engineering and Sciences Building
Avaya Auditorium
201 E. 24th Street
Austin Texas

DISCLAIMER

Due to technical difficulties with the sound system during the Austin meeting, several portions of the discussion were inaudible resulting in gaps in the transcripts. Written statements submitted for the Austin meeting are available on the QER stakeholder page at: http://energy.gov/epsa/downloads/qer-second-installment-public-meeting-austin-texas

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Opening Remarks

>> CHRIS KELLEY: Good morning, everyone, we'd like to welcome you to the Public Meeting for the second installment of Quadrennial Energy Review those of you here in Austin, welcome to the beautiful campus. Those of you who are joining us by the live stream. My name is Chris Kelley. I am a consultant with the Department of Energy and I have the distinct honor of being the facilitator for today's meeting, we'll be hearing from a number of speakers today, but before we get started, I'd like to refer to a few housekeeping duties. QER Task Force welcomes comments from the public. Please sign up. Second, for those who are joining via live stream on the web, please submit your comments via the web. We have an outstanding set of speakers here today. Their comments and presentations can also be found at that same website.

I'd like to read a short statement about the purpose of this meeting, pursuant to the Federal Advisory Committee Act, the purpose of this meeting has asked for your individual input and your organization's input regarding electricity from generation to end use 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, individual advice, information or facts regarding this topic. The object of this session is not to have a position or consensus, rather the U.S. Department of Energy is seeking as many recommendations as possible. Please welcome Melanie Kenderdine the Director of Office of Energy Policy and Systems Analysis at the U.S. Department of Energy.

(Applause.)

>> MELANIE KENDERDINE: Thank you. I was here just a few months ago.

(Noise on the microphone.)

For water issues and we had spent a fair amount of time here working with Scott. We put together a consortium on the natural gas by R&D. And that's no joke.

Our first speaker today is Daniel Jaffe. He's the Vice-President for Research at the University of Texas. He received his PhD from Harvard. He is a Fellow at the University of Chicago and assistant scientist at UC Berkeley.

(Applause.)

>> DANIEL JAFFE: Thank you, Melanie.
I want first of all to recognize Secretary Moniz, and the panel members. Quadrennial Energy Review meetings allow us to collaborate with the Department of Energy with future policy of

research and develop. The panel today is electrical energy production is part of this process. To hold a meeting like this in Austin is fitting. There are deep connections.

UT has active projects.

UT has 54 active collaborations.
The State of Texas is a leader and innovate to about distribution of energy.

Windy day last year wind generations by 40% electrical power use in the state. Today the system distributes power for half the state's needs. Not only in reproduction and distribution, it makes it possible to produce the energy efficiently.

Research over many decades.

>> Daniel Jaffe: The DOE and industry paves the way to better lead our future to meet the energy needs of society. Welcome to UT at Austin.

(Applause.)

>> MELANIE KENDERDINE: I am honored to have Steve Adler the Mayor of Austin, Texas here. I understand he might have had a few problems getting to the panel this morning. How did you arrive, sir?
That's the -- that's what it's like being the Mayor.

Steve Adler looks to do good things for quality of life for everyone in Austin. I wish him very well. This is one of my favorite cities.

Mayor Adler, along with his brother were first in their family to graduate from college. I think that's spectacular. My father was the first to graduate from college. He practiced Civil Rights law for many years and later found successful eminent domain law practice representing landowners. He served two years of chief of staff and General Counsel for Texas State Senator working on school grants equity access issues. Let's give a big welcome.

(Applause.)

>> STEVE ADLER: Good morning. And I have the privilege of welcoming everyone. (off-mic.)

Innovative, we are trying to (off-mic.) Subjects like this, many politicians. And also to be -- to the Secretary and USDA Deputy Undersecretary. Welcome to Austin. To Mr. Jaffe, it's nice to have you here, and I can't imagine anyplace to have this other than Austin, Texas. Here at Austin the way we get electricity is not just about power. In this community it is about our love for the environment. It's about our drive for information. And in this community.
This city was a very early adopter. Wind and solar is a strong component of our energy portfolio. Right now we're 28% of our portfolio. We authorized the purchase last year of about

425 megawatts of solar. That more than doubled the solar portfolio in the entire State of Texas.

(Inaudible).

Well on our way. In fact, (inaudible) 55% by the year 2025.
It's important to note that we did that because the rest of solar was (inaudible) in it.
The city signed (inaudible) 2015.

(Inaudible) under national treaties, but when it comes to climate change (inaudible) half of the carbon load, the rest of the load is going to be addressed (inaudible) decisions (inaudible). Because of what happened to climate change is going to be happening city by city and utility bayou stilt and transit system by transit system.

(Inaudible) 0 carbon footprint by 2050. Carbon-free municipal operations by 2020.
We are involved on the Secretary of Transportation challenge which has a large component of that electrification (inaudible). And we're excited and working in that regard.

(Inaudible)

So in closing let me just add (inaudible).

Austin (inaudible). We have been for the last five years. We produced more middle-class -- per capita than any city does in the country. We have just been named by Forbes as the best city in the country for small businesses. We have more patents.

We have more patents, is this better?

We have more patents and start-ups than anywhere else in the State of Texas.

And it is safe to say that Austin's leadership on removal of energy has not come at a price to our economic well-being.

In fact, we believe that it has enhanced it.

Welcome to Austin, Texas.

(Applause.)

>> MELANIE KENDERDINE: Next we have Deputy Undersecretary for Rural Development Lillian Salerno, appointed by the President. I can tell you that as we look at electricity issues and -- in the office that I run, we are doing the analysis on the QER. We spend a lot of time discussing rural electricity needs. Primarily because they have generally a small customer base, and any changes that we need to make are relatively more expensive. So we spent a lot of time looking

at these. And how can we make the changes affordable to rural electric systems and Co-Ops, et cetera, et cetera.

As the Deputy Undersecretary she oversees the development and strategies of policy initiatives. She is a former entrepreneur. She grew up in rural Texas, I grew up in rural New Mexico. We probably fought for some of the same camping places.

The -- they're all in New Mexico.

But where her manufacturing business continues to 35 and support the local economy, deputy undersecretary Salerno went to UT Austin. Got a BA in Latin American studies, a Master's in sociology from the University of North Texas and a PhD from SMU. So let's welcome Lillian Salerno.

(Applause.)

>> LILLIAN SALERNO: Good morning. I'm so happy to be here. I was here many, many years ago where I studied only liberal arts so I never got to this campus, but my brother did and he's a graduate of the University of Texas engineering school.

In my role at the Department of Agriculture we deal with that land mass approximately 80% of the land mass in this country which represents about 40% of the population. And so we are very happy that Secretary Moniz invited the Department of Agriculture, because we think it's real important to have that other prism that's outside of San Francisco, Austin and New York talking about energy. So we're real happy to be here. So, thank you, Secretary Moniz, and I just wanted to give a shout out to the Department of Energy and Secretary Moniz because of the tireless dedication to energy security in the 21st Century, as the leader on behalf of President Obama's climate action plan to reduce greenhouse gas emissions by 25% by 2025. Under Secretary Moniz's leadership it's really unheralded and 0 he the other secretaries that those of you, well, Austin is (inaudible) some of us who grew up here don't realize what the secretaries have to do to make it work. And if you look at what Secretary Moniz and my secretary does to try to unleash innovation, it's really unprecedented. So they deserve most respect as Americans.

I'm the Deputy Undersecretary of rural develop the at the Department of Agriculture and we look over the land mass, land stewardship to ensure we capitalize on any and all opportunities to create energy opportunities.

And in this role we look upon opportunity (inaudible).

Specifically we have the opportunity to lay out strategy (inaudible) enterprise and they established the (inaudible). And the depths of the Great Depression there were Executive Orders signed. And it didn't take long to get and it didn't take them long to get to work. And in 1937 the rural electric administration note handled the most spectacular increase of rural

electrification in the history of the United States. And for the first time in history thousands of rural communities had the hopes of security electricity.

Their history of 80 years is important when we're talking about the future.
$120 billion of total investments, $446 billion in loans. More than 40% of the U.S. electric infrastructure. 600 current borrowers, $6 billion in financing every year.

The USDA -- the rural electrics occupy an agency called the rural utilities service in the USDA family. And that -- the -- of that group is still so important for the building of our infrastructure. Each year urban households in the U.S. combined use more than three times the total energy that America's rural households do. Yet the Energy Information Administration estimates that rural families spend about $400 per year in energy bills compared to the typical urban household.

That's why meetings like this are so important, because sometimes we look at through our prism of big city, all of us do that, about investment and innovation and opportunities. And sometimes those rest in only 2 or 3 regions of the country, which is awesome that one of them is Austin, Texas, which I hope to come back to some day in my career.

Except the country doesn't work out that well if the rural space is not connected, nor self-sustaining.

And maybe it will work out when the robots get smarter but for right now, the folks who decide where your taxes are being spent have placed a piece of our national energy portfolio in the hands of agriculture.

Those programs include a bio-based marketing program, a repowering assistance program, rural energy for America programs, and a bunch of programs under section nine. Title nine of the farm Bill.

The most important thing that we do know with serving the rural part of this country is that because we have those farmers out there and those conservation folks they bring to us some real-time information about what we can do to make sure we protect the environment and make sure that we're ready for the climate change that we're sure to feel.

And so I leave you with the idea that what we need your help, what we know for sure as a presidential appointee what I know after being a private-sector tools person is that we certainly can't do it alone. We need the community. We need the shared focus from the rural and urban sectors to make sure that we get the kind of results we need to protect the future generation. Thank you.

(Applause.)

>> MELANIE KENDERDINE: Finally, let me introduce Dr. Ernest Moniz, he is the 13th Secretary of Energy. We think that that's the lucky Secretary of Energy, and he's actually the fourth secretary that I have worked for. I think everyone would agree he has been an outstanding Secretary of Energy.

And his work at DOE as he's tasked with implementing critical DoE missions in support of President Obama's goals of growing the economy and enhancing security and protecting the environment. This encompasses advancing the President's "all of the above energy strategy," maintaining the nuclear deterrent, reducing the nuclear danger, promoting American leadership in science, clean energy technology and innovation, cleaning up the legacy of the Cold War and strengthening management performance. DOE is a very complicated organization. You can tell by the missions that I just read.

Prior to his appointment as Secretary of Energy by President Obama, Dr. Moniz was Cecil and Ida Green Professor of Physics and Engineering Systems at the Massachusetts Institute of Technology (MIT). He had been on faculty there since 1973 at MIT, where I worked with him. We worked as -- he was the Director of the MIT energy initiative. I was the executive director. We started the MIT energy initiative up there, and just left to come down to Washington when -- when Secretary Moniz became secretary.
From 1997 to January, 2001, Dr. Moniz was the under-Secretary of Energy. I was with him there, as well. That was the last time the department had a single undersecretary.

They now have three undersecretaries. And so he was quite busy when he was there before as well.

He served on a number of boards and commissions, and importantly from the perspective of this meeting here today, when he was at MIT he was on the President's Council of Advisors on Science and Technology. That PCAST recommended that the Department of Energy, the Federal Government actually do a QER review. We worked on, DOE, several quote unquote comprehensive energy policies, thought that we needed to step up that game a little bit and enhance the recommendation on doing a wad rev.

And so let me just state, Dr. Moniz received a Bachelor of Science from Boston College, a doctorate in theoretical physics from Stanford and has honorary degrees from the University of Athens, University of Nuremberg, Michigan State University and University (inaudible). And I know I mutilated that. Anyway, Secretary Moniz.

(Applause.)

>> ERNEST MONIZ: (Inaudible) okay. It is a pleasure to be back here in Austin. I think this is at least my third trip as secretary, but as my friend Dale Klein reminded me, who is also here I think my last public appearance before being nominated for this job. And he claims causality, but I'm not quite so sure. But a lot of friends here. Actually Melanie mentioned how PCAST, the President's council recommended the quadrennial energy review that we are here to

discuss today, and I just say that the Vice-Chair of that is Bill Press here from UT Austin. So, Bill, Dale, Michael Webber here, the only one of the three who's still doing honest work I might add in terms of -- in terms of research and education, but it is fun to be back here in a school that can be the second best engineering program in the United States (laughing).

So pleasure to be with you, Dan Jaffe.

>> DANIEL JAFFE: We have to fix that.

>> ERNEST MONIZ: We have to fix that. Right. But really want to thank Mayor Adler. Austin is such a dynamic and innovative place, including in our space, the energy space. I won't go through all of it hearing.

Here at UT Austin, it was mentioned that we have a tremendous number of programs and I want to mention Austin, itself. The Austin utility has been a tremendously innovative. And for example, our largest sun shot program in the integration of (inaudible) storage is right here in Austin works with it and this is not the first time but the kind of up innovation shown here is really -- really very important for the whole country and certainly for our programs.
I also want to thank the Deputy Secretary of agriculture.

This is emblematic of another feature, it's that the Department of Energy, you know, for obvious reasons would be called the Department of Energy has a lead role in Melanie's office, in particular, in terms of doing core of the analysis, for example, that underpins the Quadrennial Energy Review but the point is it is a whole government effort because equities in energy extend across so many agencies in the government and the Department of Agriculture is clearly one of those. Biomass is multiple uses an obvious example of that.

But if you think about it obviously Interior, EPA, Department of Defense, Department of State, Department of Commerce, we could go on and on and on in terms of the roles in the energy space across the government.

So that is another feature of the Quadrennial Energy Review, integrating the equities and the wads across government.

So with that, let me say a bit -- make a few points that I think are important for this meeting. And then leave some time for discussion of this panel before we move on to the three panels discussing various aspects of the electricity system.

One, I want to emphasize review put forward with a novel approach to formulating government energy policy, has established a strong track-record. And I'll say why I think that's important for this meeting.

Specifically, the first installment which was published just over a year ago focused on energy infrastructure across-the-board.

Wires, pipes, inland waterways, you name it, all the infrastructures of relevance to moving energy transmission, storage, distribution was -- was included.

We'll come back to some of the specifics, but what I want to emphasize is that the approach of having highly analytically grounded recommendations wherever whole of government was anticipated to provide a foundation for much better bye partisan, bicameral energy policy making.

That report had 63 recommendations. 14 of them have already gone into law through the transportation Bill, the highway Bill, and the bye-partisan budget act in December.
Secondly, the -- for example, the Senate Energy Bill that has passed the Senate has many more recommendations in it, specifically tied to the Quadrennial Energy Review. So I think first of all the thesis has been borne out that this kind of analytical whole of government approach really does have a shall we say an adult dialogue going on in terms of energy policy.

It's also been very effective in dealing with states, for example, state energy offices.
Now, why is that important here?

That first installment the QER had an important grounding in a whole set of regional meetings, to get answers on the many energy questions we faced. In that case the energy infrastructure. And regional answers are quite different innocent country. We have a whole variety of approaches to, let's say, reaching a clean energy future, because different regions have different resources, different issues need different capabilities, different search capabilities. Different institutions.

I want to tie that together. These regional meetings including this one today on the second installment of QER really have impact 0 and a process that has really had impact. So I want to urge a vigorous discussion here. Make your views known today, make them known in the days that follow. We are open to continuing input on this. But what I can promise you is this has impact. I believe our second installment will have impact as did the first one.

Secondly, another aspect of the first QER, and it will again extend to this, is North American energy integration.

Indeed, by the way, we have coming up in June a North American Leaders' Summit that is Canada, U.S., and Mexico. Obviously, Texas, bordering on Mexico, has a strong role to play in that as well. The whole integration. And certainly with Mexico's energy reform going on, historic energy reforms, that is going to have -- open up major possibilities.

Now, there's always been the link up in terms of natural gas.

But interestingly, when we started -- when we revived in the same time period as the first Quadrennial Energy Review energy ministers meeting from the three countries, the excitement

expressed by our Mexican colleagues centered mostly around electricity and the much greater potentials that are going to be opened up with the -- with the energy reform in Mexico and with commitment of the United States and Canada with Mexico to look at much more energy integration.

That's another very important feature. And that will be featured again, therefore, in this second installment.

The third thing I just want to mention even though it's not directly relevant to the subject today, but I mentioned how a number of the recommendations in the first review have found themselves into law. I'll just mention one of substantial financial consequence, is that we were authorized, following the QER recommendations, for $2 billion to pursue modernization of the strategic petroleum. I saw the need for that modernization. But also a new point that with the dramatically changed energy scene in this country including things like reverse pipeline flows in the Texas region, we need to have a new approach to marine distribution. So that's all part of this and once again, guess what, Texas happens to be involved in this. I know Houston claims to be the energy capital of the world but we think Texas has a broader impact here.

So anyway, I just wanted to really emphasize those points to lay the foundation for this meeting and the second installment. What is that? I think you know from the documentation, but when we looked at the infrastructure it's clear that electricity system is in many ways the infrastructure of infrastructures, in the sense that just about all the other infrastructures and not only energy infrastructures, communications infrastructures, for example, rely on electricity. No electricity, no other infrastructures.

In fact, as an observation, when -- which was a painful case on the groundless reason when Hurricane Sandy, you know, took out power for a long time, they say the New Jersey region, lo and behold, there was plenty of fuel around. You couldn't pump it out till the electricity got restored.

So electricity is key.

So our second installment, and why we are here today is the electricity system end-to-end. Supply and in fact, the first panel was on bulk power, and transmission.
The mix of supply following my earlier theme will look very different in different parts of the country.

Here, for example, among other things, you all know that Texas has the largest windy employment, for example. I might add, I was in Iowa over the weekend. I submit that Melanie forgot to add Iowa State to the list as of Saturday. Change that website.

The -- but -- and Iowa by the way is number two in windy employment, number one in fracture of wind, 30% already and with an announcement made last week of a big new project they expect to be at 40% wind in the state within about three years. It's really quite remarkable.

Just one example of major resource and how, again, it's clearly -- clearly quite -- quite regional, since in the Southeast we have today 0 wind farms, for example, because very, very different resource. There is one now under construction.

So anyway, so this is the discussion.

I would like in particular to emphasize the innovation theme, another character risk here in Texas, everything from this campus, the UT Austin, to as I've already mentioned the practices here in Austin with the electricity system. But I do want to emphasize is that as you think about innovation's role in answering today's questions, a reminder that there are multiple dimensions of innovation that we need to pursue. One is certainly technology innovation. In terms of the technologies for the grid, serious integration, for example, of sensors in information technology. We need to go beyond scratching the surface, and into developing the kinds of technology deployment. We need a systems, systems innovation, we need policy and regulatory innovation.

Now, (inaudible) is always a modeler's dream because of its isolation. As we look here certainly in more of the country there are serious issues of policy and regulatory innovation that we need. For sure the regulatory structures that we have inherited in the last eight years do not recognize the physical world of technology, deployment and knowledge abilities today. How do we manage that, for example.

So policy innovation.

And third, business model innovation is critical.

Certainly the utility sector, again, I refer back to Austin. Austin power, but the -- as we go to the new realities, and we're going to be touching on them today, from the issue of long distance transmissions in other parts of the country causing (inaudible), for example as we go to distributed generation, as we go to a world in which demand growth is not what it used to be. Maybe demand reduction. Those are fundamental challenges to traditional business models. How are we going to open new services? Are we going to have utilities? Having a much broader set of prerogatives for their business model. Or not.

These are all very, very fundamental questions, which then are tied to market structures. They are tried to the valuation of services.

For example, we've talked about, again, I'm just going to repeat using Austin, we talked about this project we have here, multi-billion dollar project the DOE is working with Austin Utility on for integration storage. How do you integrate storage into the value proposition for rate payers? Not to mention other issues, diversity of fuels, energy security, power quality and you can go on and on and on. So we've got a lot of big challenges, we're going to do a lot of innovation, we do that innovation in multiple dimensions and that's part of what we would like to start drawing from our regional meetings.

Let me end on that innovation theme.

This may not be directly in terms of the agenda today but I think it's combined. It's specifically linked to the technology innovation agenda.

In Paris in December we had a very, very important first big step on the way to a very low carbon future. I emphasis big step when you have essentially every country in the world committing to lower carbon, but I also emphasize first step.

What were then called INDCs are now called NDCs since we passed the extended. Commitments made are substantial, they are ambitious in a 2025 to 2030 context, but the world isn't going to end in 2030. The need for more and more ambition in meeting a low carbon -- the low carbon requirements that we need, let's say, to stay the two degrees are or less of global warming to use the globally accepted metric. That means continuously increasing the ambitious for years and decades ahead.

We posit that all those innovation agendas I mentioned earlier are part of the requirement, but in particular, technology innovation, Department of Energy, we have special responsibilities there. So I happen to focus on that, not to mention my own background, but in the first day of the Paris meeting was the announcement by the leadership of 20 countries, including President Obama, and frankly the U.S. was not unusually kind of at the head of the train, announced mission innovation with a capital M and a capital I where these 20 countries commit to seeking a doubling of energy R&D over the next five years.

We are dramatically underinvested. This has been stated now for years, including by the major leading CEOs of this country. I don't mean leading CEOs of energy companies, leading CEOs of this country has been emphasizing this. We are now committing there.

In parallel with another coalition led by Bill Gates of international investors prepared and eager to take advantage of the increased innovation pipeline by investing with a combination of patience, risk tolerance and willingness to scale up the capital investments when these technologies are ready to move you know across various valleys of death and the like.
So this is a very, very important -- important direction. It will be across-the-board. But this technology to power opportunities will be critical.

I'll just give one example in closing. Just because it's related to the Mayor's challenges. If we think about kind of an example of what could be a major technology business model (inaudible) of electricity going way back to the Mayor's challenge, here is an example where the technology has surprised us and gone way ahead of the policy kinds of discussions.
Urban systems, are, apologize to the Deputy Secretary, but getting back to urban systems, and the idea of dramatically increasing electrification, potentially including autonomous vehicles. No fingerprints needed.

(Laughter.)

>> ERNEST MONIZ: Just cybersecurity. But any way, that's just a slightly humorous, except to the Mayor, perhaps.

The example.

And we're going to see a lot of that in the system.

So anyway, that's a set of observations which is why we are first of all excited about this meeting but also commenting on it and other regional meetings to really influence in a profound way our electricity end-to-end set of policy recommendations that we want to make towards the end of this year.

So thank you very much. And hopefully there's time for a few questions.

(Applause.)

>> CHRIS KELLEY: Thank you, Mr. Secretary, so as the secretary mentioned we do have time for a few questions for our panel. Any questions from the audience here today? Yes, sir.

>> THE PARTICIPANT: (Inaudible).

Okay, this works? So -- so, question, if it wasn't heard is will the QER have legs analogous to the quadrennial defense review which is a long established process?

>> ERNEST MONIZ: Well, in our internal discussions about -- as we approach the end of this administration, we've got another eight months, 8 plus months or so to go, we have, not surprising, a number of areas that we think have worked pretty well.
And so we discuss how we can institutionalize those in a certain sense, or have them go onto next administrations.

QER is certainly among them. But what I want to emphasize, our view is, and our approach is that the best way to institutionalize something is to show value.

And there's never any guarantee, especially when this is the first go-round of this, but if you look at the timing, first of all, we have already seen one round as I emphasized, where the results have been material. There is no ambiguity about this. I mean, in the Senate, for example, the Chair, obviously a Republican, the ranking member, they have both publicly discussed the QER as having been a motivator of legislation. And by the way, several comments have been made by the leadership in the House Committee.

The second installment on electricity, as I've already said, we expect to have the same.
The quadrennial cycle will be to the end of 2017.

In other words, in the first year of the new administration there will be the opportunity to take three years of substantial analysis that has had material impact and bring that together in terms of a more complete energy strategy.

That seems to me like a pretty enticing opportunity, but, you know, but we have to see. But all we can do is demonstrate value.

>> CHRIS KELLEY: Any other questions?

>> THE PARTICIPANT: My question is about -- it's pretty broad and general but as local energy supplied like in Austin, I had -- our power went out in the recent storm twice in three days. Spectacular transformer lightning strikes, and so my question is does the Department of Energy look at some sort of long-term plan for where our mature infrastructure is more protected, perhaps underground?

>> ERNEST MONIZ: Maybe the Mayor should give that answer.

>> Going underground is one of the things that you could do. It's expensive. And -- and -- but it is obviously one of the solutions. So we focus on resilience, we're also focusing on security issues, both cyber and physical attacks. And so we're doing a whole range of analyses, and that will be one of the final focus areas, security, resiliency, et cetera, et cetera, with a technology component to it obviously. It's technologies you're talking about.

>> ERNEST MONIZ: Let me add a few things, as Melanie said the resilience theme is a critical one and just to give examples, you know, again, one example that is not relevant to Austin but is relevant in parts of Texas, when I was down in Florida few months ago, Florida Power and Light, there's a place where the combined effects of say, rising sea level, normal waters and severe storms is very much present. So not surprisingly, they are one of the utilities that's kind of out there.

So what they do, what you see them doing already is a combination of hardening infrastructure. Some of it is pretty straightforward, like, you know, going away from wooden polls, but every time they do that, they are at the same time taking advantage of the incorporation of smart. So they're doing tough and smart.

So introducing information technology, dynamic metering, all kinds of issues. So I think it's a -- I think that's a very wise approach in terms of the integration of new capabilities while hardening the infrastructure.

There will be analogs in other parts of the country where the risks are different. Could be draught, could be wildfires, there's all kinds of -- all kinds of issues.

Second dimension, because you mentioned transformers, for example, in -- in the first QER, one example of a recommendation was to move forward towards a -- some form of national strategic transformer reserve.

Now, the large investor-owned utilities are, themselves, moving forward you know in this domain, just I guess I should probably say, I think most people know this, but if a big transformer goes out, you got a problem. These are not easily replaced or ordered and show up by UPS the next -- two days later. That ain't going to happen.

So, the big guys can do that, but let's go to our rural colleagues, the Co-Ops, et cetera. It ain't easy to think about having these transformers in reserve.

So -- so that's something that we're still working on.

The Congress in this case did not authorize -- are implementing but did require that we do a large integrated study of something like that. So that's the kind of thing that is not resilience but is response. And it's resilience in the sense of recovering from a problem much more rapidly than we can today.

>> CHRIS KELLEY: Other questions for our distinguished panel?

>> PARTICIPANT: Hi. (Inaudible). Energy efficiency is implemented by utilities but also renewable portfolio standards and metering and all these things happen at a state level. So you talked about regulatory innovation, what's the Federal role when this happens state by state and even municipality by municipality in cases, how does the Federal Department of Energy work with states and localities to get regulatory innovation.

>> MELANIE KENDERDINE: We have an extremely active engagement with the state regulators and the state energy offices. So that is constantly ongoing. We have a contact with the three state organizations to vet a lot of these issues through them.

One thing I would say, I think the Secretary mentioned it earlier, from an efficiency wad, valuing efficiency, valuing distributed generation, valuing base load, valuing security, those are a whole set of analyses we are going through right now. And I suspect although I don't know that we won't get much further than frameworks, and -- and the key components of how you might value electricity, because we do respect the state role in establishing what goes into a rate. But we are looking at a lot of those issues, and the big change is on the distribution end. And there are very, very fuzzy lines between transmission at this point in time. And the Supreme Court case was about that, and so that's a major area of change. Ultimately how we deal with it remains to be seen, but we are in direct contract -- contact with the states on a very frequent basis.

We have a jurisdictions baseline that we just got a draft of, we're putting out there. We have a markets baseline that we're working on. And so these are tough issues, and we'll deal with them to the degree that we can.

>> ERNEST MONIZ: Again, let me just add a couple comments. One is that first of all if I take a step back and think in terms of had a global warming climate drivers I would just say flat out I have never seen a credible solution, credible scenario that does not include a major demand-side response.

That, in turn, then leads, I won't -- not to repeat but that in turn leads to the whole model business issue and that's apparently your business. So that's absolutely critical.
And again, were he do this multiple ways. I'll just mention one other way which is not regulatory but can influence how things are done eventually, is that the department has responsibility for setting efficiency standards for appliances and equipment, electric motors and heating and cooling systems, and microwave standby power and all kinds of things. And we have picked up the pace dramatically. Last year we issued 13 final efficiency rules. We expect to do that again.

When you look at -- you know, each one may sound like not much microwave standby power would be an example of you say, okay, all right. But when you cumulatively put them together, the efficiency rules for appliances and equipment that we will have put out just in the Obama Administration, I'm projecting to the end of the administration, and then you look at the cumulative impact to 2030, it is north of a half a trillion dollars of energy consumer savings. And if -- roughly three giga tons of CO_2 avoidance.

So these are big deals.

And again that wraps back into the issue that we're going to need some different business models to deal with a very, very different demand equation.

>> CHRIS KELLEY: So I think we have time for one last question.

>> PARTICIPANT: Good morning, I'd like to back up just a second to the idea of the grid is the strategic resource. Can you speak to any coordination between DOE and DOD as to the -- when you mentioned hardening or upgrades to that, the actual physical security of the grid and how the organizations might be coordinating.

>> ERNEST MONIZ: I'll just answer that briefly.

A, the principal joint activity -- there is some joint activity in terms of bringing, for example, large-scale renewables to supply fixed assets, military bases and the like, for example. Just had a major effort with the Navy in providing solar to -- to the Naval base in San Diego.
But the other thing is, I've lost count now, but I think it's at least 30 microgrid systems for -- for bases that our labs have worked with DOD in terms of the design of these microgrid systems,

and what's interesting is, okay, for example, Sandia Laboratory has done much work on that, and that work, having been done for military bases came at the right time I already mentioned Sandy. During Sandy a critical corridor, a north, south corridor went out because the grid went out. Well, this is a public safety issue.

So now that microgrid experience was brought with the state in a cost-share way to design a large microgrid, the macro-microgrid, 50 megawatts of distributed integration but one that will in any future such event if the grids go down around it that corridor can keep operating and certainly enhance public safety and a quick recovery. So it's with the military, but it's a shared -- shared kind of technical experience.

>> CHRIS KELLEY: So please join me in thanking our distinguished panel. (Applause.) So at this point we're going to transition into our next panel. So if you are scheduled to speak, please join me up here. And during the transition time I'd just like to remind those of you here in the audience if you'd like to provide public comments at the end you can do so. You just need to sign up at the front of the room where you entered, and again, for those who are joining via live web streaming please commit your comments to the website. We'll start in a moment. Thanks.

(Break.)

Panel 1

Bulk Power Generation and Transmission: How Can We Plan, Build, and Operate the Appropriate Amount for Future Needs?

>> CHRIS KELLEY: Okay, so we're going to get started here in a few moments. If we could have folks take their seats.

(Pause.)

>> CHRIS KELLEY: So hopefully now we've worked out all the audio difficulties with the AV team and were going to move right on to the experts here.

So, we're going to get started here with our first panel today. Panel number one is focused on United States bulk power generation and transmission. How can we plan, build and operate the appropriate amount for future needs. So I'm very pleased to introduce our first panelist here up on stage with me. We have Cheryl Mele, Senior Vice-President and Chief Operating Officer for ERCOT. Cris Eugster, Vice President for CPS Energy. Mark Schwirtz, President and Chief Executive Officer for Golden Spread Electric Cooperative. Franklin Maduzia or Frank, Associate Commercial Director for Energy with Dow Chemical Company and we have Dr. Michael Webber, Deputy Director of the Energy Institute, Co-director of the Clean Energy Incubator, Josey Centennial Fellow in Energy Resources and Professor of Mechanical Engineering at University of Texas Austin.

With the panelists up here, we will get started and have you each present for 5 to 7 minutes, we have some colored lights here to show you when your time's up. The red light will go off in two minutes, and if I have to get the hook out, I'm sure I won't, again, you have the clicker here, we'll go right through the list and have everybody present. It will come back to me, then I'll have an opportunity to ask questions, are you ready to go.

>> CHERYL MELE: Thank you, good morning, pleasure to be here. I have some slides right there. So not wasting any time. As everybody who's in the room hopefully knows where we are, and it is about 90% of Texas grid.

The other interesting thing about it is already been hinted at by the Secretary as well is we're not really connected to the other grids, we have some DC tie to say Eastern and western and Mexico but largely we're in the grid that operators here. And so what is ERCOT responsible for? For the scheduling and dispatch of power. We manage the wholesale energy market here in the state. And I would say that we have unique little twist there as well in that we're an energy only market. So there's no capacity in our market. We just pay people to produce energy and we are looking node by node all day long to see who has the best offers to provide us and as

the transmission operators looking up the flow of energy across the region as well we're also taking into consideration are there any constraints, is there any reliability issues that we need to be aware of. So all day long in our control center we're looking at what are the lowest prices that are going to get the consumers good, competitive prices today and can we deliver that low price energy while still maintaining reliability. The important pieces of our operation.

And then the last important function we actually perform for this market is that we manage the switching of retail customers between their reps, so we need to know where a customer is to make sure that when we bill that energy we get that energy allocated to the right location in terms of the rep.

So other things, what about challenges, we started hear a lot about those this morning. I don't think we're going to have too much disagreement as to what the challenges are as we all look forward. You know, significant challenge is adapted to this changing resource mix. Whether that's generation resources, demand sponsor distributed, distribution level resources, things are changing, compared to what it was. So we're trying to stay on top of that as best we can. Another step that we're trying to take, a little step at being proactive as to how those things can be value in there our marketplace in the future. And at least staying on top of what's going on among the groups that are using the tools that work down on the distribution level. Certainly they're having an impact on wholesale markets and potentially could have an impact on some of the ways that we do planning in the future. So that's an important thing for us to stay on top of. And we continue to analyze the impacts of environmental regulations, we don't know where things are going to end up but we certainly want to be aware of what could happen. We mentioned last week that that's one of the points of uncertainty is what is going to happen with environmental regulations.

And I think the other important thing that we are taking a look at is cybersecurity challenges in our industry. We heard a little bit about that, as well.

So changing resource mix, right up there with lots of change, right? No surprise. The Secretary already touched on that wind that's here in Texas, it's a splendid resource. Continues to grow. Here are some statistics to show you a little bit about the type of growth that we're seeing in that wind sector.

The peak penetration that we've accomplished thus far has been 14,023 megawatts and 48% at the time that that occurred and that was earlier this year, back in March.

What's next on the agenda, solar.

Solar is going to be coming in and growing here in the market as well.

We've seen a lot of projects get announced, and we're going to see some of those large projects probably come out online at the end of this year probably toward the end of 2016.

Integrating and managing. The forecast of what the resource and the future of the forecast of solar is going to be extremely important as the grid operator to get better and better at. So you can see from this slide we have continued to get better in that forecasting but there still is plenty of opportunity to improve that.

The other thing that we need to keep in mind is our resource of change is how do we make sure that we've got the right amount of reliability reserves. The ancillary services that support the grid, an important thing to be thinking about as we moved away from having about 50% of the energy coming from large steam generating type facilities to a lot of (inaudible) and cycles, the ancillary services might need to change. There are opportunity to say make sure that we are properly valuing the services that different types of generators and technologies can bring to the market. So we're going to continue looking at that as well.

Demand response, I already mentioned. That is another area of growth in the Texas market. We're seeing the ability of customers to respond to help us manage the grid and make sure we have reliability and that they're price-sensitive and we'd like to see more of that. Distributed generation, growing, how will we look at that and grow in the future, and finally customers, I think there is a lot about that. Customers play a large role in how we manage the grid going forward. More so in the future.

>> CHRIS KELLEY: Thank you. Cris.

>> CRIS EUGSTER: First of all, thank you for the DOE and the University of Texas to invite us to be part of this discussion. Quick introduction to CPS Energy, we are the largest municipal electric and gas utility in the country with our AA+ credit rate we offer best in class for reliability. Really (inaudible) in transforming the utility business model to one of greener energy and new technologies that enhance services to our customers. We are the third largest generator in the State of Texas. Our generation portfolio is one of the most diversified in the state, includes natural gas, nuclear, coal, solar, wind, landfill gas, energy response efficiency, and what's interesting is, you know, 5, 6 years ago 80% of the power was coal and nuclear and now we've got much more diverse background. So it is possible to kind of (inaudible) mix for a short period of time.

We have over a thousand megawatts of wind. West Texas wind, south Texas as well as Gulf Coast wind.

We are a leader -- the number one solar utility in the State of Texas with 250 megawatts in the ground. 80% of all of the solar that has been deployed in Texas has been ours. We will have 500 megawatts by the end of this year with rounding up our portfolio.

We also have 771-megawatt energy efficiency demand response program which is the equivalent of not having to build a power plant. So very diverse portfolio. But one of the things we're especially proud of with our Vision 2020 we have a goal of 65% of low and non-emitting resources. And part of that strategy is the early retirement of two large coal plants in 2018.

15 years ahead of schedule. And that is -- you know, that along with our renewables really is taking over a billion cars off the road from an emissions standpoint. We're very proud of that and we were able to do that (inaudible) in the country. I would say Texas is very well positioned to be a leader here. Like Cheryl said, Texas electricity market is ideal for innovation. Strong day on the markets to transact power in the most efficient and economical manner. I think Cheryl said we have over 16,000 megawatts with wind. Solar coming down the pike. There are middays 24,000 megawatts were being supplied by renewables so it is getting to be a big, big player in Texas, the shale and Texas is all about natural gas (inaudible) in the state and I think it can be a beacon for the rest of the country.

We at CPS are really trying to push the envelope in terms of transitioning to a clean energy utility for the future. We're integrating renewables and demand response with our traditional resources.

Some of our coal plants running a mid-load for many, many hours of the year because there's enough wind on the grid. And it only ramps up if the wind dies off, is overcast unexpectedly. We are seeing the whole concept of the power plant is a thing of the past. All the plants have to be dynamic. All the plants have to engage with the market so that they can integrate with one another and really provide, you know, a cleaner set of resources to the customers.
So we are significant -- investing significant capital, kind of you know in the delivery side of the business to marry the demand response, energy efficiency with our legacy with the renewables to create and integrate a platform.

As you know that's the cornerstone of the future.

I would say that that brings up a series of challenges, you know, if you're cycling a coal plant that's not easy, it's going to take a different maintenance philosophy. It's going to take a different capital investment in those assets.

And so while there's a great story you have to figure out how to continue to integrate and fund some of the legacy assets as they continue (inaudible).

And so with 12 seconds left, I'd just like to close -- it was 13 seconds, you know, we are -- Texas is a great place. You have Austin and CPS Energy and the rest of the State that are really coming up with some really great ideas on this particular subject. Thank you.

>> CHRIS KELLEY: Thank you. Mark.

>> MARK SCHWIRTZ: If it's okay I'll move over here.

Good morning, everybody, my name is Mark Schwirtz I'm the CEO of Golden Spread Eclectic Cooperative. We appreciate that they brought in the Undersecretary of rural areas today. That was good to get that kind of representation. You've heard a lot about innovation, most of it seems to be only in Austin, that's not necessarily true. We also do some things in the rural

areas as well. So I'm going to talk about some of that innovation and integration of renewables, I think Cheryl talked about some of the renewables that's happening in Texas, and we think it's important to understand how the best way to integrate that is.

And I want to show you our service area. Gold Spread represents 16 cooperative members and we go from the Oklahoma to south of San Angelo, each one of those different colors are different members and the icons are our plants. We serve electric meters and 24% of Texas even though it's mostly cows and wind farms as you'll see in a minute. So this is our area, geography is very important to us, if you look at the dark color there is Gold Spread service territory, those are our plants, we have wind up near Amarillo, we have over 900 megawatts of natural gas outside of Lubbock, and just north of there we are building new plant going commercial now, some new technology called the Antelope Energy Elk Center. And that blue line right there hooks us to the market. So most of those assets are in that Southwest power pool but we also recently hooked into the market so we will have over 750 megawatts that goes into either market and can support some of the renewables that are in our area in both of those markets. You can see the yellow and the red transmission lines, that's both the SPP and the other and they are intertwined.

There's a picture of the wind, over 14,000 megawatts of wind out there. Each bubble represents, 175 to and there are the little ones and like I said, 14,000 megawatts and if you look over on the left, I think Cheryl talked about this, there's more coming, especially in solar, we're starting to see solar develop mainly out there and the reason for that, west Texas, the wind blows a lot and the sun shines a lot and it's in a perfect place and there are no trees, so the only trees we have right now are basically wind turbines going up everywhere out there.
As a balancing act for the markets for the Southwest power pool, to be able to balance the demand for the energy and the resources that are available to serve it we think there's good ways to do that. So first we all know that it's intermittent. Sun doesn't shine at night. Wind doesn't blow all the time. Balancing authorities must ensure a reliable and efficient market. We have to monitor and balance supply with demand and maintain power quality or answer ancillary items in the market.

We happen to have a few of those at our Antelope Elk Energy Center. Show you here in a second. We put in a simple cyclic gas turbine, that one can start within seven minutes, in ten minutes it can be 70% of the full load. 190-megawatt simple cycle gas turbine and there are sister units to that. Within 11 minutes they're at a full load. We also have reciprocating engines, 168 megawatts of them at that location, they can start and be at full load in five minutes. And I think these are the kind of products that are needed for the markets.

Another picture of that.

So to accommodate these variable Energy Resources the wholesale market should ensure efficient price in both the ancillary markets. To ensure the investments that the quick starts are in and put more of them out there as the wind and resources start to grow. Storage and batteries you have to insert to that to get into the marketplace as well as demand response.

There should be a product out there that will consent that it is there to support when the wind doesn't blow or sun doesn't shine. There are several investigations on this, we are participating in all of them, I've included an appendix in my talk here. What we think are the goals of an efficient market -- proper price and energy in ancillary markets, adopt a shortage and scarcity pricing model. They go up to $9,000 megawatt hours and let the market provide the price signals so that they are there. What we are concerned and here is the first state of goals of price formation, I think you've seen some of those out there, maximum market benefit for consumers and suppliers provide correct incentives, market transparencies and ensure suppliers receive cost recovery. We are a supplier. We spirit the first position so that the market prices should reflect the shortages and actually the price is increased when the shortages occur, (inaudible) and fine-tuned ancillary products, regulation of down spin and spin reserve and consider many (inaudible) products. One of the things that happens is we get (inaudible) when they have a need and they call ahead of the need for the demand. What happens is it expresses market prices. So it actually works against it and you don't get proper pricing for some of those products that you deliver. You start to run your assets more and more and more. You have more maintenance costs and not getting recovery.

And we should -- believe that resources should be able to recover all those costs if they are supporting the integration of those resources, thank you.

>> CHRIS KELLEY: Thank you, Mark. Let's turn right to Frank. Frank, and you can slide your mic close to you.

>> FRANKLIN MADUZIA: All right, I'm Frank Maduzia, I'm Associate Commercial Director for Dow. I appreciate that we are a consumer and generator. Most of the folks that you have been talking to or listening to are that. We represent both side of things. As far as Dow Chemical in Texas we are a very large user of power and supplier of power. Our Freeport site is where most people think about us, we're the largest complex there. But we employ over 7,000 employees in Texas, and that's over $850 billion of payroll alone. So we're a big user of Texas.

How big? All right. Our demand side is over 1,300 megawatts right now. We generate a thousand megawatts. You think about it from BI E data that's bigger than some states' residential load. Look at Alaska for a month. We manage a lot of power in Texas. And we're just one industrial. There's a lot of industrials in Texas. Texas probably has some of the largest of any state. It is different to manage industrials.

So what are we talking about? We're here to talk about transmission and generation planning. This is a picture of just a transmission line to generation in Texas. It is a very complex system. All right? And unfortunately most of the renewables over on the left-hand side down in the south, you can see the low pockets, Dallas, Austin, San Antonio, and Houston. Moving all that generation of renewables into the low pockets is what we are here to talk about but we've been working on it since 2002. This is not something to be solved in a one-hour discussion, this is a very complex steel and it takes a lot of planning to make it work.

All right. For transmission, industrial needs really dependable clean power. We've been talking about these units. What they don't take into account is the noise it puts on the transmission system. I'm not talking about noise, I'm talking about frequency deviation, (inaudible), resonance, (inaudible), you name it. Where that might dim the lights at your house that trips a chemical plant and if it does we can be down for a month trying to restart things. It hurts our bottom line. There's been some chemical plants that went down and the CEO had to tell the investors why the system went down. And it impacts their stock price. A simple little dimming of your lights could be a major impact on a chemical plant and a refinery. We have a lot of those.

And integrating renewables is nice, but that does cause problems with the type of electricity we're getting. This is where we need to look at that side of the equation, not just when we get it in there.

Transmission planning. We need to have a better super impact task. What I mean by this is consumers end up having to pay for this, right now transmission is almost as expensive as energy in Texas. You're paying $27, $28 for energy, some places we're paying $19, $20 just for the wires.

Consumer impact means we do a study and say, all right. It takes X amount to put in the new line compared to the congestion. Which one is a better plan? So we need to improve the planning process.

On the generation side, I look at it on two things, behind the fence generation, we have talked about that a lot. But behind the fence generation is basically industrials building generation plants. And we use it for steam first. So we operate it for steam first. But there's a lot of barriers now going into place, there's a tax on PE RP A which gave us a lot of abilities to supply power to the grid. There are also criteria that we have to follow that does not make sense for an industrial, it causes us to trip the machine if we try to change operations as they asked us to do so. We need help on removing some of the barriers to give us incentives again for industrials to build generation.

On the planning side, provide regulatory market stability. You've heard that earlier. Every time you start talking about changes, changes to (inaudible), renewables, ETA. Everybody stops building and planning. As soon as those barriers are removed or the discussion resolved, things come in and all of a sudden they start building again. So you need some type of stability versus changing just for the sake of change in the marketplace.

So what are our asks for DOE. Well, I can't read all of them in the seven seconds left. But the key is to really support behind the fence generation. Try to work more with the other agencies. In system generation planning, again, look at planning criteria and see if we can't get more renewables in the right place but it really is the wire side map. It's moving all the generation to the loads and how do you do that with its being clean. Here I think it's more R&D type investments, looking at ways to improve the type of power we receive.

And I told Christopher I would limit the acronyms. You can't do that when you're talking about CIP and Federal Regulations, you know, DOE, DHS, EIA, you name it, I couldn't put them all on one page. We have to deal with all of those, and that was causing a lot of difficulty just getting things down nowadays. There are a number of different organizations we have to deal with. Thank you.

>> CHRIS KELLEY: Thank you, Franklin. Michael.

>> MICHAEL WEBBER: Great, thank you so much to be on the panel, and before we go into Q&A. I'm pleased to have the Secretary of his team here. As you heard from Cheryl and others we have taken a leadership position but in gas and wind and design and policy innovation, it's great. There are a couple reasons why wind and solar do so well in Texas, we're unique. We've got a lot of choppy, flat, sunny, windy land. It's a lot easier to build things on the land when it's cheap to buy and there aren't things in your way and it makes it easier to harness the resource. It makes sense that we would be leaders in these areas. We have assets in infrastructure. A lot of natural gas capacity, makes it easier when solar is not available. That's the difference between us and other areas, Great Plains states where they don't have natural gas back-up it might be harder for them. We get a market design with marginal prices and that's really compatible with resources at the low prices. We have the infrastructure and transition line. We have a "if you build it they will come" philosophy and that's turned out to be true for infrastructure. I think that's really good for us. Another good piece for Texas for integrating more is we have the growing demand for electricity. And I think that's a non-trivial point. The secretary mentioned earlier that demand for electricity is flat. It would have dropped if not for three things. The growth of data centers which are non-trivial growing part of electricity consumption. The growth in electric vehicles and now with the washing the car and growth of marijuana operation. So it turns out that farming of certain crops can consume a couple billion dollars worth of electricity. A lot of utilities are happy about that are now pushing for decriminalization in other states which as a non-obvious partner I wouldn't have guessed utilities and marijuana growers would be hand-in-hand on that one, that's causing demand nationwide. It is growing in Texas because of population and economic growth. It's easier to build something that you like, because you have to build something any way. You don't have to shut down other stuff. Growing demand is important.

Wind and solar are appealing in Texas despite the challenges of availability there are very lean in terms of the water need. I'll talk about water for a second. The power sector is very thirsty, needs a lot of water for cooling, about 75% of our power sector uses the steam cycle and that uses water to cool the power plants. That's very good for efficiency and performance if they are in an area with water scarcity. That's been a challenge here and in the world. If you need water for your power plants it can force you to turn off power plant and de-rate it. The water can be too hot, too cold, a budgeted for scarce. Goldilocks water, where it's the right temperature and quantity. If you have a drought you might not have the water for cooling, if the water is too hot you might have pollution laws, if it's too cold it can trip power plants offline like in 2011. Heat in France caused it in France. You can be too hot or too cold. Floods are a

problem. They almost had to turn off because of floods in Nebraska. We have the problem with water especially in a state where we expect water scarcity might become the new normal. There are options, natural gas. Wind and solar even less water intensive. Things like dry air cooling not as efficient, more expensive but it's more resilient. You can get fundamental science to come up with better things that improve cooling systems and power plants. And think about our grid as a vehicle for moving water around. We can re-dispatch power to serve more areas in the state. Texas has plenty of water in the Eastern part of the State. We can think about that for siting and using it as an aid. That's something to keep in mind. It's a big issue in California and the west where they use water for hydropower. We have opportunity to say think about new technologies, fuels, approaches to using the power sector with water to create better resiliency. And Texas has taken a leadership role on that, which is great. I'll stop there. I've got 34 seconds left. I'll donate to anyone else.

>> CHRIS KELLEY: Excellent. Well, I really appreciate everyone sticking to their time. So thanks very much. So we'll go right to the questions here, and make the most of our time. So I was taking notes as I was hearing you chat. And a couple points that I thought were interesting, first, I guess, Cris, and I'll open this up to everybody, but, Cris, you mentioned significant coal plant reductions that have occurred recently. But the same time also mentioned that coal is a back stop. So my question and this is to everyone, if Cris, you have first right of refusal, but do you foresee a future where this base load generation makes the charge we go to a point where we don't see coal generation anymore, is that possible?

>> CRIS EUGSTER: I think that sort-of is possible. (Inaudible). Can you hear me? So I think 40% of Texas was coal here and a couple years ago. That is declining now. You know, does it make sense to, you know, mine coal in Wyoming and put it on rail and rail it down here when we have an abundance of natural gas and shale, and abundance of solar, wind. So you know, coal came on to the scene in Texas when there was natural gas price spikes that happened in the late '70s, and I think unless you believe that the shale phenomena is temporary, which we don't have that. We see studies out there that say that there's plenty of shale and prices will stay, you know, low, and not volatile over many decades or at least another decade out there, I think it makes it really hard to kind of justify coal in Texas.

Now, for us, shutting down the coal units what you do we put scrubbers on them, invest $500 million into those units or redirect that capital to natural gas or renewables and we chose the latter. 3 or 4 years ago that was a tough call. Natural gas prices were about double where they are today, now it kind of looks like a no-brainer. I don't see any new coal getting built in Texas. I think legacy assets have been that those assets have been made and I think there's a role for them to play in terms of firming up some of the intermittent power that's happening with the wind in Texas.

>> CHRIS KELLEY: Thank you. Anyone else care to comment? Michael?

>> MICHAEL WEBBER: I think coal is tricky for a variety of reasons, mainly around emissions but I think it has a role in the future to think about what coal does for us that other things don't

do. Electricity can be difficult and expensive to store, and I'm a fan of electricity storage. We can think about other ways to store energy, piles are pretty cheap. With natural gas in California where it might be harder to restore than we thought, it can float away. Coal cannot float away is better from a liability view. So I'd say that a lot of people are calling for coal to go to zero. But if we can get it to be clean and lean without the water emissions and the domestic liability really offer some value. When you think about technology for scrubbing and that kind of thing that means 1970s coal probably doesn't have a role. It will be some future function of coal. But the fact that it's relatively easy to store we should keep in mind given the challenges with other generation sources.

>> CHRIS KELLEY: Thank you. Other comments, Cheryl?

>> CHERYL MELE: (Inaudible) resources that had to survive to the future so we can get that same reliability (inaudible).

(Inaudible) that is solar, gas and probably doesn't have the same liability characteristics with the present technology and investments in storage and things like that, that we have and having some of the coal and nuclear plants providing (inaudible) storage if you will in their field supply. It's going to be an interesting conversation to really understand as we move forward and I think we're going to have some good discussions around that. But I agree with Cris that you probably won't see coal plants built in Texas, at least not with the current technologies.

>> PANELIST: I would add that the economics of large-scale resources combined with products that we have with our resources and the markets, is really as economic as any coal unit. We call it time (inaudible).

>> CHRIS KELLEY: Thank you. Yes, sir? Passing? Okay.

So, let me turn to another question, since we're -- since we're here with you, Mark.

Some of the other panels across the country have mentioned so-called seams issues, so you mentioned ties to your territory. My question is more broadly to all the panelists though. Do you see these issues and can you maybe discuss the potential seams issues that are present in this region?

>> MARK SCHWIRTZ: Well, obviously we're unique in where we sit with the power pool and ERCOT, we think there valuable to the market and for members that we serve. We've -- the 2 RTOs had to get together and come up with rules on how we would do that. For our members and the people that do the markets, the rules are how they get treated in an emergency. Otherwise they serve both those markets any way they can to support whatever the conditions are at that time. Obviously economics will drive some of our decisions on where it goes but each market then has the ability to recall that. So I think we've solved at least the seams issues for now with respect to the two markets that we operate.

>> CHRIS KELLEY: Great. Anyone else?

>> FRANKLIN MADUZIA: We don't have them, and also (inaudible). There are issues there (inaudible). It is something that needs to be addressed on how to move power between these areas more efficiently. Because we have seen where there's been (inaudible). We don't have that issue.

>> CHRIS KELLEY: Great. Thank you. So, Franklin, since we're with you, let me address another question to you, and again we're opening it up to others, let's talk about security for a minute. So you mentioned SIP as a prime example of a TLA or a three letter acronym that the government's using right now.

So let's talk about cyber and physical security for a moment. Are you seeing challenges there or can you discuss any challenges that might be present in maintaining security as more and more technology comes online?

>> MARK SCHWIRTZ: There are two issues, one is a chemical plant. We're under DHS control, too, we have cybersecurity. That was for (inaudible) plant. And then we have the SIP standards under (inaudible). And those are now applied (inaudible). So we are audited under both parties. And both parties won't allow us to share the information with the other party. So we have to have multiple type reports just to satisfy all the agencies. And the more you integrate all these power plants the more likely it is that you're going to have a problem.

You know, the best firewall is a physical firewall. You cut the line. We're doing more and more to integrate everything together, and then if there is a issue it's going to ripple through the whole system.

As a chemical plant we can't have that type of risk. So we try to put as much physical firewalls between us. Wherever we can, but then they will come in and say we have to allow our machines to be operated the same. So we're constantly going back and forth with all these different agencies, trying to somehow find a (inaudible).

>> CHRIS KELLEY: Thank you. Other comments on physical or cybersecurity challenges? Cheryl.

>> CHERYL MELE: Sure. I mentioned that (inaudible) very important in our sector. Continually trying to manage that risk. And certainly, as mentioned earlier I think that there are a lot of devices in the grid. There's a lot more information we can harvest from those devices to help manage the grid better. And so having awareness of what it's going to take in terms of managing that risk going forward is really important as we start to integrate those devices back. Having good perimeter boundaries and being up-to-date and many of the things that SIP asked us to do are baseline and often times we need to go in beyond that to make sure that we maintain the cybersecurity of our systems.

>> CHRIS KELLEY: Michael.

>> MICHAEL WEBBER: I'm with Austin Energy. It was celebrated a few times today for its excellence. Cheryl was one of the executives. And (inaudible), and I was their regulator. I think between the three of us we can take credit for all this excellence. Even though (inaudible). I was there for five years as a commissioner from 2008 to '13. We brought up the question of cybersecurity. You can say all the executives say, no, we don't want to talk about this, it's difficult to talk about it. I'll talk about it now since they can't. So the -- if you, a as a utility want to talk about it and the seriousness of the risks create a panic and a news story that gets out of control and doesn't ever end. It's difficult to talk about it because people will talk about it if you talk about the number of attacks that occur in the United States in the grid. If you say we have it under control, no problem, you brag about it too much, you find all sorts of attacks as well. It's a difficult conversation to have in public about how to manage the need to protect the public from the risks and assure people that things are going to work while also not over cleaning and bragging and inviting more attention that you want from bad actors. It's a conversation -- I don't think we sorted it out to have the right conversation in the public.

>> CRIS EUGSTER: (Inaudible) a person has a place at the table. The executive leadership team. But one of the challenges and this may need some feedback from the DOE is the integration with the various services, whether it be the FBI, Department of Homeland Security. Having those relationships and having it be seamless is really, really important to me. We'll have -- you know, (inaudible) by our power plants (inaudible) with the FAA, drones, you know, there's just a lot of things, and seamless information with all the different agencies is key there.

>> CHRIS KELLEY: Thank you. Other comments.

>> PANELIST: We take it very seriously.

>> CHRIS KELLEY: Good to hear. Thank you –

>> PANELIST: We have it under control.

>> PANELIST: We don't have much choice.

>> CHRIS KELLEY: Excellent. So I'd like to turn to a theme I heard this morning from our first speakers, and even touched on a bit from y'all in your opening comments. And that's the theme of innovation.

So the Mayor cited rightfully Austin's role as an innovator, the Secretary talked about mission innovations, doubling investment in R&D. So I'd like you to maybe give some thought and speak to innovation needs or what's happening in the bulk power generation transmission sector in terms of innovation, and it's helpful for the DOE to understand this given their role in R&D. Anyone want to take a crack at it.

>> PANELIST: Oh I think R&D is a great place. One is for the most part industry agrees that's a place where the government should be involved and gives plenty of room for growth. Especially for the grid they had been low for several decades. Of the total national Federal R&D was $2 or $3 billion a year which is less than what one pharmaceutical company would spend on R&D. It's great to hear that they are on the rise and pledged to make it double and I think we have a lot to learn from R&D. I would say R&D is one of the things the United States does very well. It's a competitive advantage. Why not keep pursuing something we're good at. It gives us a great pipeline of people and talent and devices. So I think it's a good policy option, and as far as policy goes the downsides of R&D is maybe a waste of money. You employ some people. In the worst case scenario it's a jobs program but in the best it gives great things for R&D. And there are other policies where they are much worse, I like this policy where the downsides aren't bad and the upsides are good.

Particularly the industry has been regulated for so long, it's hard for 83 Tuttle to spend money and get their regulator to say approve it. And so utilities are often obligated because they want to spend the money and can't get in the right face or for approval. There's a challenge for Federal investments. Sometimes they partner with the Power and Research Institute. But it's a challenge. So if you look at electric utilities and how little they spend on R&D, it's embarrassing and low and partly because of the culture and partly because the regulators won't allow it. There's a big opportunity there. I think is going to unblock a lot of promise for whole new concepts for moving forward.

>> CRIS EUGSTER: I would say this. The transformation is $370 billion industry. It's doing the same thing in industries did in the 1990's and 1980s, to Michael's point there's a culture of risk adverseness, you make a mistake and get fired. You make 900 mistakes they may invite you as a (inaudible) company. That's different for the utility sector. And how do you really drive innovation, research, pilots, scale those things in a way that you can manage risk, and really kind of manage that risk dynamic. Committees.

>> CHRIS KELLEY: Thank you. Cheryl.

>> CHERYL MELE: The Task Force stakeholders make up one of the things we need to do is just be listening to them and make sure that we keep our tools available and help enable the technologies to be successful to make sure ancillary services are design in there such a way that we can get the benefits out of the did you ever tell technologies that come out. Still when you go to those that are existing as well. And I think the other piece is to really just be engaged in that conversation enough to make sure that we're clear we're being innovative with the ideas moving forward and that we bring opportunity to say the technologies to be successful in our marketplace because I think there are some things in the whole sale market that are currently valued the way that they could be and the way that they need to be for all of these technologies, whether distributed resources, generation, command response, storage, all of these things are certainly I think from the conversations we hear here and other places part of our future. We need to make sure that we're repairing the market for this.

>> PANELIST: I would agree with what everybody said. One of the things is economics, so to be consistent with my theme economics of the marketplace and I think Cheryl just hit on that what really drives some of that innovation are one of the things that market could really use, plus today Austin is looking at options for doing that, but if the economics are there people will be innovative to be able to take advantage of those economics.

>> CHRIS KELLEY: Franklin.

>> FRANKLIN MADUZIA: You have a lot of like minded people on the board here. So same thing with R&D. On the generation resource side of it, the market will figure out which one is the right technology. If we put in the right tools in the market that allow (inaudible) appropriately. On the transmission side as I said earlier in my presentation this is where DOE can really spend their money to help come up with solutions. You don't practice on the grid. You don't come up with a new technology, stick it on the grid and see what happens. So that's a lot of money to come in with a technology. And as Cris indicated we're risk adverse, we're not going to sit there and try new technology just for the sake of trying it and see what happens. That's where R&D, I believe the DOE wad really helps.

>> CHRIS KELLEY: Excellent. Thank you.

So now I'd like to turn to regulatory uncertainties, so, Franklin, you brought that up as well or maybe other challenges associated with the regulatory environment. So I'd just like to hear from the panelists, can you maybe speak to the current state of the regulatory environment and potentially where you do see current challenges, where you'd like to see changes? You care to take that, Franklin?

>> FRANKLIN MADUZIA: We are from the ERCOT market, I'd say we're in a period of calm. We just went through the whole capacity discussion, that was two years of uncertainty. Now we're kind of tweaking Oracle RDC which is another way to price things but we're almost in a calm period right now. Recent announcement of 2,000 megawatts of new generation. Some of the uncertainties coming forward is you have new legislation coming up and they have some things on the agenda that again we'll discuss and demand response (inaudible). Go with fast and other items. More of this uncertainty there is out there the less people will put a plant in place until these decisions are made it seems to be (inaudible). The same with Casper and CPP. Once people know what to do, they will know what to do with (inaudible). So it really is getting these decisions made. They might change its mind over and over again.

>> CHRIS KELLEY: Other comments.

>> MICHAEL WEBBER: Yeah. So my impression as an academic. I teach a lot of courses in industry and do a lot of research in it. Industry has certain pain over uncertain pain, I think stability clarity longevity has a lot of benefit. If people can make four-year decisions without the policy changing 18 months from now, the certainty becomes very important for how you price that in. I would think off the record a lot of industry would say we hate that policy, we

can live with it. It's not what we want but we'd rather have the clarity, which is ironic, it gets dragged out because you have different parts of the industrial sector duking it out. Certainly policy clarity is better for the markets –

>> PANELIST: The only thing I would say is obviously certainty for us, making any utility capital investments really matters, we are very fortunate that we made investments about 5 or 6 years ago as you saw up on the screen. But that was anticipation of certain things happening regular with policy.

Clean power plant, we don't know what's going to happen there, but also there was more tax incentives for renewables, we set that policy. That regulatory certainty for us is obviously very, very important. How the markets evolve, I think they are changing to adapt to different resources that are coming online. How they evolve will be very important and obviously we'll be watching those very closely.

>> CRIS EUGSTER: Texas I think tends to be more market driven especially on the ERCOT side. I think we do have a stakeholder process, there are a lot of things going on in Texas from a regulatory standpoint that DOE could get (inaudible).

>> CHERYL MELE: (Inaudible) we are (inaudible) assets really our systems and our technology. So you know that's not the piece we're responsible for. But I think that as we work with stakeholders we do recognize the difference of not having certain regulation and that regulatory framework drives their decisions and also our planning processes and so we certainly look forward to everybody having that regulatory (inaudible) so we can do the right amount of planning and looking at the reliability of the grid in the future as we start to see what might be playing out for (inaudible) changes.

>> CHRIS KELLEY: Thank you. So, Cris, you just touched on the fact that the region is more market-driven here. So I heard others, you know, mentioned markets and state that it seems as though it's working. I just want to make sure that we have that right. Because we haven't heard that in every region.

So can you talk a little bit about how the markets are operating, and do you agree that things are working here and to what extent do you think things are different and why is it that it's working? Anyone care to comment?

>> CRIS EUGSTER: So we're in two markets, and what you -- I don't know what you defined working as, but there are stakeholder processes that are being used in. ERCOT, and in the power pool. They come up with protocols are rules on how to operate those markets so we believe completely in that process. I think with respect to the things that we're concerned about, that's transparencies and pricing, that you get (inaudible) than other markets so we're working for those same kind of ideas in both Southwest power pool and at the Federal level, as well, try to get that transparencies in pricing so the markets can be more efficient in how they operate.

>> FRANKLIN MADUZIA: The ERCOT market is very efficient from the transparencies on pricing, it's easy to connect a new generation asset whether it's a solar farm or wind farm or natural gas plant. The (inaudible) process is very fuel efficient.

>> CRIS EUGSTER: I do think it has longer action, even these days we're seeing price spikes, the market is very, very soft so that doesn't incentivize a lot of new build. We see price spikes for five minutes, 10 minutes, then it gets very, very soft again. There's a lot of legacy assets that can respond to that, but as the market gets tighter I think things like ancillary services, battery, technology, some of that has to come to play in ERCOT. I think that still is a TBD from an ERCOT wad.

>> CHRIS KELLEY: Cheryl.

>> CHERYL MELE: (Inaudible) I think that's very good for our consumers here in the state. Great for our economy and you know the predictability of that is something that those who invest in businesses here in Texas would look at that as a positive. Maintaining that certainty and as we said maintaining predictability and while we're not seeing volatility in the natural gas markets right now we are seeing some in the prices throughout the day that occur as maybe wonder dies off or maybe we didn't get that forecast quite perfect. That we do have the types of resources today, that we have the capacity reserves today to be able to stand those periods, so there is some work to tweaking that and making sure that in times when we don't have the reserve that we are still investing in our marketplace. Prices have to drive at all to drive an energy market. I think we accept that, that's part of the design of our market that overall it generates an extremely efficient market. It's very transparent for everybody who wants to participate.

>> CHRIS KELLEY: Mike?

>> MICHAEL WEBBER: Yeah, I'm the long-winded professor, just one more comment. The market is looking great. There was a time when people were not so happy though so we should back up a little bit in the early 20s, to 2008. It's very clean, more efficient. (Inaudible) people are happy today. But you back up when the market first regulated natural gas was spiking around the same time. So prices are going up. The market opens up, the prices spiked. People were really upset. And then you had a situation later on where the wind forecasts were pretty bad and (inaudible) around 2008 I believe it was. And so the system had its bumps on the way. Right now the market feels very efficient. It's a very good market. People are happy. But there were some bumps in the transition from the prior form in the '90s. That's not unusual with markets there are some bumps along the way as something new comes along and you didn't plan for it. The natural gas price spikes used to be insulated from a lot of the consumers and they weren't this time. So it's really good now but it wasn't flawless all the way till today.

>> FRANKLIN MADUZIA: Okay, I'll throw in a little curve Ball, prices, et cetera, but the ERCOT market was designed very well for people who generate power. In ERCOT 2002, there's a lot of

industrials on the design team. We can self-schedule, send power out without having to reboot. They don't dispatch us up now. That's a key component in allowing industrials to operate their facilities. We run steam first. Once we set that steam limit the power either has to slow out to the market. We take whatever prices there is, it's up to us. We drive to negatives and start cutting back where we can, we have a lot more flexibility. And then the other is the opposite, they try to dispatch us first and without understanding the impact of how we operate our co-generation system. They will tell us to cut down, we can't. We have steam sitting there. If we cut back the steam we (inaudible) the unit. The market design of ERCOT is a lot more robust for industrials and allows us more flexibility. And the same type of flexibility is what we're trying to get in markets to get that understanding.

>> CHRIS KELLEY: Thank you.

So, with that, we have time for two more questions, the last being kind of your closing remarks, so second to last, I just want to bring up a point that's come up in some of the other panels in the other cities, that's about the blurring of lines between a transmission and distribution especially as more are coming up online. My question is for you, are we experiencing any blurs and is that posing any challenges for you, care to comment.

>> CRIS EUGSTER: We're vertically integrated. We serve the greater San Antonio region. Seen a large demand for distributed generation resources, rooftop solar, community solar. So there is clearly a strong, strong demand for that type of product service, you know, whether you're doing it to lower your bill or environmental reasons, but the demand is clearly there. We've seen states like Hawaii, California, you know, see significant penetration. For us that level is still low, it's very manageable. But we do need to think carefully in how we integrate those resources within our distribution system, what kind of technologies we need to deploy there, the whole concept of Smart Grid and inverters so that they can interface with the grid and main taken grid reliability. So those are the kinds of things we're looking at. Potential research opportunities, pilot opportunities but clearly there's a lot of demand for that.

>> CHRIS KELLEY: Thank you. Others? Michael?

>> MICHAEL WEBBER: Yeah, you know I'm going to say something, right, so I think that there is a shift in the role wires and pole inside play, if we look around the nation about 60% of the cost (inaudible) distribution. (Inaudible). It turns out there number is the same globally as well. $2 trillion worth of stuff. (Inaudible). And we have a couple challenges. One is as we build the more things that are far away from the centers we might need more (inaudible). The rates are often 5% fixed and 95% variable even though the cost might be 60% fixed and 40% variable. We have a fundamental mismatch between what we charge for stuff and what it actually costs. And we come to part of the solutions. For every megawatt of power you have one of natural gas, but that might not be true if you have longer wires and polls, is it a generation problem? We need a better system that reaches farther to the capacity. If you look at $2 trillion of assets, 1.2 trillion is on power plant assets, we are using them less than a half of the amount of time. Over a trillion dollars of money is used less than half the time. And that makes it different than

refineries which get 90%. Most capital-intensive industries like to use their capital because of the way things change through the time of the year. (Inaudible) maybe we can have half as many power plants and use much more. And who is in the wires and polls business will probably be a likely winner of that and I'm glad we have Electric Company ones here, we have John in the next panel later, they might be the one that lead us on the business model for wires and polls as we do the merger. I think that's where a lot of the innovation will be in business models and policies.

>> CHRIS KELLEY: Thank you.

>> MARK SCHWIRTZ: I think I'd say if it's call being billed in energy it will be tough to recover the fixed costs especially with penetration of additional renewables that take away the use of the transmission facilities or the generation facilities and then they're not adequately compensated. So I think there is a big disconnect and I'll be talking about that for a long time.

>> CHRIS KELLEY: Thank you. Other comments?

Okay. So with that, why don't we turn to our closing statements.

So you have the QER Task Force before you and we still have the secretary here. You've got two minutes a piece, I'd just like to kind of hear from you any summary comments, if you'd like to bring up something new you're welcome to do that. I want to remind you that you heard the secretary mention earlier that the significant number of recommendations came out of the first round of the QER and many of those are -- have been considered by Congress as well. So we see that as another opportunity for us here. So if you have policy recommendations for Congress, you have recommendations for the entire Executive Branch on the Federal side. Now is the time to share those. We'll start here with you, Cheryl.

>> CHERYL MELE: Thanks, I think that you know just continuing on with the discussion we've already had today, is that ERCOT really hopes that we continue to be leader in integrating the new technologies, whether those are renewables, storage, other technologies that might emerge. And so our focus will continue to be there and we look forward to working with our stakeholders to make sure we can all be successful in that area. And then ongoing discussions are right on the heels of that. We change that, we have to make sure that the market stays up with that. And I think the last thing that I think future panels will talk about but I think as an industry as a whole is that a lot of investments have been made already in some of the grid elements that perhaps they don't really maximize their return, this isn't so much an ERCOT issue, there's a lot of smart meters with the customers, how is that consumer engagement going to change the future to make sure that there is good utilization of the infrastructure that's been invested on utility. Whether on the T&D side or the generation side or some other innovation, but demand response, energy efficiency. All of those things. Really at the heart of this is the consumer. We're blessed with a lot of industrial consumers here in ERCOT that brings some success to our operations here but I think that the next -- the next decade is really going to be focused on continuing to manage -- different sets of generation resource but

getting the consumer engagement, and commercial, small and all the way down the line. They are interested in having a different mix, make-up. So they're getting that, but now they have to engage to the process of managing energy so that we don't overbuild or under-build.

>> CHRIS KELLEY: Thank you. Cris.

>> CRIS EUGSTER: I think these types are forums are very useful, sharing ideas, discussing topics, getting different wads, I think that in and of itself is very, very important so I appreciate the DOE taking leadership on it.

I think integration is key, you know, we have legacy assets, we have new technologies, renewables and how those play together is very, very important because we don't want to be building a lot of new stuff if we don't need to. To Cheryl's point, how do we be as efficient as possible and integration between legacy and new ideas? I think another area the DOE could be helpful is taking technology risk off the table. I think we said utilities are not good at R&D. Thinking about new technologies very risk adverse, so if we can be helped by taking that risk off the table or at least better understanding that risk, that pays huge dividends for our industry. And then finally information sharing, best practices, you guys are looking at this in a number of different regions, states, really, seeing what works best in different places and how do we share that information I think would be very helpful.

>> CHRIS KELLEY: Thank you. Mark.

>> MARK SCHWIRTZ: Yes, as my presentation says, we obviously believe that the market needs to benefit both the folks that are in it and the suppliers and the customers as well. Provide incentives for those markets so the right generation is built, right assets are built, right products are there for it. Marks transparencies, of course and ensure that we receive cost recovery for the assets that are being built within those markets, so we support what's being done, I think there's a lot of good discussion right now from a national perspective on how those markets should be shaped. Totally agree with some of the things out there. Obviously commented on that. One thing that didn't get mentioned up here that's going to be very important to all of this and I think the Secretary talked about the previous Quadrennial with respect to infrastructure. I think we still have some work to do with the natural gas and the transportation of that natural gas, so we look at our resources that we have. They require instant demand for natural gas, we have contracts to do that. But the infrastructure has to support it. So if you're going to have Quick Start generation that's natural gas-fired you have to have the natural gas to fire to be able to do that. So that's a very important point for us that natural gas also get considered in this entire thing and that the two get married somehow.

>> CHRIS KELLEY: Right.

>> FRANKLIN MADUZIA: Okay, I put a slide up here, one of the things that really would improve is relations between RTO, the TDSP, for (inaudible) generators, one of the things that we see behind the fence generators is we don't move our generation at all. So the RTO does

not assume that our load or our (inaudible) changes. We can swing 200 megawatts just by our process plants turning them off and on, so the transmission planner will say I have a line outage. The RTO will turn around and say, oh, no problem, we did our model off everything (inaudible). Then when the day comes the model breaks, because we've changed our load (inaudible). So this communication is really key. It's not just work behind the fence, it's all resources are impacted. You know, right now top 001 says 002 says the TDS B talked to RTO. The generation talks to RTO. The RTO talks to TDS P. They don't go back and talk to the resources, that's not in the plan anymore. There's a breakdown of communications in our system.

And then on the generations side, again, there's more communication changes in our resource mix, more generation on the distribution level which is the next (inaudible). How does that impact. Most of the plants are at the transmission level because it's stable. Well, now, that might not be the case, with changes in where the resources are being hooked up to. Again, that goes back to the R&D. And finally, the standards, we need to consolidate, we need to do something about making sure that we have one standard that applies versus all the (inaudible). That is as you indicated a very sensitive area but it also is very time-consuming when you have hopeful entities trying to support everything.

>> MICHAEL WEBBER: All right. The last word. So this should only take about 20 minutes, I know the Secretary has to leave so my recommendation for him is I think there's a role for the Department of Energy in energy literacy and energy education, and that is if you ask people where does electricity come from, they say the wall. Where do we get oil from, they say Iran, so there are a lot of wrong answers out there. And I think there's a lot to learn so as we learn more we can make better decisions as constantly consumers and stakeholders, leaders and that kind of thing. I taught an online course energy 101 and the hunger for energy information is quite high. 44,000 people from around the world signed up and in my virtual office hours over 200 students from six continents showed up. I think there is a real desire for energy information and we have to educate people on that. I think that's an opportunity for very positive policy engagement. So that's it.

>> CHRIS KELLEY: Please join me in thanking the panel.

(Applause.)

>> CHRIS KELLEY: The next panel.

We will transition for the next panel here. So during the transition time I just want to remind folks again that if you haven't signed up at the front to provide comments at the end there will be a public comment period, and once again, if you're joining on the web, you can submit comments if you like to the website. And as our panelists indicated the next panel will be focused on distribution and end use. We'll start in a moment. Thanks.

(Break.)

Panel 2

Electricity Distribution and End Use: How Do We Manage Challenges and Opportunities?

>> CHRIS KELLEY: Okay, so we're going to go ahead and get started with our second panel here. Focused on electricity distribution and end use. How do we manage challenges and opportunities?

So joining me here up on -- up at the table are another round of stellar, distinguished guests, who will be talking to us about this panel topic. We're going to be hearing from Mark Carpenter, Senior Vice President from Oncor. John Hewa, Chief Executive Officer of Pedernales Electric Cooperative. Phil Williams, General Manager, Denton Municipal Electric. Jennifer Smith, Executive Director for the Congregation Beth Israel. And finally, Tonya Baer, Public Council for Texas Office of the Public Utility Council. So just again a reminder to you all, what we'll do is everyone will have a chance to present their opening remarks, you have 5 to 7 minutes for that. We do have the colored lights up front. I didn't have to yank anybody last time. So I don't expect to be have to do that this time either. And then it will come right back to me for the questions, and I just have a request. Could we close the doors just because we're getting some noise? Thank you.

So why don't we go ahead and get started with you here. Mark?

>> MARK CARPENTER: Glad to be here today. Meeting our customer expectations over ever increasing demands is a real challenge for us, we've got reliability, we've got cost. We've got resiliency. We've got customer communications. There's any number of things. And also, a big fundamental thing is customer choice.

This comes at a time when we are really having a renaissance in the technology area, whether it be on the customer side, the utility side, or the analytic side.

So what we've done with our company and much of ERCOT is we've got -- we laid the foundational systems out to really help us meet these needs.

First thing is, we've got distribution automation in a similar form that we only dreamed of having it similar to the transmission system.

We got a fully deployed advanced metering system here in the state. We've got 3 million customers, and last year we had a total of 4.5 million service orders that were all automatically executed. As, you know, 1.5 times per customer, which is just phenomenal.

We've got about 99.5% read success right rate, two way success rate approaching 99.5%. We've got an outage management system and a usage management system that we've built and we've under grated the advanced metering system with that system, about 27% of the time we never get a call from a customer to just restore power. And that's a pretty good change. In the customer arena, how we communicate with customers continues to change. We try to meet them exactly where they're at. So we've got a number of different ways whether it be text, email, or social media. We do those kind of things. We've got a simple target of where we're go trying to go. We want to be able to tell our customers any time they have an outage we want to give them an accurate estimate time of restoration, notify them when their service is restored so we're in the process of doing that now.

So if you look at the challenges and opportunities on the go forward basis, first of all, balancing the full needs of the customer and the cost, we look at all of the things we need to do, we look at customer cost and reliability and various pieces of customer service. We've got an aggressive asset management model that we -- that we use to try to -- to try to beat that balance. But doing that is a significant challenge to us.

Analytics. The world of analytics is totally changed. We're in the process now where, you know, obviously (inaudible) faults and distribution systems, predetermining transformer failures by monitoring voltage abnormalities, those kind of things are what we are doing today. We are looking forward into zonal type weather prediction to actually predict facility damage and outage based on the weather by zip code. Those are the types of things that we're focused on looking forward.

We've really hit the tip of the iceberg as it relates to that.

Storage. Now, that is the -- that's the really big game changer. Now, storage is -- the price point of storage is just not quite there. We're hoping it will get there. The ERCOT market really doesn't facilitate being able to harvest all the benefits of storage by a single provider. So that's one area where we've got a bit of an issue, because distribution liability can be significantly enhanced with distributed storage.

Distributed generation, in ERCOT because of the low prices I believe what was it? $28 a megawatt hour, $27? You're not going to get a whole lot of distributed storage because of the price of energy in ERCOT. But that storage is a big deal and we need to figure out ways to get ahead of this.

So, as I -- as I look out, standards, standards can be really, really good and standards can be an anchor to progress. So we need to ensure that standards don't stifle innovation.

If I look at the regulatory arena, we've got good legislative regulatory market groups in ERCOT. Everything in here really is working pretty well. I heard that at times there were a couple of bumps, certainly there were, but it's really working well. So we need to continue to do that and

to get a little more flexible as was pointed out the last panel about these new technologies and the appropriate way to let the market integrate them.

Security, that's a big concern for us, not just cyber, but physical. You know, we live in a free society. And all of our facilities are easy, soft targets. That's not going to change. So we need to figure out ways to make incremental changes and have the kind of resiliency to back that up. And lastly, this is one that you may not have thought of but just developing a workforce and having appropriate trained workforce in this new technological society makes us partner different with the schools, it makes us recruit different and makes us train our folks different. Thank you.

>> JOHN HEWA: Yes. Hi, thank you, I'm John Hewa, I'd like to thank the Department of Energy ant the University of Texas for the opportunity to be here today and talk a little bit about the distribution challenges to integration of the new energy revolution here. I want to just spend a few moments talking about the Co-Op business model. It is aligned perfectly. We own 42% of the distribution system in the United States of America. We cover 75% of the land mass. We exist solely and only to support our members and our owners, we'll gradually take that on from the end of the line, the voltage support the reliability and the resiliency that that end of line electron represents.

PEC is a very unique cooperative. We have two service territories, a low density two account per mile territory and a booming Eastern territory with about 17 to 18 accounts per mile. We're one of the fastest. The nation's largest and if not the fastest growing in the United States. We have 20,000 meters in the last two years, improving rates. Ushering in new platforms to help power the Co-Op forward. It stands right now at about 2,080 active accounts, we will probably see that increase to nearly 12,000 this year. We're spending $165 million a year in infrastructure to keep this grid powered up.

When you look at energy in Texas, we've had -- a strong energy producer and consumer and we've seen a lot of demand growth. PEC has seen our transmission rate increase more than 80% since 2010. So that's a huge amount of dollars packed into a very narrow window in June, July, August, and September.

On the energy side, Cheryl mentioned earlier the energy market here in Texas, the market has been very soft and predictable. That's been very good for our consumers but we can't forget the potential to increase to $9,000 price caps. That would be about 375 times higher at any moment than the average pricing we experienced last year. While the low prices have been good for consumers, we're moving way beyond the point where traditional rates where you touch and work with a member once a month are adequate. We have to get to real-time notifications to be able to engage our member owners, our consumers in the energy market here in Texas and with its realities. If you look at our energy future, we're looking for a diverse portfolio, strong energy efficiency and demand management programs and we're seeking a trait flexibility and partnership on distributed Energy Resources. We've done a whole lot around this Co-Op, too much that I have time to get into today, but I'll put this in the slides in

terms of new software systems and initiatives helping us engage with our membership very deeply. We have new rates, including expectation for time of use rates this fall. These rates will help align our membership with the realities of the market and will also help us to promote distributed Energy Resources and other services that are producing on peak energy.
As far as the poles and wires go we maintain 21,000 miles of power line to serve our membership. And we are implementing a host of maintenance and operating efficiencies, thanks to the technologies and the way they penciled out here for rural America.

Our lines are longer, our service territories are more exposed so technologies play a huge role in helping us compete and have strong rates. We're providing our membership with energy services support with the use of Honeywell tools and a partnership to guide them on their energy consumption and energy production. We are working in the area of renewable distributed generation. We've just launched our empower loans and on bill financing program.
A 15-megawatt fractured community solar deployment and rolling in advanced rates.
In the area of renewables we've moved beyond education and work with our membership now to directly interfacing and helping our members choosing to adopt the technologies, the loan program finances low interest on the face of the bill for a term of up to ten years to promote member investment and lower Lifecycle cost. And I'll just mention that we're finding sustainable business a venues to do this, we're finding sustainable ways to receive that energy and to make it fit into our operating margin at the Co-Op. I mentioned a 15-megawatt deployment, these will be sub-one megawatt systems fractured around the service territory, about 20 deployments that will put solar up close and personal with our membership but still gain the economy of an aggregate community solar buy. Regarding storage, we've done analysis, were very excited, very, very excited about where energy storage will go. However our indications are that the price is still about twice what it needs to be.

We're spending a lot of time on cybersecurity, as well, around, and in the Co-Op world.
So a couple of areas just to close out in terms of challenges and opportunities we need to enable consumers, we need to give them very granular rates on the wholesale and retail side.
We need to provide strong information flow, notifications, and align them to the market.
We certainly need energy storage. And we certainly need the dynamic modeling of the grid.
Lastly, as far as the Department of Energy is concerned, I would just ask DOE to consider more applied demonstrations for technologies to work pragmatically in the business out in the field, and also an investment in advanced interoperability to help the grid grow and to expand technologies with more certainty and control. So, thank you.

>> CHRIS KELLEY: Thank you, John. Turn right to Phil.

>> PHIL WILLIAMS: (Inaudible) speak to DOE (inaudible) appreciate that. Feel like you're going from one of the largest investor owned utilities, the largest in Texas to the largest Co-Op in the United States and Denton -- Denton, we are the 6th largest (inaudible) utility in the state. It's an interesting place. You know where Denton s just north of Dallas Fort Worth, my son-in-law commutes calls it half way to Oklahoma and we're always there. We're half way there. Close enough that I can easily go to Windstar to see a concert. (Inaudible).

It's an interesting place to sit here over 120,000 (inaudible) but we also have two universities -- of North Texas and Texas (inaudible) University. That brings in 18,000 (inaudible). And also (inaudible) nature of the community (inaudible) diverse area.

Thank the electric utility business is not a hot political issue. It is in Denton, if you think it's not (inaudible). (Inaudible). And politically the utility in our future and what our future (inaudible) supply would be was political talk. And part of the (inaudible).
(Inaudible) has been there since (inaudible). 51,000 (inaudible). 750 miles of distribution. So half that distribution system, 57% (inaudible). So (inaudible) 68 customers per mile wide (inaudible). And so that gives you a lot different area to serve (inaudible). We recently completed installing smart meters, our challenge now, is trying to (inaudible) how the best (inaudible) smart meters.

Data richness information. I have a challenge, I have a warehouse (inaudible) and I need software and products and people (inaudible) pull information to tell me what my future rate structure needs to be for (inaudible) customers. What my rate structure needs to be for customers that come (inaudible). And how to influence those customers to charge off (inaudible). So that's part of our challenge in the future.

(Inaudible) operation (inaudible) responding to power-outages. Get to (inaudible) where customer has an outage during the day. Everybody's at work. Right now the first time we know about it is when they call us and say the lights are out. And I have a meter that tells me the lights are out. (Inaudible) and integrating (inaudible) system. Customer information system. Because even though that meter says it's out, maybe it's supposed to be out. I have 50,000 students (inaudible) and power is supposed to be off. And so you have to integrate that (inaudible). And all these systems. (Inaudible) talk to each other. And that's our challenge.
In addition, (inaudible) as Mark said before (inaudible) customer has been (inaudible) talk to us. (Inaudible) fee, social media, some way to interface with them. Be on the web (inaudible). To have (inaudible) interface and tell customers the information they want about the system and their outage. And hey, it's temporary, ten minutes, you know, something big happens it can become hours.

Looking forward to (inaudible) our systems. And doing so (inaudible). Also working towards ways to improve reliability of our system distribution area.

2014 we had 416 outages. That's down 1200 outages five years ago. And much of that's due to just (inaudible) things like doing a better job of maintenance, a better job of (inaudible). Average (inaudible) customer outage year is 1.3 million outages a year, our customers (inaudible). Concise system response time was less.

(Inaudible) Mark's talked about having a robust workforce, and a lot of these people are retiring and replacing with people (inaudible) new technology. Neither one of these gentlemen failed to mention the number one issue we have in our distribution system. (Inaudible). Wildlife

(inaudible) protecting yourself against cybersecurity and all those other things we still have a (inaudible). And have to keep working ways to harden our equipment (inaudible).
With that I'll pass it to the next.

>> JENNIFER SMITH: My name is Jennifer Smith, and I'm the executive director of Beth Israel and I bet you're wondering why the Director of a synagogue is talking about the Department of Energy panel. We were the first recipient of the property assessed clean energy or the PACE project financing that allowed us to purchase the equipment and improve or energy efficiency. I've been at Beth Israel for nine years, and I would say almost every day for the first nine years, I spent at least some time working on a repairs or energy efficiency issues. We spent a lot of time feeling like we're just putting Band-Aids on our system. We tried retrofitting the system, putting in controls, adding solar panels, and it soon became clear that we had to remove the Band-Aid and find a cure.

Of the last year, our boilers became unrepairable. Parts were obsolete. In order to keep the building comfortable they were running 24/7. Of course, winters in Texas are mild. So we weren't really worried about that. We figured we could, you know, kind of make those last a little bit longer. Unfortunately then the chillers starting failing with obsolete parts, up repairable parts. And the technology has improved so significantly in the last 15 years that it was difficult to try to find the things we needed to get these to stay working.

We were able, again, to keep them running, by running them 24/7. The building wasn't comfortable for the students, and we actually had a few days in the middle of the summer with no air-conditioning. Parents were not super happy with this. It became clear at that point that we just had to move forward and get new chillers.

Those words not one that a board wants to hear, especially because chillers run around -- was going to be about a quarter of a million dollars.

So with our first meeting with the HVAC Company. I was kind of really worried about our budget, but one of the attorneys at our company had been working on the legislation that brought the PACE program to Texas. He explained that the program was to help building owners be able to make much needed repairs that would improve energy efficiency. It's a unique program in that the financing actually goes with the property, not with the building.

That piece didn't matter so much to this 140-year-old congregation that's been in our location for, you know, 60 years. However, for a commercial building owner that sells this property the liability would go to the new property owner. And so that way they might make repairs that they wouldn't have already initially made in order to just improve energy efficiency.
For houses of worship and other non-profits the benefit is the (inaudible) us to take out a loan for up to 20 years, the life of what these -- this new equipment would be.

The other benefit is that it's a cash-positive proposition so that savings from repairs and energy savings and capital avoidance would pay for this new equipment that we were going to bring in.

So, after hearing about the program, we decided to move forward in procuring the loan. Our congregation has been striving to lower our carbon footprint. But hearing this made me think what else besides new chillers we can do. So we ended up creating a much project that included new chillers, boilers, (inaudible) and updated controls, almost a half a million dollar project which for our board again was a very scary prospect. How could we spend this much money? But in the past couple of years we've spent almost 30 to $40,000 on repairing just our chillers. So it kind of made sense to look at a way to get new ones. And they -- the project was defined by the company, and then a third-party engineer had to come in to quantify savings. They took all the information from the HVAC company, our energy roles and repair costs and the efficiency differences between the old equipment and the new equipment. We had site visits and continuous grade of contractors that helped us determine the best way to move forward.

The third-party engineer signed off, and we were ready to go.

But because we were the first PACE project in Texas, we were kind of the guinea pigs. So while everyone was watching us we were also trying to figure out, you know, how all of these documents should work, what information needed to go in them.

Luckily that wasn't my (inaudible), that was the Texas based authority and finance people and other attorneys'.

On the first step was a construction loan and then that loan will roll into the PACE financing, once it's completed, and the third-party engineering -- engineer signs off and then we actually pay through Travis County through the property assessor's office to pay for the financing.
So the closing happened in February, just super, super exciting. And we were really thrilled to be the first people, but all I could think of was are we going to get our chillers in time before the heat-wave happens.

First we installed the window tint, and right away the rooms were cooler and the hallways were cooler. We've had our new chillers for about a month now. We could tell right away just by looking at controls that things were better but then we got our first energy bill this week and we have saved 9,000 kilowatts what's in the past month from the prior month. And from last year at this same time.

So -- and this was during a time when we really spent a month learning how to control the chillers, and we had a ton of special events, which minute we were running our AC system a lot more.

So we're looking forward to seeing the additional savings that are moving forward. And we're pretty happy that we cannot only lessen our carbon footprint but see energy and dollar savings while we're doing it.

>> TONYA BAER: I'm Tonya Baer with the Texas Office of Public Utility Counsel. Let me tell you a little bit about the office, because you may not know. We were created in 1983 as an independent State agency to represent the interests of residential and small commercial consumers in utility proceedings. So usually I'm at the other side of the table from these gentlemen. So it's nice to be on this side with them. We represent consumers in electric, telecommunications and waste water cases and projects before the Public Utility Commission, the state office of administrative hearings and state and Federal Courts.

As you've heard this morning the ERCOT region is distinct, one of the reasons is because of our competitive retail electric market in most of the State of the and most consumers have a choice in the selection of their retail electric provider because in 2002 the state opened the market to retail competition and today Texas has one of the most successful competitive electric markets in the nation.

Consumers can control their energy use, they can compare their offers and control their energy usage and pick a plan that is right for are them. Currently customers located in competitive areas of Texas have some of the most attractive energy rates in the nation. And although our energy rates are very competitive an increasingly larger portion of consumers' bill are from transmission and consumer charges, they will focus on trying to control the energy part of their bill by shopping the competitive market like we've talked about or by reducing their overall energy consumption. And one important tool that consumers use to reduce their electric bills is smart meters and we've talked about those this morning. They have enabled residential consumers to participate in demand response programs, to use energy efficiency devices to control when and how they consume their electricity and to choose from a greater offering of products and pricings.

Another area where there has been significant development has been distributed generation or DG as we've talked about this morning, I feel like I'm just repeating what everyone has talked about. That's the dangers of going last. Texas has been seeing a wider adoption of DG technologies such as rooftop, solar, by residential consumers as the cost of these technologies continue to decrease. Using these has helped consumers better control the cost and reliability of their electric service. However the economics of installing DG are heavily dependent on the regulatory policies and pricing in place.

So before installing a DG system most consumers perform a cost-benefit analysis to determine when they can expect to recoup their upfront costs. Any subsequent change in the rates for electric service or the credits if any they receive for supplying electricity back to the grid can completely change their investment. I'm already over. Do you want me to -- okay. As these DG technologies gain more widespread use utilities nationwide are struggling with how to address the which wills of InterConnecting the personal GD owned systems to their own system. And how do they continue to recoup their total costs when these consumers are consuming less electricity. And as a result of this the utilities have been proposing strategies to address this loss in revenue including increasing the fixed charges, implementing new fees, and reductions in the credits that customers receive for supplying electricity back to the grid.

I just want to say, quickly, one, we currently have a pending case for a fully integrated utility here in Texas that has come in, because they are seeing more roof top solar -- residential rooftop solar, and they actually -- their original proposal was to have a higher fixed charge on the DG customers, and to implement a demand charge on them.

Through settlement negotiations they have changed their proposal to just add a separate monthly charge on residential customers with DG. In full disclosure they are contesting that right now. It's the first case of this kind in Texas, we'll see what the final outcome is.
So, as advances in technology in the electric industry, while they've created new options for consumers, there's also policy considerations that we all must take into account.

>> CHRIS KELLEY: So with that, now, let's turn to some questions. And we have a bit of time for that.

So let me ask my first question on the subject of consumer customer engagement. So I heard a few of you talk about this concept, and, of course, going from transmission down to distribution there was an expectation from the previous panel that we would talk a little bit more about customers and how you engage customer. So my question is simply when it comes to customer connections, education, and awareness can you expand on the value of this a little bit for us? And if you're experiencing any challenges when it comes to edge gaiting customers, can you talk about that, too? You care to take that?

>> MARK CARPENTER: When we went to the full deregulated market at that point in time it was strongly encouraged and really by law that the wires company not have a relationship with the customer. And at the time we weren't really joined with the generation of retail customer. It made sense. We realized pretty quickly that we needed to have a very good relationship with the customer. And that was after about two years of trying to have (inaudible) just refer back to the original provider. So we've had a significant effort segmenting the customers, trying to figure out which customers wanted what, and getting the types of communication that the various customers want. Because, you know (inaudible) on a whole different kind of communication that my kids want and my grandkids are probably going to want something totally different. So we've done quite a bit of research and focus and we really feel like the more we can get the customer understanding our business and us listening to theirs that that just pays dividends. Now, we're not like the city of Denton, the Co-Ops which have always had a good relationship with their owners and their customers.

>> JOHN HEWA: I'll jump in there. The engagement with us for our ownership and consumer is in our DNA so-to-speak, but we've engaged very deeply, involved our membership in all of the rate designs and shaping, any excess revenues go back to the consumer, the member owner and we've incentivized -- in fact I was listening to some of the things Tonya listed and are lowering our fixed charge June 1st. Increased the buy back on billables and doing financing to lower (inaudible). So we're doing a whole lot in this area, and I think one of the very big things that we've got to do and the reason I point it out in my slides the increase in the transmission cost and the -- how favorable the ERCOT market has been but how volatile it could be is that we

have a perfect market, and Cheryl, thank you for your leadership there, we have a perfect market for utilities to map back the real time cost to their consumers and if we'll do that at the wholesale power level, if the reality of the transmission level, 10% is packed into 60 minutes in the summer months and peaks and if we also do that at the distribution level being time sensitive and locationally operated, we provide signals to our membership and consumers that allow them to take their own dollars just as the Co-Op was formed and rein vest those back into new resources on the grid. So we're excited about the engage. And I believe the model lines very well with what we do every day.

>> PHIL WILLIAMS: And this is in the utility (inaudible) our budgets, our discussions with the public are very open to, let's say -- two weeks from now I'll be presenting my budget to a public utility board that's open to the public. Later on this summer my budget along with the rest of the city budget will be present in there public hearings in front of the council. And so those are all open to the public to see our business model and so see what our cost drivers are.
We also like to stay in touch with our utility customers. 60% of my sales are to 12% of my customers. So commercial, industrial customers are a percentage of that. And so we absolutely stay in touch with those and see how we effect those and work whir the city to enhance economic development.

Any manufacturer in our city is in competition with other manufacturers in other locations and we want tower manufacturers to be the first police to, their corporate office will expand because of our liability and costs and the last place to think about cutting back. But the retail side we also (inaudible) to those customers and next year open up a prepay. So that customers will come in and prepay their electricity and the smart meters monitor use Lin found to implicate other cities and other Co-Ops that have done this that customers that have that interaction with their electric meter on a daily basis to see how they're taking down their usage more than about 10%. (Inaudible).

>> CHRIS KELLEY: So maybe I can change it a little bit to make it a more simple question for you, Jennifer, since you're on the other side of that equation as a consumer, essentially, I'm curious to know so how did your congregation find out about the PACE program, what motivated them to take the steps you took to implement energy efficiency.

>> JENNIFER SMITH: We found out about it from the HVAC company, they brought it to the table for us and then introduced us to those at the Texas based authority. For us it was the only -- well, probably not the only way but the only logical way for us to be able to afford a half a million dollar project and not have to take out a commercial loan and/or change the project so that it was moreover, time. Because originally we were looking at -- we needed two chillers and two boilers, so originally we were looking at, well, can we stagger them over time, and can we do one here and one there, and so the project in going through the process with them allowed us to find out we could do it all once, we could, you know, have the loan last the life of the equipment. But know that our savings every year was going to help us pay for it. So that was another way for us that the board decided, you know, it was really the way to go.

Without it I don't think we would have new chillers and lovely window tint that keeps our building nice and cool (inaudible).

>> CHRIS KELLEY: Thank you. So we talked about customer education. Mark, you mentioned workforce education in your opening remarks, so we haven't heard a lot about that to be honest in some of our previous panels in other cities, it's an interesting concept. And so if I'm understanding you correctly you're talking about sort of these evolving technologies on the grid and the need now for these, you know, legacy utilities to educate a workforce that's ready now for these new technologies. Can you talk a little bit about and I can follow this up to the other panel as well but can you talk about what you're doing to educate that workforce? Where do you think the need is?

>> MARK CARPENTER: I'm scared these guys are going to take our tricks and take our workforce away from us. Back in 1999 on the transmission side of the business we decided the barrier to entry was a two-year technical degree for every craft job we've got. PNC technicians were a four-year (inaudible) degree. Since that time it has substantially altered that workforce, we've been a little slower on the distribution side. We're in the process right now on the distribution side of bringing people in through various two-year technical programs or through linemen Certification programs. But the day of us going out there and getting somebody straight out of high school and just developing them up or taking a meter reader and converting them to a technician, just don't seem to fit the technology in front of us.

So we've partnered with the various Junior colleges around. We've got, go to school at night, work in the day programs and we've set up various company and programs so that we can hire people that don't yet have the educational background and they can come on full-time and get all the full benefits, insurance, especially, and go to school. And there's no obligation from them or to us on full-time employment when they finish. But if you look at the demographics of our workforce, age-wise, there's plenty of work. And if you look at the demographics of all the utilities in the United States, there's going to be plenty of work for a long, long time. So, it's key that we have to get the educated workforce and then Phil mentioned the analytical side.

On the analytical side we're going out. We're getting PhDs, data scientists and those kind of people and bringing them in, instead of having somebody that's really good at Excel become your data analyst we're bringing in a much higher level skill-set.

And lastly for many of our sister operators, it doesn't get any better than (inaudible).

>> CHRIS KELLEY: Thank you.

>> JOHN HEWA: I'll just add, we're adding energy auditors, inspectors. Invested in Telecom and their architecture, a lot of investment on the IT side including cybersecurity managers and such. So we're seeing a tremendous specialization occurring on top of what we do which is

normally maintain 21,000 miles of power line, and that tends to be increasingly brute strength plus surgical. So even the name of the game is changing -- changing there.

We're taking (inaudible) for efficiencies through technology. Our perfect year in our drive at the company and is to reduce revenues (inaudible) and increase our operating margin. So our goal is to bring down in a very literal sense on a per consumer basis, bring down our operating revenue annually and increase our interim operating margin efficiency.

>> PHIL WILLIAMS: So we have fewer employees per customer, but we have higher paid employees. Because they're more technical -- you know, they're more technically advanced. We've also seen the need to do more compensation surveys to make sure we're keeping up with compensation upon those different levels. As working can afford. The other way I had linemen come in here and obviously I have a job I can go to for so much more and it caused us to start looking and evaluating our pay scales on closer levels so weren't training our employees to go somewhere else and that's the thing you have to constantly work on is making sure that you can -- you invest so much money in training these employees, you want to make sure you compensate them properly so that you retain those employees (inaudible). And so that's been one of the challenges we've had.

>> CHRIS KELLEY: Thank you. So let me ask a question that might be suitable starting at the other end of the table and that's more on the consumer side of things.

So, it's really just about motivations of customers.

And when it comes to the electricity that they consume.

So something that's been interesting to observe across the tree as we've held these meetings is those different motivations and some of the customers are motivated by cost, environmental issues, some like to geek out on the technology, you might hire them as your analytics guys. So, is it, is it safe to characterize customers in this region in one way or another? Or what do you see in terms of motivations when it comes to interacting with electricity companies?

>> TONYA BAER: I don't think it's safe to generalize that all consumers are the same in this region or any other region which makes it difficult for our office because we represent residential consumers as a whole so we have to balance everyone's interest and you do have the people who really want to be actively engaged in their usage, those who are more towards the environmental and they only want to use green energy and those who strictly need the lowest cost option possible. So I think when we're talking about consumers we have to always recognize that every consumer is different and their motivations are different.

>> CHRIS KELLEY: Anyone else have a comment on that as to what you're seeing with your customers.

>> PHIL WILLIAMS: (Inaudible) liability. So reliability especially for (inaudible). Reliability is first, and rates is after that. (Inaudible).

>> JOHN HEWA: I'll add that we're taking an anti-subsidy approach. That's working for us, we're finding utility pragmatic ways to support renewables that actually improve our operations and our reliability and operating standing. I'll just say that I think in Texas and just for rural America in general, I'll just say kind of overarching our members have the rooftops and the ranches and the wherewithal and the self-sufficiency to really go big with distributed resources and so that's why we're really excited about it. Of course, it's got to be the right balance between the traditional resources that have gotten us here so-to-speak. So we can't discretion interrupt that balance untimely. But I do think that we'll see and we're going to continue as a Co-Op to find way to say strike that balance with our supporters both with reliable, traditional services, strong delivery systems and also help them make their technologies pencil out and work in rural America.

>> MARK CARPENTER: The only comment I'd have is that we really tried to put a good effort to hear all the customers, not just the squeaky wheel customers because the squeaky wheel customers don't necessarily represent the thoughts of your entire base, like Tonya said it's hard to -- you can't categorize them all. We try to put them in fine enough segments so that we can address those different segments.

>> CHRIS KELLEY: Thank you, and so as our resident case study what would you say was the primary motivation for your congregation? Was it a cost savings or.

>> JENNIFER SMITH: I think it was both, you know, we are definitely -- our Rabbi started the environmental -- interfaith environmental Network. So environmental was really important to us, we put solar panels on, you know, we participated (inaudible) in Austin, so that was a big incentive but I think, of course, a bigger incentive was, you know, cost and trying to lower our energy costs, lowering our carbon footprint was great. It was nice. We were able to say that, you know, we're using better refrigerant in our new chillers, and you know, it allows us to spend money in areas that are more important and more towards our mission.

>> CHRIS KELLEY: Thank you. So keep with the theme of cost. Mark, John, almost everybody really mentioned a lot of different new technologies that are being put out on your systems. Whether it's new smart meters, so my question is back to that of cost.

So with all this new technology being deployed somebody has to pay for it. Who's responsible for that cost?

>> MARK CARPENTER: As a regulated utility. In Texas the wires come here fully regulated. As a regulated utility ultimately the customers pays for the cost. You know, we've got a clear target that we try to hit, and that's being in the first quartile of reliability being in the first of cost and cost efficiency and to do that what we're finding like Phil said he were may have fewer

employees that may be higher dollar employees and our overall performance gets better as we put these systems in.

Frankly, I don't think our customers -- our customers expect FedEx type service whenever they want to know what the situation is with their power being restored or those kind of things. They want a who's going to be there when. Same with the new hook-up. And so for us to get to that, to meet that portion of the customer expectation, we've got to build some of these systems.

>> PANELIST: Yeah, I'll add to that. But the good news for the rural space and company and space is that these technologies pencil out very, very well with efficiency. Our owners pay for everything we invest in one way or another. I think that it's very -- I think it's incumbent upon utilities in Texas and across the rest of the nation, quite frankly that at the retail level we have to provide a lot of rate options, we've got to provide and in our case we're moving toward voluntary time of use options and other rate options but if we provide rate options and rate alternatives that map back to the time sensitivities of the actual power markets to the actual realities of transmission cost, again, 10% of our revenue, $60 million will be jam-packed into 60 minutes throughout the summer of our peak system performance. So that's a lot of dollars in a lot of minutes. And so not too many minutes.

So if we are, I think, nimble and granular in the way we provide rate alternatives and options to our membership our goal is to provide that single to them and allow them to invest their dollars in the same way that Co-Op members (inaudible).

>> PHIL WILLIAMS: Not much more to add. Our customers mostly pay the cost of any new technology. So it has to (inaudible) outnumber cost efficient and essentially at some point pay for itself although long-term (inaudible) services project.

>> TONYA BAER: I guess I can echo what they've already said. Consumers at the end of the day pay for everything and I think as we're developing new technologies and as decisions are being made to implement them on a wide, full screen scale we have to make sure we're doing that efficiently and effectively so that consumers aren't paying more than they need to.

>> CHRIS KELLEY: Thank you. So, Phil, you mentioned hardening against wildlife in your opening remarks, but that really speaks to reliability resilience and (inaudible). You touched on (inaudible). So whether the system attack comes from a squirrel or from a severe weather event, can you speak to the challenges of implementing resilience and reliability?

>> PHIL WILLIAMS: So, the best protection is redundancy. (Inaudible) the substation services (inaudible) different location. Certainly the standard in the utility industry has gone from (inaudible). Now most of us put a ten-foot concrete wall. Something as simple as that, but also the cybersecurity (inaudible) added people, added resources to enhance our (inaudible), enhance our systems to protect against cybersecurity.

Cybersecurity I mean coming into a system (inaudible) physically is trespassing. And it's a crime. And so crime prevention is (inaudible) every single crime from ever happening, but you try to (inaudible) protection -- protect yourself against (inaudible) (inaudible) systems.

>> JOHN HEWA: You know to a certain degree one of the recommendations I had for the Department of Energy was advanced operability. If you look at the way Telecom has come together, there's a high degree of certainty when two units, systems, routers, plugs are put together, you know what's going to happen. The electric grid isn't built in the same fashion, unfortunately we can still count the number of grids across the country and storage systems across the country. And while solar and other technologies propagate very rapidly it's still got a long way to go in terms of being a large percentage of our poll energy requirement. So I think that we really need nationally to see an investment in advance interoperability. Right now we're tying a lot of proprietary systems together, when you do that it creates vulnerabilities at the edge of those systems and the way they have to speak and I think we need to see some investment that looks at how the nodes whether it be down to a transformer or meter, a circuit switching at a transmission level or a recloser on the distribution line, we need a much stronger interoperability and architecture as to how those pieces fit together and act somewhat in concert or also autonomously depending on grid conditions. And those grid conditions could be reliability. They could be autonomy, environmental, preparatory, there's a number of grid conditions that could trigger and cause a different operating scheme to be established.

>> MARK CARPENTER: I've got two comments. I'll start at the end and back down to the squirrels.

On the high-end I agree with John that we need interoperability. I think that's very important. When I look at the Telecom occasion industry the way that those standards were developed is somebody got out there in front, figured it out, made it work and gave it a de facto standard. What we tried to do in the history of some other things was create a standard and try to get everybody to build to it and nobody would. So I think it's important when we get through the standards the right way technology always leads standards, not vice versa.

On the side of the squirrels we got full portfolio of things we're trying to protect against. And, you know, we've got an embedded system, and I will guarantee that everybody -- us three guys at the table have had plenty of time looking at various ways to defeat squirrels. The squirrels are winning, but we're getting better. It goes back -- it goes back to cost. You know, everybody will have certain levels of wildlife protection, but you don't go back and retrofit your grid. You use stuff, get the more enhanced ways to do it, whether it be for squirrels or for snakes or for anything else. We're having to protect everything from the one point-of-contact of service being out to somebody coming in with a -- with a C4 explosive and taking out a corner transmission structure.

So we've got the full -- full range of things we have to protect for.

>> CHRIS KELLEY: Thank you. So the last -- the last panel talked a little bit about regulatory uncertainty. So I would like to talk a little bit about that regulatory environment right now. What extent do you see -- see the environment being part is supportive of your operations? Do you think that there are changes that are needed? And I guess to kind of broaden it out a little bit, and we can talk about regulatory opportunities as they are present for people's council or others as well, maybe state and Federal opportunities so.

>> TONYA BAER: Yes, they're all looking at me. I'll go first.

Well, our office focuses a lot on rate cases. And right now there has been a trend for -- to do rates based on cost to serve.

And I think that is, you know, it has some merit, but there's also times when cost to serve isn't the only element of rate design that should be taken into account. And we have seen where that has been a discretion service to the residential consumer.

So I think that's somewhere that will need to continue to talk and hopefully make some changes.

>> CHRIS KELLEY: Thank you.

>> JOHN HEWA: I think we are seeing some delays with investment in the industry because of regulatory uncertainty. I think we've got some over driving regulations that are despaired and we need to see our agencies come together, clean power plant is an example. We've done a lot for renewables in Texas and our company on has done a lot, we are seeing issues related to cost and reliability but more so timing and security. Because I feel like the plan causes us to take a snapshot of where we are today with technology. And we really need energy storage. We need it here. We need it here big time as a bridge for what CPP really contemplates. Other would you see we'll just simply see another 40-year investment in natural gas. That's great for Texas, that's great in terms of carbon reduction and methane and Mercury and some of the other issues, however, it's not actually -- maybe optimized with what we could see from a national energy policy standpoint.

So I think that the timing factor makes CPP simply a natural gas play. That puts burden on pipelines, that -- and negotiating are still trying to figure out if we have enough capacity and as Michael Webber mentioned earlier that onsite pile of coal is very, very, very valuable from a national security standpoint. So I'd like to see our Federal Agencies come together a little bit more tightly in terms of aligning cyber and security and environmental and national economy and a number of other factors that I think can be worked. We just feed a roadmap that is taking those factors into account instead of one agency running in one direction as fast as they can. Thanks.

>> PHIL WILLIAMS: They have gone the right direction since 2005 when it first came out the regulations and the enforcement of those regulations drove (inaudible). And the same to hone

more towards the audits now are going more towards not auditing but (inaudible) I think it's sort of taken a step (inaudible).

>> MARK CARPENTER: We didn't get the wind by having people sit around and doing things. We need the nation to work well over 90% of ERCOT has (inaudible) and that comes in with some real good leadership at the regulatory level and the PUC level or the legislative level, regulatory level and the stakeholder level. You know, ton yes and her group were very active in those kind of things. And so the stakeholder processes worked well. Where we've gotten a little bit of deficiency just the basic nature of our market puts unnatural fractures in some normal decision-making points if you had an integrated utility. If you had an integrated utility that you had generation transmission distribution direct load control would be a -- would be a big tool in your tool basket.

And so, figuring out ways to let the market work to use all those technological tools that are there, that's something that we're going to have to do and I think the stakeholder process is going to have to be the first driver of it. But if the stakeholder process can't get there it will end up happening probably either legislatively or through the PUC.

Same thing with storage. The advantages of storage, if you could aggregate them, everything from distribution reliability to ancillary services the business case totally changes. If you just look at ancillary services you hit one point on the grid. If you look at the portfolio you do another point and when you do the full cost-benefit analysis you just have to do it to see where it's going to fall out.

>> CHRIS KELLEY: Why don't you hold that. We have a minute left a piece to just give your final comments so just a reminder that we've got the QER Task Force here, really representing both the legislative and the Executive Branches of government. If you have policy recommendations for them you can provide them now, any summary comments or any new comments if you want to do so.

>> MARK CARPENTER: I'm going to follow to step into some of the Federal Regulations, let's is keep it as simple and practical the DRE even enforces those things here in the state. Does a very good job, but the two things that we don't want to forget, the customer.

>> CHRIS KELLEY: Thank you.

>> JOHN HEWA: Well said. Real quick, I've got five areas that I think for the industry and for the Department of Energy, I think we need to see more investment in applied technology, applied grid and business demonstrations, storage being first of those. Dynamic modeling. We need to be able to model the grid in a time sensitive real time way and we need to focus on grid optimization and resiliency because there is still a lot of line lost on our grid. The second area is advanced operability. I think it advances technology, reduces cost and deployment risk. The third area is access to secure Telecom. Telecom is a prerequisite to most of the things we've talked about one way or another and that's particularly a challenge in our more remote areas

but also they challenge securely in our higher density areas. I think we should see investment in utility specific cyber defense systems. We have a very unique business. We have all of the risks of business in operational combined as well as physical. So I think we need to see some investment there. And then the last area would be simply just some alignment at the Federal level with the agencies on an energy development. Thank you.

>> CHRIS KELLEY: Phil.

>> PHIL WILLIAMS: I won't belabor the points because these two gentlemen made the points very well and I agree with all those things that when (inaudible). One area I would add is to me battery storage is where solar was years ago.

And what made solar advance was to continue to invest in R&D and drive the cost down and make a place in the industry. I think that's the same thing for battery storage.

>> CHRIS KELLEY: Thank you, Phil. Jennifer?

>> JENNIFER SMITH: I would say when we found out we needed new chillers I never thought I'd end up here at a DOE panel talking about them. It's been quite an interesting journey. And I would just say, the Texas PACE authority has gotten us to the point where we can. We're now officially a case study for them and you can find out that information on their website and more about PACE. It's www.Texas pace authority.org. It really kind of has changed the synagogue's life in allowing us to be more energy efficient and be able to afford to be so.

>> CHRIS KELLEY: Thank you, Jennifer, finally, Tonya.

>> TONYA BAER: Okay, well, I don't have any specific policy recommendations but as policy recommendations are developed I think it's important to remember that all consumers are different, but while they all are different and motivated by different things, they all want reliable, cost-effective power.

>> CHRIS KELLEY: Thank you, so with that please join me in thanking our panel.

(Applause.)

>> CHRIS KELLEY: So at this point we're going to take a break for lunch. We have one hour. So we will reconvene with our third and final panel at 1:00 central time. Once again, if you would like to provide comments, that period will occur immediately after the third panel. We'll be taking public comments. So please make sure you sign up at the entrance and again (inaudible) we'll get started back in an hour.

(Lunch)

Panel 3

New Technologies and Actors in the Grid Edge Space

>> CHRIS KELLEY: Welcome back, everybody. I hope you had a good lunch. We'll get started with our third and final panel. After this panel, we'll turn to the public comment period. But our panelists will not be on stage for that to let you know. We'll have our QER task force up. So our next panel is focused on the topic of new technologies and actors in the grid-edge space.

This panel will touch on the earlier comments we heard. And we also will be diving deep into issues surrounding the challenges and opportunities present as new technologies and actors are involving in joining the electricity industry and the grid between distribution and use in other places potentially. So with that, let me introduce the folks that we have up on stage, another great gang of speakers. We have Brewster McCracken, President and Chief Executive Officer of Pecan Street, Inc. And Deborah Kimberly, Vice President of Customer Energy Solutions at Austin Energy. Doug Lewin, Vice President Regulatory Affairs and Market Development for CLEAResult. Jim Steffes, Executive Vice President, Corporate Affairs, Direct Energy. And finally Matthew Lynch Co-Founder and Chief Product Officer for Bractlet. So, for the panelists up here on stage, just like the last couple of panels, I'll give you each 5-7 minutes to give your opening remarks and go down the list and we'll start with Brewster and go to the end to Matt and then come back to me for questions. I do have the colored lights in front of you so when that light turns red that means 5 minutes is up, and you have two minutes left. So there are only five of you so you can go a little bit long but I'll eventually pull out the hook. With that, let's start with the Brewster.

>> BREWSTER McCRACKEN: I'm Brewster McCracken. We are a Research Institute at the University of Texas and we do consumer primarily residential energy and water and behavioral response research; how people use new technologies; what is their impact on distribution systems, so as part of that, we make all of our data, research data, available for universities around the world. It is the world's largest research database on customer energy water use and it is used by University researchers and 175 universities in 38 nations. So, we gotten some pretty unique data-driven insights on what is going on inside the home and how that impacts transformers and the assets.

>> DEBORAH KIMBERLY: Are you ceding the balance of your time to the rest of us.

>> BREWSTER McCRACKEN: I got 45 seconds.

>> DEBORAH KIMBERLY: Thank you for coming out. I find it interesting.

[Off Mic]

>> DEBORAH KIMBERLY: -- third largest municipal owned utility, department of the City of Austin. A lot of people heard a lot about Austin Energy and certainly our partnership. We were a founding member of the Pecan Street research and they do - I'm (inaudible) for Brewster here. He does a great job. I have the phenomenal good fortune of being able to work on all of our customer side of the programs as well as data analytics, business intelligence, key accounts and a like. Austin Energy is what you would call a mid-sides utility. Our peak is 2700 megawatts. But when it comes to goals, our goals are anything but mid-size. This being Texas, and this being Austin, the bigger the better. And so, we have as a result of our recent generation resource plan update, a plan to get to 950 megawatts of solar by the year 2025. So in less than 10 years.

That's 950 megawatts of solar, including utility-scale solar, much of which is in west Texas but as much as 200 megawatts will be here in the Austin area. So if you look around, that presents some challenges, right? It presents challenges because guess what? There are a lot of trees here. It presents challenges because we have a downtown network and if you have systems that are back feeding on the network, you will shut the network down, including City Hall. I never ever want to do that because I don't want to face the consequences that would be associated with that. So 950 megawatts, 200 megawatts of customer side of solar and I support that. We have gotten great bids but I think prices in the solar space will continue to come down. We are putting up a community solar offering on a parcel of land we own near a substation in east Austin. We also have big energy efficiency and demand response goals. At a minimum we need to get to 900 megawatts of energy efficiency and demand and response by 2025. And that's the minimum. Our stakeholders have asked us to consider 1000 or even 1200 megawatts of energy efficiency and demand response. So keep that all in the context of that 2700 megawatt peak. Those are not small goals, as well as energy storage. Now thanks to the support from DOE, Austin Energy recently was a recipient of the SHINES grant, so we like to boast a little bit at 4.3 million dollars of the 6 or so recipients, we are one of the largest, Pecan Street is partnering with us on that grant. What we want to do is the fact that we are seeing increased penetration of distributed resources as well as extremely low consumption and trending lower consumption within our service territory.

So how do we go about getting to that glide path of ensuring we continue to remain reliable, but as well as affordable? I think the shines grants which means sustainable holistic integration of storage and solar PV. That's a mouthful. We'll talk a little bit with all of you as to how we get there, but we need technology and that is why I'm so supportive of DOE's support. In my opinion, you need almost a man on the moon to put a man on the moon effort as it relates to R&D if we are to get to that level of sustainability in what is otherwise a short period of time. And you also have to meet customer needs. And our customers are increasingly engaged. They are engaged on steroids in Austin. That means they need more choice and better service and energy management that is seamless to them in their lifestyle. They are digitally engaged and if the gentleman over there could show us what an Austin Energy customer in the future might look like, it is something like this. So, Google and master partners with us. This is the holistic -- this is a utility joke, okay?

[Laughs]

So, can y'all see it in the back of the room?

[Reading]

There you go. It's that type of holistic experience that we look to. We have got to make it easy and simple to do business with the utility and be aware that there are new players and new actors on the scene and that is a complex problem and we can't solve it on our own. So, I look forward to the questions y'all have and thank you so much for inviting me.

>> DOUG LEWIN: I guess it's a good thing that nobody -- to have to respond to that. That was good. Hello, good afternoon. I'm Doug Lewin, Vice President of Regulatory Affairs and Market Development for CLEAResult. Before I get started with my prepared remarks, I want to say thanks to Chris and John Richards, and the whole crew that put this together. For those, congratulations if you're still here. You were here all morning. You're the hardy ones. It was a great couple of panels this morning, obviously though panel three is great too. Glad to be a part of it. So real quick before I jump into it in case you don't know who CLEAResult is, we are a leading provider of energy efficiency solutions for utilities across North America. We have 2700 employees working with 200 utilities in 70 cities across the United States and Canada. We have teams of energy experts, technologists, engineers and marketers that help with the grid-edge to use energy more efficiently. Work with 22,000 contractors on over 900 programs in virtually every sector including residential, commercial and industrial. So, that's who I am and who our company is. A lot of people talked about today, you heard it said over and over again in different context, the electric and gas utility industry is in the midst of a major transformation. States, advocates, utilities and service providers are struggling to find regulatory and business models to the Secretary's point this morning, we need policy innovation.

Regulatory innovation. Business model innovations. Struggling to find models that fit this paradigm. Until recently, the industry and the regulatory model that supports it were oriented towards one main goal, build infrastructure. We take electricity for granted now but as recently as 1970 according to one survey, 30% of consumers didn't have a single T.V. 40% doesn't have a washing machine and 85% didn't have a clothes drier. The current model in place now was built to ensure mass electrification. Everyone wanted a clothes dryer and a colored T.V. and lack of electricity was not going to hold us back. And let's acknowledge this fact. The regulatory model was successful. It worked. We have highly reliable, safe and affordable electricity and it is nearly universal in the U.S.

It worked by giving utilities a higher return on equity to build, build, and build more. But today, load growth is projected 1%, higher, varies by region, Texas is a little higher than 1%, around the country it's at about 1%. But growth has been consistently flat as the country came out of recession. Sales last year were roughly equal to 2007 even though GDP went up over 10%. We

need infrastructure and utilities will continue to earn on those investments, but the question is being asked from California to Utah to New York to Texas, how much is needed? And are we incenting the right types of spending? How do we align utility interests with increasing efficiency? Let's take an example. Say utility could spend 50 million dollars to upgrade transmission and distribution infrastructure and I have to preface this, this is grossly over simplified. I only have 5-7 minutes. Or spend 40 million dollars to reduce demand so it wasn't needed. WIth a 10% rate of return on either way, most times energy efficiency doesn't earn that same rate but let's say it did, the utility would lose a million dollar by reducing demand. So, in what could be described as sane and financially responsible behavior, utilities want to spend 50 million dollars.

What if they could earn 15% on distributed energy resources like energy efficiency and demand response? Now they make a million dollars more. 40 million, 15%, they will get 6 million instead of 5 and it would be sane and financially responsible to opt for DERs. Meanwhile consumers would be on the hook for 46 million instead of 55 million. It's the quintessential win-win but it's simply not done yet. Partly because it is far more complex in reality than this over simplified example. This is the fundamental question we need to address if we are going to maximize activity. How can utilities earn more from DER deployment than from conventional buildings? In tandem, we need to focus on technology and consumer engagement issues. The description of this session alludes to the digital and information revolution going on. Nearly 40% of customers nationwide and over 90% as we heard this morning, 95% of customers in ERCOT, now have smart meters which provide potential for utilities and third parties to target energy saving measures. Companies like ours focus on bridging the gap between the customer and the utility and the grid. The energy services industry over all, is focused on the grid-edge consumer interface. We are able to leverage insights with gains in analytics, to provide quick and actionable information to consumers. This convergence between program data and information is where this is rapidly emerging. The convergence of services and technologies are enabling a more flexible grid. For example, the services industry can deliver a suite of solutions including energy efficiency, HVAC, lighting, insulation, paired with connected devices, and storage, giving the home and business the potential to be a dynamic revenue source. Pricing structures, time of use, coupled with data analysis from smart meter deployments further enable the grid-edge to become an active activity resource to address grid issues whether by intermittency, outages or unexpected spikes in prices. We have to remember, for the vast majority of people, the most basic energy information is often difficult to access and even more difficult to analyze. One of our most successful programs is called resource management services which we implement for our client energy in Texas schools. We start by organizing utility billing data, often unorganized for entities with multiple buildings and departments and then later on analytics at 15 minute increment data. With customize solutions with a phase approach and the first year or so, it is mostly operational or behavioral in nature including retro commission.

This is in line with our approach we call people first, building second. So we address the operational and behavioral and low hanging fruit first and then get into revenues after. So we will then move on to lighting, HVAC controls, and by that point, where in management has literally proved the value through financial savings and is becoming more important across the organization. We can then pursue deeper retrofits including building envelope, water heating and the recovery and renewable energy system. I know I'm going over but you went over. I'm almost done. Sophisticated control systems have been in play for a long time. With the help of utility programs, they are increasingly delivering high quality data in real-time. The decision logic is becoming extremely refined and automated giving building similarities and managers a greater and greater opportunity to implement effective strategies to manage use and demand response forge distributed generation to their advantage. The grid-edge is full of opportunities. To maximize the potential of the grid-edge, we need to address the issue of utility business model. Utilities are rapidly moving towards cleaner sources of energy in the interests of the U.S. I want to read you a quoted from Brian Wolf, Executive Vice President for Public Policy. Said, "If it doesn't fit in the clean energy, grid modernization or a focus on the consumer, we are not doing it anymore." I'm going to read it one more time. "If it doesn't fit into clean energy, grid modernization or focus on the consumer, we are not doing it anymore." Let's figure out how to put the profit motive behind that trend that is already underway. If we can find a way for utilities to earn more and consumers to save money while strengthening the economy and improving the environment, the grid-edge will become the leading edge of energy transformation. Thanks for the opportunity to speak today. Look forward to discussion.

>> JIM STEFFES: I want to thank The Department of Energy and University of Texas for the opportunity to participate in the panel. It's a pleasure to be here in Austin and discuss our energy future with some very thoughtful leaders. To put some context on my comments I'll talk about Direct Energy and who Direct Energy is. We are the largest competitive energy and energy services company in North America serving close to 5 million customers throughout the United States and Canada. Including a very large number here in Texas. We are also one of the -- Texas -- competitive grid suppliers of electricity. Last summer we served 20,000 megawatts of peak electricity load during the summer. Without owning any generation. In addition, we provide our customers with home services such as air-conditioning, plumbing, electrical services to help and repair and replace energy equipment. Together, more than 5000 employees in North America are focused on helping customers better understand how their day-to-day decisions impact energy use and bills, in our goal to empower our customers to become more energy efficient. In short, our business model is designed to help our customers from individuals to families to homeowners to businesses of all sizes use less of what we sell. That may sound strange but we believe that we are giving our customers the insights and knowledge they need to make smart energy decisions our customers remain with us over the years as we continue to help them on their energy journey. Here in 2016, technology makes our lives easier in many ways. The smartphone App we can order lunch. We can buy a new pair of shoes. Last week we could order an Uber car here in Austin.

[Laughs]

But while many industries have been disrupted by technology innovation, unfortunately, not much changed for electricity consumers. At Direct Energy, we want to change this. We believe that consumers want to control their energy usage. The key is we must put technology in easy to understand insights into their hands at the right time. Let me share a couple of ideas that we are doing today. A few years ago we launched a program here in Texas that coupled energy bill payments with daily text messages to customers' phones telling them how much money they spent on their electricity during the prior day. Each day participants would get a text message that said today was a 4 dollar day or 7 dollar day or 13 dollar day. They were linked to how much money remained in their account. It was timely and easy to understand and gave a clear signal into what they were doing. One customer called our new program a brake pedal for her electricity bill. Most importantly we found this program worked to help people manage spending and usage. Customers in the program reduced energy consumption by over 10% and sometimes by more than 15%. Those results convinced us that consumers would respond to insights and we move forward with additional innovation.

We have a partnership with a learning thermostat and developed sophisticated algorithms with others data science officials to enable us to give customers detailed insights into energy usage. Those efforts led to our Direct Energy platform currently available in Texas and assuming we get the right data elsewhere, will be available across the country. The district energy platform allows customers to view a dashboard that includes information about how much energy each major appliance is using and what it is costing in dollars and cents to the kilowatt hours. It's a grocery store bill for their electricity. No longer do customers have to guess why their bill is going up and down. They can see their air-conditioning is running hard and link it to their bill. We are doing this across the country but we are not able to do it where we don't have access to the smart meter data that has been deployed nationwide. We have over 50 million meters across the country. I think this is where we are going to go and I think more and more people realize that solutions technology and business models are incumbent upon having access to the data. Data which is being created today but not fully utilized. We at Direct Energy stand ready to help policymakers think through these issues about how to get this data and use it effectively both to protect consumers, provide security and maintain reliability but unleash the creativity out there we can use today with customers. We have also deployed something on the business side called panoramic empower. Panoramic power deploys a small piece of hardware which captures device and circuit level information every 10 seconds and able to provide energy in business performance. In Texas, in Carrollton farmers branch independent school district we did a pilot up there. In three short months, the -- in two months the pilot found 23,000 dollars of savings for the school district. Simply because they were running food warmers, water heaters, air-conditioning at the wrong time. It's not that they didn't want to do it, it's that they didn't know.

Here is two examples of a company that sells a lot of electricity, wanting to drive innovation for our customers helping to drive down consumption, again, our goal is to leverage technology innovation to help our customers use less of what we sell. I share these examples with you to demonstrate how competitive energy retail produces innovation and benefits our customers.

For my company it's a business model imperative. It's central to where we are going over the next few years. Competitive retail energy firms like ours are the conduit to consumers. In 2015, the study found that 14 retail markets Texas, New York, Massachusetts, Pennsylvania and beyond, showed more than 17 million households were buying electricity supply through competitive retailers more than 70% of the eligible load. Nonutility suppliers are engaging consumers in a different manner. I'm glad that we are invited here today. My hope is that the Department will continue to reach out to firms like Direct Energy to consider how to advance our country's broader goals of energy affordability, sustainability and resiliency. The energy model is changing. Direct wants to work with all the players in the area old and will new to create a better 21st Century economy fueled by a more consumer-driven, digitized and personalized energy world. Thank you and look forward to questions today.

>> MATTHEW LYNCH: Hello, everyone. Thank you for being here today. Again, thank you to the DOE and UT for hosting and putting on this event. I'd like to say we are very, very happy to help represent the Texas energy ecosystem today. I think this board is a great example of cooperation within this sector in Texas. For example, just before this I was talking with Brewster and we have been able to work with the Pecan Street with some of the things we developed. This is a great panel and really happy to talk with you today. So, we talk about the grid-edge. That is exactly where my expertise, my background and where Bractlet lives. We focus on beyond the meter, getting all the data that is beyond the meter and using it to our advantage and to the customer's advantage. But then again, we also need information from the utilities. We need pricing information, interval data and things like this. So we really do represent the grid-edge in this ecosystem. So, to put context on my comments today, I'm going to talk a little bit about Bractlet. At the end of the day, Bractlet is here to drive forecasts and sustain energy efficiency in a scalable way in a built environment. As a background, we worked with a number of different stakeholders, energy service companies, we worked directly with end users and we work with the chemical contractors. We worked in hospitals, many factory and industrial and large commercial and even school districts. And so, what have we built to date and how do we do what we do? We have a hardware and software platform that is installed in the buildings, it's a ton of data from that building for 200,000 square foot building is about 100 million data points per month.

This is through our own sub meters we built-in house. We collect data and upload to the cloud. So, for us, we then use that data to simulate and forecast how the building will work in the future and then we have a database of savings measures that we find, what is the perfect payback for that building?

What we are trying to drive is a mass customization model by leveraging data. Every building is different. We want to address that but also drive energy efficiency at scale. And so, the things I'm going to talk about or what we are thinking about, one of the big ones is really what is holding energy efficiency back? We know that the investment potential is there. We know that technology to install into build suggests there to save energy, what is really holding it back? And so, one of the largest things is that the buildings that are out there, they are constantly aging. And they are never quite up to par working as efficiently as they could.

One of the things is that energy efficiency is seen as a one-time large capital investment, which makes it difficult to sell to a lot of building owners today. Another issue when you go to end users, is the risk that they won't see the paybacks that you're telling them. There is also what we call a fox in the hen house situation that there is also uncertainty and trust issues out there when it comes to energy efficiency. And one of the ways we are really looking to help this and the ways we think this should be placed across the industry, one is better and more accurate. Quantifications of savings. So in a building, being able to forecast the savings accurately and then equally if not more importantly is after they are implemented, being able to quantify those savings accurately.

And not just have the whole building level but at the individual savings measure level. This will drive trust and sustain savings in that building. The other thing we see is business models need to be flexible. They need to be flexible to address maybe shorter term paybacks that the customer wants. Also flexible on how they finance the energy savings. Every building out there and the purchasing power of every building is different. Some people like shared savings, some people like to finance their own projects and some people want financing from another source. So, flexibility in the business model will be key. And lastly, quicker and easier access to information. For us, that is what we want to provide. We want to bring more data to this equation to drive trust, credibility and accuracy and forecasting energy savings and verifying them. So, for us, at the end of the day, really what we want to do is attack the verticals that may not have energy services available to them as much in the past so we are looking at again, large-scale commercial, industrial manufacturing, and bringing our solution and energy efficiency to those verticals so we are very happy to be here today and to answer questions from the audience.

>> CHRIS KELLEY: So our plan is to just take questions –

[Off Mic]

when the power goes out. So yet we talked a lot about customer engagement here. So my question is, the extent to which you feel that this is important, do you see where utilities exploring customer engagement and do you see customers really looking for more customer engagement beyond the two instances I was just talking about? I see you nodding. Do you have -- Debbie you want to take that?

>> DEBORAH KIMBERLY: Clearly, the two opportunities that utilities have are to make the bill paying process easier but let me ask a question. Do you know what one of the biggest drivers of customer satisfaction is when it comes paying their utility bill will?

Any guesses? She is asking Moderator a question. No? Paying the bill, they want to pick their own bill date.

That is in the research that I conducted over the years, the single biggest driver of customer satisfaction. Why? If you live on a fixed income and your Social Security check arrives on the 15th of the month but your utility bill is due on the first of the month -- what a simple way to make it easier. In case of Austin Energy it's a challenge because we bill for all the City services. That means Austin (inaudible) garbage pickup, water, acronyms, transportation, drainage user decease when I first posed this idea they said we have to have individualized routes for reading water meters. No, you don't. There is a simple thing called holding the utility bill to a certain date so you can bill those customers. We are a 1.4 billion dollar a year company. We can figure a way out around it. Single biggest driver of customer satisfaction. What is another one? Outage restoration.

We had a bunch of those. 22,000 customers without power a little over a week ago. Strong storm moved through. 70 mile per hour straight line winds. Snapped wood poles like they were matchsticks. We don't have, you talked about two-way AMI meters. We don't have a full roll out of that yet. And how do we know when a customer is out of power? A lot of times when they pick up the phone and tell us. They want a general idea of when they are going to be restored so you need to have an all of the above approach to communicate with your customers. That means Twitter, that means e-mails, that means public service announcements. So, those are two of the biggest ones. But here is another thing where I'll take you on the on the poll outage and bill thing. Any customer that was born after the year 1983, has been connected or Brewster put his cell phone away. They have been engaged, digitally –

[Off Mic]

>> PANELIST: He is within reach. I can grab his smartphone. They have been engaged since 1983. They want to know exactly what Direct Energy is doing. How much did I use today in dollars? And they want to keep a running score. Running track of how much they used. And they like to keep those costs down. And they even like to compete with their friends in terms of how little they use. So, you got to get outside the typical mind-set of it's just a bill, which some customers don't even get in writing anymore. Taken in the case of prepay. They don't get that in writing. But they want to know what they are using and how, especially for those millennials and I can see some of you on out there. What am I doing to save energy and avoid leaving the environment in a worse place than it was when I was born. And that means what have I done to save greenhouse gas emission, socks, knocks, water and all of the sorts of things. So the consumer public is much smarter than people give them credit for. I think it needs to be an all of the above approach.

>> JIM STEFFES: Maybe I can rephrase your question. I think the understanding that we had or the general view has been or hypotheses in the industry is that consumers are not engaged with electricity or energy. The fact of the matter is, consumers are very, very intelligent. If you get a bill in September for your August usage, why would I be engaged? I have no ability to control what is going on. So if we are going to basically say what we did in 1972 is our understanding of consumers, I think we making a huge mistake. I mentioned prepaid. If

consumers engage with the bill, why are we only billing them 12 times a year? We send people in the industry for years, 12 pieces of bad news a year a month after they did what they were doing. I mean, of course they are disengaged. No control.

I think fundamentally with the rise of advanced meters and the rise then of products aligned with consumers diverse preferences, I think you'll see more and more engagement because there will be more and more control. Then I think that is what we have to start with. The earlier panels again I think come at it and I think we have so many issues in this industry and I think we have to collectively work together. But if we don't put our customers consumers first in this conversation, this energy conversation, this 21st Century energy conversation, I think we'll once again miss the boat and miss the opportunity to really find the valued that they have, and again it's around affordability, sustainability, and resiliency. Those are the elements we have to drive. Consumers are ready to go. It's up to us to deliver products to help them find a way.

>> MATTHEW LYNCH: This is probably more of a symptom of this. One thing we typically see is that energy efficiency is typically gone up when something breaks. Mechanical system breaks. That is the time for the large capital investment. Which is of course leaving a huge opportunity on the table, there are already things people can be doing in their buildings now to save electricity. So, one thing that we think is really important is that when you walk into a building, very rarely will something break that day so suddenly they think of well, it's time for me to invest into my building. And so that is why it is so important to have an understanding of buildings. They're need to be lower payback measures and go to a building with that works for them any day you walk into the building because opportunities are there. And then a sustained engagement that building so that maybe when that system does break, they are thinking of a deeper retro fit. Now they have data, they have the knowledge to really invest smartly into their building and drive well energy efficiency and operational cash lessening that we know is available to them. So that is -- we want to make them think of energy efficiency not just when they are probably crippled HVAC system breaks but before then. Be more proactive in driving energy efficiency in their buildings.

>> DOUG LEWIN: I agree. I think there is a lot of focus on this question right now, what do customers want? And obviously, it starts with acknowledgment that customers on modeling. Even within a sector, millennials or baby boomers or different kinds of demographics, even within those they want models. So customers centricity for utilities whether they be retail electrical providers or vertical integrated utilities is a different thing -- vertical. The key is to provide a suite of different solutions. Some customers will want to be real involved with daily updates and constantly looking for what can I do day in and day out to reduce my carbon footprint, save money -- carbon footprint. And the others won't be as interested. But I think from an energy efficiency point of view, we should never accept there is anybody that wouldn't want to save in some way. If they are given the right set of choice and present it in the right way. I think what we are seeing is an explosion of that kind of segmentation and really targeting down to not judge market segments but sub segments and sub segments. We'll see

more and more of that as data gets better and better. I think that is something that all of the utilities again, regardless of whether they are competitive or very quick –

>> BREWSTER McCRACKEN: I think the customer engagement is -- there are actions to build customer satisfaction and trust and more precise and timely information, that kind of stuff does build more trust and satisfaction for customers. But there is another level of customer engagement from a grade operator's perspective which is, can you mass the actions of hundreds of thousands of people to produce predictable results? And I think it is pretty mixed on that. Demand response leverages people's tendency towards inaction by saying we are going to change your thermostats, most of you won't bother to. That's very valid. It is a deep insight into customer engagement on a mass scale. So, I think customers clearly do appreciate accurate, timely information that is relevant to them and specific to them that builds trust with their provider and then you're trying to say, we are going to get all the people in the program with DRs to suddenly act independently so we can keep the grid under control. That is the much tougher hill to climb.

>> CHRIS KELLEY: Thank you. So, we have been talking from the customer perspective and we only have one utility here today. We had some of the previous panel we should have asked when they were up here but I'm curious, so it strikes me that some of the changes are to utilities. Sorry. It strikes me that some of the changes we are talking about when it comes energy efficiency they pose a throat traditional business models for utilities. And some of the other new innovations we are seeing here. So my question is, not only to the utilities but to those who work with customers and with utilities, are you seeing utilities embrace these types of programs? Are they seeing it as a challenge? Could you speak to that a little bit?

>> DEBORAH KIMBERLY: So you're going to give me a bully pulpit because Austin Energy is a utility not motivated by profit but public power who masses along returns to dividends to our customers in the form of low prices, has been doing this for 30 years. So, it's not as though it's anything new. But what else are we doing? You look at other opportunities, so for example, to grow revenues. We have an electric vehicle program. We have 250 public charges stations around Austin. But where do you think most customers charge their vehicles at?
Home. 90% of our customers who have electric vehicles charge their electric vehicles at home. And we recently rolled out to your point, a time of use pilot to incentivize those customers to charge-off peak and by the way, if you charge on peak, then there is a price signal that is associate with that. That is a way to grow revenue. So on the case of Austin Energy, for every customer that gets an electric vehicle, that is 400 dollars or so a year in revenues thanks to the fact they are using electricity in a way that otherwise they wouldn't have used. And by the way, it is also reducing greenhouse gas emissions and good for the environment. So I think that is a good thing to do.

I think there are also ways to bundle products together. So I did. And Mark Stroma is a good friend of mine at Google fiber but there are other things you can do to bundle products and services together. So instead of going out and single shotting your approach and selling a bunch of different products and services, who knows so much about their customers? Electric

utilities do. We send that annoying 12 times a year bill, right? And maybe a month or 6 weeks after the end of the -- but we know about their consuming habits. So you can develop multiple options in terms of price plans that fit individual customer's lifestyles it's not a one-size-fits-all approach. I come from a place where it is not unusual to be 120 degrees in the summertime and I am conditioned now, conditioned, to use energy off peak. Even though I don't have a time of use offering in Austin, Texas. I do all my laundry and use the bulk of my energy off peak. Here is how else to make money. Have enough of those demand response offerings and you can monetize that by bidding into ERCOT. Is that another way to make money and by the way hedge prices, and keep your customer prices down. Those are just two examples of thinking outside of the box and maybe three of you want to consider the bundling one, of ways we need to adopt that new mind-set you talked about Jim, and not be the 1970s utility and not be in my case, the dumb old utility gal or no offense Doug. You haven't heard that acronym?

>> Oh, man!

>> That's a utility humor. Second one today.

>> DOUG LEWIN: I hope that doesn't stick to me.

[Laughs]

>> Utilities don't get into the comedy business.

>> DEBORAH KIMBERLY: Just trying to lighten up your afternoon, folks. So I look like you're –

>> CHRIS KELLEY: Jim?

>> JIM STEFFES: So where not a not for profit utility, there are two utilities up there, I guess you're referring to me? Yes. That is an interesting -- and one of the points I tried to make early on is, I would not consider myself to be a utility. We at Direct Energy own no wires or pipes. We utilize other people's wires and pipes like Encore. And we do that across the country and in New York City we do it with Con-Ed. So, we do like I said, serve over 20,000 megawatts of peak load without any generation. And that is across from California to Texas to Alberta to New York and New England. So, this is one of the issues I would again kind of highlight for the department and for the QER, is, the industry's evolving and clearly companies that are on the technology side that are bringing very unique either products or solutions to market. There are also, again, a growing part of the sort of nonutility supplier business. So I'm a utility in many people's mind or a retailer but I will tell you, 15 million households across the country are now being served their commodity needs by companies like mine and I think engaging this sector, this new growing sector, is important because I think we bring a unique lens. We bring a unique customer lens. As a for profit seeking enterprise that has shareholders asking me for specific return, and they ask a lot every day, they still are comfortable with our vision and our goal of helping our customers use less of what we sell. So there is -- I think you can find a way

in this new business model. We are trying to do that very clearly and working with the whole industry we can get there together.

>> CHRIS KELLEY: Other comments?

>> DOUG LEWIN: I'm glad you asked the question. The example I gave in my prepared remarks fits either in the regulated poles and wires segment within Texas, we call TDUs or TDSP, transmission distribution service providers or in a vertically integrated investor-owned utility model. You're in Texas and here because you want a different regional perspective. You got them on the previous panels and some on this panel. We are a mix of municipal, co-ops and investor owned TDSP and electric providers and energy service companies. It's a fascinating ecosystem. So, similar to the answer for customers, there is not on the business model side of things, it's not a one-size-fits-all for all different areas within there. But I think the competitive market where Jim and the retail electric providers are, there is very interesting innovation happening there because there are price signals associated with that and exposure to peaks and a good business model reason to have consumer engagement and reducing peaks for investor-owned -- excuse me, for municipal at all times, Debbie was also talking about how the utility can actually fit into the market on both of those.

This is also customer satisfaction reasons for this. All kinds of different reasons. There is a difficulty in if you sort of back up and look at what is the most traditional sort of regulatory model across the country? This is a Quadrennial Energy Review so it's looking at the entire U.S. It's the dominant model in most of the country investor-owned. Coming up with that formula where there is a higher return on equity, higher profitability, which those two things aren't always the same but coming up with that right formula that puts incentive behind going after these technologies, which I define as include efficiencies, it needs a lot of focus. I think in Texas, we are seeing it happen at an accelerated pace from other places because of this very interesting diversity ecosystem.

>> Thank you.

>> CHRIS KELLEY: So, you did touch on a little bit on innovation and I want to stick with that theme. So if you were here this morning and heard the opening remarks, the Mayor of Austin talked about how this is a very innovative city. And we also heard from the secretary about mission innovation. I think he has a meeting on mission innovation this afternoon and doubling investment and Research and Development in the energy space. So can you talk on the grid-edge space, is there a need for further innovation? I mean, we are talking about very innovative products today but where do you see the gaps may exist?

>> MATTHEW LYNCH: I'll jump in. A lot of places of innovation we see, the DOE has already -- investing into. We are on a technical Advisory Board around the concepts of energy simulation. So, there are people in the room who are familiar with building modeling, building simulations. It's the analytical models you're creating to forecast how your building is working. But these are only as powerful as the data you have to make them accurate. So, what we are

seeing a lot of innovation around is how do we create these very accurate models at scale? And that comes around how do you get the data and then how do you insert it into this model and then have it real-time predict how the building is doing and what should you do? And obviously there is a ton of benefits from doing this. Advanced demand response programs like ones up in Chicago that we are involved in and these huge commercial real estate buildings that have banks of chillers and every day they are writing on a whiteboard how to run their chillers that day based on predictions. They can only guess and they can only kind of really squeeze the savings out of their building so much because they can only see maybe a few hours in advance of what nay should be doing. And that is why investment into how do we really make these simulations energy simulations, really work for utilities, really comes down to how to get more data into them, how do remake customers trust them? So that is where we see a lot of investment should be put into but luckily, like I was saying, DOE already has a large-scale project working on this for national lab which is exciting for us. So, that is where we see a lot of innovation happening on the technology side where it needs to continue to be focused on.

>> CHRIS KELLEY: Thank you. Did you have a comment?

>> DEBORAH KIMBERLY: I talked a little bit in my introductory remarks about the goal that Austin Energy has and the level of penetration of solar for example. So again, keep in mind, 2700 megawatts peak demand. We have about 34 megawatts of customer-side of solar and another 30 megawatts of utility-scale solar located at a plant outside of town. But big, big plans to get to more. You can't have a huge level of penetration within your load zone of an intermittent resource unless you can move to the next level of being able to manage that resource, go back to what I said about seamlessly interacting with customers. Is battery storage right now at a price that makes it really easy to deploy? No. That's why I'm so happy that we have been able to partner with DOE on the shines project because we are seeing some solar installations going in, especially on a single distribution feeder. Imagine a half megawatt or 875KW system going in all along the same distribution feeder. That is when you start to have real problems in terms of voltage variability. So we have to figure out how can we control it. And again, it means things like smart end burners. It means having the middle wear that you can use to control that. Yes, it means having battery storage at a level that can accommodate the production of that resource into the off-peak production hours for that resource. That is where I think there is a real need because again, when you go at a point on some distribution feeders where you do start to see measurable issues in terms of voltage variability and I'm all in favor of increasing the availability of solar and storage and we are seeing it right here on our own service territory with Tesla power walls coming into play here in the not do distant future.

Just because we offer rebates or incentives doesn't mean someone will take advantage of it and put something in. If you don't know where that is, then you need to deal with it. You have to find a way to deal with it. And the grid is pretty smart. But I don't think it's really at shall we say, the University level. Not UT standards yet. So I think that is where you need to see yet more innovation and getting some of that technology to a scale where it is affordable and

preserves grid resilience and reliability and power quality. Ask anyone of our large customers when they see even a small voltage sag as we saw a week or 10 days ago because of the storm that rolled through here, that cost them money. If they are out or seeing voltage sags and they compete in a global mark and -- market and suddenly they are experienced in repeated issues in terms of serving that facility, that is a huge opportunity.

>> CHRIS KELLEY: Any other comments on innovation?

>> BREWSTER McCRACKEN: Debbie, I'll let go and build on what Debbie said. We have about 1000 households in the United States doing consumer research. We have one neighborhood that has about 250 of those, and about 200 rooftop solar panels and another 60 or so have electric cars. First deal is, we found this three years ago. Electric cars are not a big deal for the grid. The assumption that people would be all charging at 5:30, maybe on the military base or some kind of corporate setting like that but it's not playing out in the real world. The charging patterns are more closely resemble electric drier use and air-conditioners. They all come on because there is an external prompt unrelated to the personal behavior called the temp outside. So if it is 103, you're going to get a tier up.

But electric car use charging is all over the map we found that. But solar panels are challenging issue for utilities that operate distribution systems. In part, for some factors while electric cars aren't a big deal, there is so much -- when it is distributed on the residential side, quite a few households are not home during the day and so, you have got particularly south facing system in the middle of the day particularly in the spring and fall, when AC is this part of the world is not going on, you're getting big jumps of electricity to add to the challenge of it is, that in the spring and fall in Texas, as an example, there are a lot of clouds so a heavy intermittency factor as well. So in the summer solar panels are not in our research -- they are producing a modest helpful benefit to grid operations because dry and sunny and air-conditioning use closely correlate. We have done the - looking at a couple hundred households and in the summer it's virtually in parallel. In the fall and spring there is no relationship. So, utilities get all this power just thrown intermittently on to the grid and it does cause additional -- in addition to voltage issues, the biggest one is total harmonic distortion. So I'm a history major. I'm repeating what some of my colleagues told me who are electrical engineers. Do not ask me that question. Except I'm told that say very big problem. But this gets into why batteries are not enough. Because like the Tesla power wall for instance, the program fills up and if fills up. That tends to be at 4:00 in the morning or 5:00 in the morning and then it's full. There needs to be some intelligent interface between a solar panel for example, and a battery that controls whether the battery would elect to charge verse when is it would discharge and then the questions are quite a bit more complex on that because you're looking at things like currently solar panels on a roof of a house.

One model is, it all goes on to the grid. Second model, it's a water fall model going into the house and gets used and the balance goes on to the grid. So if you have a battery to the system, then suddenly the question is, whether does the house pull from the solar panels? When does it pull from the battery and grid? Does the battery ever send to the grid? When

does it pull from the solar panels? You ad complexity of choices and the batteries on the market are not programs to do that kind of work right now. There needs to be almost like a routing interface. We are working with the Department of Energy on open source specification for precisely that. That is the reason why. This is a huge challenge and it is getting more challenging.

>> DOUG LEWIN: Innovation is a huge topic. I'll sort of point it towards two main areas. One would be just the innovation happening with data. Thing is a lot of what you're talking about. Just there is obviously so much data from the smart meters that are out there. There will be more as more and more solar panels and storage hits out there coming up with software like companies like Bractlet are doing to basically make the reaction and the integration smarter. But I want to move back to this question of innovation because there has to be a real reason to do it. If electricity is always priced the same at all hours of the day and it's all equal, there is still some motivation to do these things but not as much. There was a speaker, somebody was saying, we have 46% use of the electric grid.

Our capacity factor nationwide is 46%. With price signals we can even that out and increase the economic efficiency of the whole system. Just a couple of other points. If we do those things, if we can get the price signals right through regulatory and policy innovation and get the date at and usage of data better, which I think is happening exponentially with almost every single day, we then get greater certainty around what can happen. How much to your point earlier, how much energy efficiency is actually delivering and measure that in real-time. There is value there. We will be able to stimulate markets and create additional investment in distributed energy resources. That ties back in to the price signals. Those investments happen more if the price signals are there to yield that. The last thing I point out, it ties into all those things is just the automation of this whole Endeavor because if somebody at home has to decide when the power wall -- forget it. I don't care how -- when we are talking about different customers, even if you're really into it and hypermotivated, that is too much work. We have to be able to automate this to make it useful.

>> JIM STEFFES: To me, the Professor at Harvard writes on innovation. He mentioned there are three types of innovation, efficiency innovation which is what all the CFOs like when you take value out of the market and have a call center with 25 plus people or whatever that is. There is sustaining innovation changing a little bit around the product and then there is disruptive innovation. And I think in disruptive innovation often occurs when people don't seek to make today's product better but to find a completely new product. (inaudible) in the 1950s but nobody thought you would need a radio but somebody found that solution. We need to think about what is the (inaudible) of the nation. All of it to me starts, you asked about technology. There is some technology hardware side conversation but as much software side innovation that we need to be thinking about and again, I keep probably a broken record on this. It comes back to the data that we can find. We have clearly advanced meters are deployed and we have 50 million advanced meters and FERC puts out a great report every year.

I think one of the energy policy acts in priors years had that and I think we should continue that effort as a policy object and I have potentially extend what that report looks at and make sure we are really getting around that. The other thing I would say on this is, I do think the market can provide price signals. I would also, though, when I see more often is people wanting perfect price signals and I think we can probably have good price signals. So again in the competitive parts of Texas, I'm sure there is a rate engineer that would say the weekend should be priced at 2.397 cents kilowatt hours. But what we do in the market say call it free and make it simple for people to understand. If you make it as complicated as we like to make it, we lose consumers in the process. I keep coming back the gentleman from encore was right. You have to get the physics and the customers right. There is a lot of bright people in places like UT to get it right. But we haven't ever really gotten the customer side right. We need to keep working on that piece of it.

>> CHRIS KELLEY: Thank you. So we have time for one more question and then we'll do our final remarks from everybody. So, the last question I have is, really one around so Doug you talked about the better use of data. I guess this is just a broad question about data security and privacy. So, as more customer data and new technology systems are present on the grid-edge that we just heard about, how are your organizations dealing with this complex issue of data privacy and securing data? Any challenges associated with that? It's a loaded question. You're nodding your head, Debbie.

[Off Mic]

>> DEBORAH KIMBERLY: There is not a day that goes by where someone is not trying to hack into Austin Energy system. And a lot of those come from overseas. Some of those come from people that aren't necessarily shall I say, friendly actors in this space. There is also increasingly the in -- let me put it this way. A desire to help customers but every time you do that, you have to look at all the firewall protections you have built into that system. Here is one. You talked about prepay. We are looking at prepay. What are the data handling controls you need to have in place in order to be able to enable that prepay system? And it's not simple. So I think all utilities these days are really, really concerned about this issue. There needs to be robust data handling controls especially when we are partnering with other organizations to reach out and make our products and services available. I never ever want to wake up and see on the front page of the Statesman above the fold, an article about a breach of customer data that you see with retailers elsewhere in the country.

I had my own Social Security number stolen last year and didn't get my tax return, and that is how I found out my Social Security number was stolen because I didn't get my measly 150 dollar tax return from the Federal Government. And when following up, I found out that well, my Social Security -- someone else got my 150 dollar tax return. So it's the sort of thing that really -- if there is one thing that keeps utility executives awake at night, it is that issue. How do we go about protecting the security of our customer data in a way that is hardened and continually hardened while we are reaching out to customers to give them the products and

service they need? I did not give you a direct answer to that question, Chris because I can say like Brewster, I was an International Relations major. So, harmony and all that stuff, no.

>> CHRIS KELLEY: Other comments on privacy?

>> BREWSTER McCRACKEN: The value of the data. This gets into what Jim said earlier. More price information is more use on the customers and value it more and it is also more personal. So if it thereby - auto more useful the data is, the bigger ramifications if it is hacked. Not to mention it's financial like if you have direct pay on your account or –

[Indiscernible]

So it's a really big deal and the higher the value of the service, the more the exposure if it is hacked, which speaks to why it is hacked.

>> DEBORAH KIMBERLY: One more thing and that is when we are developing at least at Austin Energy, when we are developing products and services right now, what we learned is whereas before we were sort of reluctant to include IT or information technology folks on the front end, we now have embraced including them on the front end because no matter what we do, we found that there is usually a data security and privacy issue associated with that. So where does the customer data reside? Where is it backed up? How long is that data maintained? All of the sorts of protocols now are thoroughly worked through with IT as a partner. So it is one of those things, especially as we utilize outside vend authorities we have -- I think we are getting better at but we are not all the way there yet -- vendors.

>> MATTHEW LYNCH: So, for our business model, we are connecting the systems. We are generating data and connecting to meters, putting in our own meters, connecting system and generating a whole bunch of data and saving in our cloud server. So, for us, this is a very pertinent discussion. One that we are watching closely and making sure that our tech staff is something that this is addressing. But you brought up the personalization. And the reason we collect all of this data is because that is what the consumers and the end users seem to want. They don't really like when you come in to their building with a cookie cutter set of 10 savings measures you sold to everybody else. They want to know that this is their building and the way to do that is that kind of mass customization model that is driven by data. So it is almost like a necessary but to drive energy efficiency at scale, but also you have to make sure that the firms coming in that are connected are doing it responsibly. So it is definitely something that we focus on and that we are very, very aware of.

>> CHRIS KELLEY: So with that, why don't we turn to our closing comments from everybody. Again, just a reminder, we'll give you two minutes to wrap up your comments, if you want to summarize things that you already said, if you like to underscore a few specific points.
We have the QER task force here. They are listening. As I mentioned to the last panel, quite a few of the recommendations that were made coming out of the last QER round did make it to

Congress and some of those have actually turned into legislation. So, definitely good forum for that type of comment too. So we'll start here with you, Brewster.

>> BREWSTER McCRACKEN: Thank you for having me.

>> CHRIS KELLEY: Quick and easy.

>> DEBORAH KIMBERLY: He did it again.

>> CHRIS KELLEY: Gave you plenty of time.

>> DEBORAH KIMBERLY: Here I was sketching out my closing remarks. You can tell I'm the comic or not so comic foil in this group. So, let me just say something. I have been in this business, I have been working for utilities and working with the electric utilities for over 34 years. So, by any standard, that is kind of the bulk of my career. And I can honestly tell you that over a third of a century, I can't envision a more exciting time to be doing what I happen to be doing. We are seeing an accelerating pace of technological innovation. We are seeing increased customer awareness. I don't view myself as someone who necessarily sells electrons or sells savings to customers. What do I sell? Because really if you talk to a customer about electrons, my electrons look just like the electrons that come from Direct Energy. I sell comfort. I'm selling convenience. I'm selling sustainability.

And I'm selling choice. Those are the things that utilities and non--utility players are looking at providing in this day and age. So again, do we need like I said, at the outset that moon shot focus on technology and innovation that can help us get to that last mile? Absolutely. But when I started down this path over 34 years ago, I figured I'd work in the business for a couple of years and then move on to something else. I can't imagine a more exciting time for young people to come into a business where you're seeing the level of transformative change that is focused on doing right by our customers, right by our communities, and right by the environment. So, that is how I would close. And I so appreciate the folks that are here from DOE and from the community and your engagement on this because that is the power of collaborative thinking that needs to happen.

>> DOUG LEWIN: I echo that a little bit. In echoing a lot of comments from earlier today, clearly, it goes without saying but I think it should be said anyway, that DOE has a strong and important role to play in R&D and some of the things just hearing Brewster talk about how power walls don't have that software in them and -- that whole playing that out like, thank goodness DOE and the national labs and entities like those exist. You have to work through those and I think that is extremely important to enable all of this. I do think and I appreciate again the Secretary's remarks this morning saying that policy innovation, regulatory and business model innovation are important. I think that ought to be part of the QER as you look at what utilities are innovating.

Actually Austin Energy with the tiered rate structure, paying less for if you use less than 500 kilowatt hours and more with each tier, those kinds of rate structures, the kinds of things competitive retailers are delivering. And then also the ability for investor-owned to be more profitable, more energy efficiency. More energy service coming into the area and to encourage that kind of innovation and evolution of the electric system. Requires putting their Number 1 responsibility which is a fiduciary responsibility to shareholders, that has to be aligned with those interests and I think while DOE can't directly -- because those are state decisions or local decisions, City Council or PUCs, that sort of thing, but I think DOE can play a big role in convening best practices, those kinds of things. So I think that is really important. I also want to make the point that utility programs on demand side management over the last 10-15 years has grown exponentially.

No reason why those shouldn't continue to grow. They give great value to customers. They give value to utilities and customer satisfaction. They also, when implemented, when designed and evaluated correctly, are able to be delivered for lower cost and other energy resources. So I think having that front and center is real important. And last but not least, there hasn't been a whole lot of discussion today of the clean power plants. Obviously a very controversial thing around the country but it is in the courts. We'll see what happens if it ends up making it through the courts, it would be a shame if states did not use energy efficiency to the fullest to make sure that costs are lower for consumers and that costs transitioned to low carbon economy are very, very low. Again I think DOE can have a big role in that. You can't goat some of the climate goals without strong emphasis on the demand side management and sufficiency.

>> JIM STEFFES: I'll just a couple of points and again, I think for one, try to make a point that there is a new segment quote competitive utilities that is something the DOE and other policy leaders should look to and try to engage. We are a very competitive business group. We like to keep things close on our vest. Engaging at the right level will bring insights back to policymakers and also help us to express to customers more what is going on. Deb said this, some of the revolution started sort of around the mid 70s in energy and sort of on the technology side and on the policy side. The consumer element of that is really the last 3-5 years. Hopefully people won't be discouraged at this point because we only reached 50 million in smart meters and the data is not yet fully available to consumers so we are still in a very early part of the laboratory. I think the other piece of this, as a cry as we think about earlier in the last decade, we talked about a clean tech or energy tech revolution. I was at a meeting in the Mid-Atlantic region and they were saying, why didn't the clean tech industry work? Again, it comes back and it wasn't me but it was people that from the venture side talking about, I said maybe we had great technologies but didn't have the right ability to sell those technologies to consumers. And I think that was a great point for us to continue to consider. And how do we bring that? Finally, an earlier panel talked about customer engagement and education insight. Consumers do want to engage on energy.

That's my core belief and I see it every day. We haven't yet given the tools to do that. I think we can do it but educating consumers about energy and safety and sustainability is critical. We talked about security grid and security data, security. The other word I hear more and more

and I think it is coming in -- I lived in Houston most of my life except when I lived in Philadelphia because there was a polar vortex I wanted to go through. So wherever I go, there is power out annuals. So you just avoid where I'm living and that is always a good thing. But I think the other question we talked about reliability for a long time. I think the word we hear more and more is resiliency and as a community, 21st Century economy, we need to make sure we are thinking about what that means from a resiliency standpoint and what does that require us to have our society and economy continue to work? Because the nature of the poles -- that is going to be happening. As an industry we need to been that and what does that look like? Distributed grid-edge technology could be a solution if it is thought through with the other parties W that I'll close. Thank you.

>> MATTHEW LYNCH: So I'll close with reflecting back on how do we drive efficiency to meet the goals that Doug was referring to? Why is clean energy efficiency needed? Realistically the current buildings that are currently out there they are going to be in our same building stock in 2030 so we can't build our way out of the efficiency debt we have. And this is all again due to the fact the systems aren't working up to snuff. They aren't taking advantage of the technology out there. So what we are looking at, the larger industry is looking at a huge imbalance between how much investment is being made into energy efficiency into buildings and the potential coming back to technologies that were created, technologies out there that aren't installed yet. So it comes back to how do you scale energy efficiency? So, there is kind of buckets here that I think will help us.

One is the flexibility, how do these get financed? There is legislation out there like pace financing that is helping. Of course flexibility on where the -- is it the company that is installing the energy efficiency measures confronting the financing? Is it coming from the customers themselves? Is it a savings approach? The ones who are bringing solutions need to be flexible for every building. Because every building will have a different purchasing model. Again transparency. Energy efficiency is confidence, trust issues, around is it building going to seat energy efficiency that the business is promising them? So transparency through data and allowing the end customer to really see that what you're evaluating is my building. And that is going to come through tons of data that we can delegate access to and that mass customization approach building owners need to know that this is not a cookie cutter model that has been given to similar buildings to them. That's through the access to all the different systems and all the different lower cost sensors and things that are out there. And then again back to trust. When you go into any Office of Any facilities department, trust in the results, trust that you're going to be sustained partner is a huge piece of the scaling efficiency. I will close with that.

>> CHRIS KELLEY: Thank you, mat. And with that, please join me in thanking our panel.

[Applause]

So at this point, we are going to make one more transition and that is to the public comment period. So if you did sign up to provide comments, what we'll do is calling you up to a

microphone to provide comments one by one in the order in which you signed up. We'll get the QER task force up here and then we'll get started with comments.

>> CHRIS KELLEY: So if you are having a conversation, if I could ask to you step out of the room because we are going to turn to the public comment period. I appreciate it. So joining me here up on stage are John Richards, Kate Marks and Larry from the Office of Energy policy and systems analysis here to listen to your comments. John, did you want to make some comments before we get started?

>> JOHN RICHARDS: I'm the Senior Advisor and Acting Director of single outreach for the Office of Energy Policy and Systems Analysis in the Department of Energy and I wanted to take this opportunity to thank our host here at the University of Texas. I think they did a great job. Maybe a few technical difficult at the beginning but seemed to have worked themselves out and I want to thank the Mayor Adler, Deputy Under Secretary Salerno and our partners in the USDA Rural Development agency. I want to thank all our panelists. I especially want to thank Brewster McCracken, a appreciate somebody who made something of himself as a former history major. I want to thank everybody in the room who are stalwart enough to have lasted through the entire day listening to what was an interesting but let's admit it, a little wonky conversation and I know that some of you here signed up for public comments.

If we can get in, we have a little bit of a time constraint this time but if 22 get it in, we can take more than who just signed up. The public comment period is very important to us. When the President set up this QER, he very much wanted there to be public involvement. As hard as we try to combine all of the viewpoints that are relevant on the dies at any one time, it's not possible but everybody who makes a public comment will get the same attention from the DO. And our administration partners as anybody who sat up here or anybody from a utility or trade association that puts in a public comment. If you don't make a public comment today, you also have an option of putting in something at our website www.energy.gov/QER and there is a comments portal there. And we have a July 1 deadline for public comment. You can even extend your remarks before July 1.

>> CHRIS KELLEY: Thank you. So the way this will work is, I'll call your name. I'd ask to you step up, state your name and your affiliation. We are go going to I have a microphone set up here for you. Just like the panelists you get a timer. We will stick to 5 minute limit per commenter. So the first person that we have on the list is Lindsay Hughes.

>> Lindsay Hughes: Thank you very much. I'm Lindsay Hughes, the Executive Director of the Texas Competitive Power Advocates. I appreciate the opportunity to participate on behalf of TCPA today to help guide policy discussions on the nation's electric grid. We are a trade association that represents power generation companies, wholesale power marketers and retail electric providers with investments in texts and ERCOT. The ERCOT wholesale market, I represent at the (inaudible) and you are the Public Utility commission. TCPA members provide a wide range of important market functions in ERCOT including development, operation and

management of power generation assets, scheduling and marketing of power, provision of energy management services and sales of competitive electric service to customers. TCPA members provide over 43,000 megawatts of installed capacity ERCOT market. That's more than 50% of the total net operating capacity ERCOT and they represent billions of dollars in investment in the state and employ thousands of Texas. We are dedicated to supporting and promoting policies that encourage a healthy wholesale retail market.

This guarantees reliable and affordable electricity for Texas consumers and now and in the future. As you heard today ERCOT operates deregulated competitive wholesale market relying on high prices to incentivize resource development in the market. Absent scarce iterating events, investors will not receive appropriate signals to support continued operation and encourage new projects. The combination of persistent, low natural gas prices and the regulatory distortions introduced into our market by the protection tax credit and the investment tax credit for solar have resulted in artificially low wholesale prices in Texas. The resulting impact leads to pricing outcomes that do not value the reliability of conventional generation provides.

TPCPA believes adjustments will be required to better support resource advocacy. The competitive ERCOT market has done more than just lower wholesale prices for consumers. It reduces NOx and SOx emissions and uneconomical power plants and replacing those plants with more economically efficient resource technologies projecting to continue. Sustained success of Texas depends on a diverse fuel mix that includes a multitude of fuel times, natural gas, coal, nuclear, wind, solar and hydro. Texas deserves credit for the investments it made in clean energy. Our state thrives when we allow businesses to compete and seen investments in research and development in energy technologies of the future, storage, batteries, et cetera.

Without the complications caused by Federal regulations and subs deeds. As the largest private owner of Texas reservoirs, our companies are committed to water stewardship and conservation. Although power generation processes use water resources primarily for cooling, they consume little water in the processes and most of it is returned to the source. Just as the electric industry is dependent on adequate wasn't supply, the water industry and dependent on electricity supply. Thus we are committed to working with to, imagery sources responsibly. Though the electric market is still evolving the, the essential building blocks are well-known. Diverse fuel mix is one factor that imperative to resilience including a reliable fleet of dispatchable generation.

The stakeholder process has been studying the resilience Working Group, planning geomagnetic disturbance task force, black start Working Group, the critical infrastructure protection Working Group and others to make sure that Texas is informed and prepared for a number of events to disrupt electricity. The lack of infrastructure -- low natural gas prices for foreseeable future and vast amounts of advantaged intermittent resources on our system. We believe the continued success of our electric market will depend on attracting and maintaining diverse fuel mix by invent vising operation development through adequate market structures. That's all I have if any of you have any questions.

[Off Mic]

>> CHRIS KELLEY: Michael Walsh. We'll move to Aden Smith.

>> Aden Smith: Good afternoon, my name is Aden Smith, Vice President of Transmission Strategy for the Southwestern Power Administration. Southwestern was established in 1943 and is a Federal agency within the U.S. Department of Energy. Southwestern operates under the direction of a principle administrator with delegated authority to carry out strategic responsibilities of the Secretary of Energy under section 5 of the Flood Control Act of 1944. Southwestern's mission is to market hydroelectric power generated at multiple purpose reservoir projects constructed in the southwest by the Army Corps of Engineers. Southwestern markets power and energy from 24 hydroelectric projects located in the states of Arkansas, Missouri and, Oklahoma and Texas. Power is marketed in those four states as well as Kansas and Louisiana to over 100 public power entities is including cooperatives, government agencies, and municipalities many located in rural parts of these six states. The hydroelectric power marketed by southwestern ultimately serves over 8 million end users in the southwest. Southwestern also owns and operates a transmission system to fulfill its state Tory obligations -- statutory.

We are privileged to provide comments for the record as a stakeholder in the electric utility industry and a participant in this second phase of the Quadrennial Energy Review. The stakeholder briefing memo prepared for this phase of the QER. And our brilliant panelists mentioned several issues of which we have firsthand experience and I'd like to talk of about two of these. The most significant of issues for southwestern Saturday availability of water. Hydroelectric power is the original renewable energy storage resource. Without water, we cannot produce power or energy. Southwestern's projects are heavily dependent on rainfall directly impact bide climate change. Southwestern is participating in Oak Ridge National Laboratory’s global climate change assessment analyzing impacts of climate change on Federal hydroelectric resources in the United States. This study preliminary shown that Southwestern's resource within the Southwest Region will experience greater volatility and the flow of water transitioning from extremes of drought to flooding conditions on a more frequent basis. Historically, our marketing plan has allowed Southwestern to respond to weather variability.

However, these impacts coupled with increasing number of requests for reallocation of the water storage from the reservoirs yield a significant level of uncertainty. Many of our projects are 50 years old or greater and equipment is wearing out and becoming obsolete. Southwestern's customers have committed to funding the recapitalization of these projects an estimated cost of 1.4 billion dollars. It is imperative that as water storage reallocations are contemplated, the increasing level of volatility climate change be considered and that southwestern and its customers be fairly compensated for impacts to this valuable Federal hydropower resource. The electric or hydroelectric resource that Southwestern markets is not only valuable to Southwestern's customers, it's valuable to the environment and to the nation.

An average year, environmentally sound energy market by Southwestern saves the American people the equivalent of 9.7 million barrels of oil, 3 million tons of coal, or 44.7 billion cubic feet of natural gas. This clean cost based energy also prevents emission of 4.6 million towns of greenhouse gas, carbon dioxide. Our high row electric resource is playing important part in environmental stewardship.

As regional transmission organizations are expanding across the nation and as energy markets are emerging and evolving, electric utility stakeholders are addressing resource adequacy focused on ensuring the future energy security of these and this brings me to my second issue. The hydroelectric resource marketed by southwestern has been a reliable source of clean energy for almost 75 years. Yet Southwestern's customers many of them from small rural communities, are experiencing the devaluing of Federal power and energy as reflected in the credit they receive for capacity and energy within these market resource adequacy constructs. It is imperative as new policies are created to ensure resource adequacy for the nation in the future that existing reliable and environmental sound resources are not devalued as a consequence. This concludes my comments. Thank you.

>> CHRIS KELLEY: So next we have Mike Nassy.

>> MIKE NASSY: Thank you for the time today. I'm here on behalf of the Texas Coalition and as a personal aside, I'm a big supporter of the Department of Energy programs and heavy user as you might say. A lot of good friends have been on the panel today. It's been a walk through memory lane. I'm an active participant in the research. My teenage daughter's electric consumption is being monitored right now. I'm plugged into a DOE City of Austin station right now and a solar panel distributed generation resource for the City of Austin. So, my personal passion for it is to carry out the energy for Texas, a group of energy providers from the money, co-op, and investor-owned utilities as well as energy producers including mining companies and consumers. The points I guess I'll make today verbally and will have written comments as well, maybe an emphasis on how great a partner Texas can be. We are here at a regional meeting. I'm not a native Texan, I got here as quickly as I could as the saying goes. Texas is a major player in terms of energy and probably reviewed to most DOE staff but for everybody to understand, with about 13 quads of energy consumed every year, that's more energy than the next two states combined. And in terms of industrial consumption a reference was made earlier, half of the energy consumed in the state is for industrial use. We make majority of the nation's fuel system chemicals and manufactured goods. Half of that consumption is in industrial sector. That industrial consumption is more than the next three industrial consumers combined, Louisiana, California and Indiana. Texas is a major participant in energy consumption in generation and can be a great partner and has been with the Department of Energy.

One comment I'll make in response to an earlier panel comment about coal. Obviously, we are very interested in preserving the existing investment it has in the grid and that includes our generation resources that are already built and retrofitted. With the coal fleet, in particular, that is roughly one quarter to a third depending on the price of gas in a given year, of the Texas

power fleet. We consume twice as much coal than any other state. Texas is a coal state. Referenced earlier to the fact that why would we import coal? Texas is not just a coal importer, it's the 6th largest mining state. We are a major producer of coal. So ballast energy cares about that industry and the role it played in the great economic success. One of the two remaining points I'll make in terms of DOE generally and these are more cheerleader comments than criticisms, one is to continue or insist upon good inner agency coordination. We have our members have major concerns about the lack of coordination, not by DOE but the environmental protection agency. And if the Department of Energy could be a convener of more coordination it would be a great thing. A couple of classic examples I'll bring to everyone's attention and the clean power planning was mentioned. The polite of the elect crick co-op. A lot of work I do and our members are co-ops. You heard from a couple of co-ops.

Neither of which are what you might call significant fossil G&Ts. Generation and transmission co-ops. The G&Ts in this state -- these are major players. When they built their coal assets in particular in set, it was illegal to burn gas in a boiler. The USDA was a partner in the financing. We as taxpayers are their banker. Had there been better coordination by EPA with USDA, there probably would have been a much better appreciation for the stranded asset of the co-op rate payer because the concept that investor owned utilities will pass through cost to the market is a great concept but in the co-op world, the co-op members bear the brunt of the assets they own. So when you talk about an energy policy that led to co-ops building and sequentially retrofitting a coal fleet and having hundreds of millions of dollars invested in those fleets and then having those assets stranded premature actually by environmental regulation, without a lot of inner agency coordination, that's a problem. Not DOE's fault but something to consider.

And we'll have more to say about this in writing. Partnership on carbon capture, sequestration and utilization has been a great success. The pelt row nova project by NRG is one we championed and I worked a lot with DOE on and we would hope that we would continue to have a true all of the above focus within DOE programs and that clean fossil energy CCUS, on gas and coal units will continue to be a part of the picture because from a global perspective, that is the answer to climate mitigation.

>> Thank you. Our next commenter is Matt Weldon.

>>MATT WELDON: I am largely representing myself as an individual and observer in the energy industry. My educational building is Chemical Engineering –

[Low Audio]

I thought all the panelists were great and the comments have been fantastic. I wanted to focus on maybe two ideas. Both premised on leveraging ERCOT's prior success in the market design. I want to make sure that we continue market system innovation within ERCOT and many people accepted on the role it had as a design leader. Both of the ideas focus on aligning our

markets to real-world needs did the physical world. So the better job we do at aligning our market design to the physical circumstances that we find ourselves in are beneficial. So one example of that is just increasing retail exposure to time of use pricing. It is a -- largely because of the information deficit. So the price of information, ease of which we move information as we meter. Naturally leverages the market so that we can address things like the so-called duck curve or choose to make investments in storage for energy deficiency. The second item, I want to go through some of the comments that all of the panels had.

There was much concern about valuing the challenges, assigning value to these programs. Rate transparency, cost recovery. These are just the words that people use repeatedly in the first panel -- repeatedly -- customer and physics. And then the third panel, we were talking about initiatives at the grid-edge. How to leverage the profit motive. You have to have a reason, a price signal. That was said repeatedly and much of the change that we are trying to implement and hurry is in the context of climate change. And so I find it fascinating that no point in time did we ever talk about carbon pricing which would of course be the most direct way to transfer that signal through to the benefit of every one of these actors because we have socialized the risk.

So we are making bad investments, we were just talking about some of these investments, because our market design does not include this very palpable risk. We are socializing that risk and if we can do or make any steps to internalize that into our price model of the market that would benefit us all. That could be the place where that experimentation takes place -- ERCOT -- we are an interstate utility. The clean power plant was mentioned and ERCOT produced a nice analysis of the clean power plan. They had CO2 pricing as one of the model options and of course if you look at it, compared to the regulatory option, if we are concerned about greenhouse gas emission, it showed to be more efficacious. A bigger transition in the fleet as a consequence of market pricing. And as a lover of the market and I'll bring in politics here, as a reliable Republican voter who is dismayed that the champions of the free market are not showing up to the field, so I hope that we don't leave what I would see as the best option as echoed by the majority of voters in polling, as echoed by the oil major, including to all and Exxon who have all said that clear market pricing would be their favored way to achieve some of these ends, I just hope that the DOE could - if they are not in a position to champion any such things, at least remind people that that economists agree it is the most efficacious and transparent way to achieve those ends. So I think I'll end my comments there.

Oh, I want to -- carbon capture and sequestration. It's hard to make money during carbon capture and our sequestration when the emission surpasses zero. That's not very favorable to developing that market. So Texas would be stellar in a carbon-priced market.

>> Thank you. Our next speaker is David Gerald.

>> David Gerald: Hello. I'm Dave Gerald and I am a technologist in the chip industry here in Austin but I'm here really as a private citizen. And I guess two points. One, I want to focus on the resiliency topic that people raised and the other is the regulatory. And the reason I care

about this is, I'm a child of the 70s when the DOE still had educational materials for elementary schoolchildren to understand their energy use. And that made an impact on me as a kid. And it stuck with me ever since. And, also I realize I'm a product of DOE and NSF programs. I mean, I went to a land grant college, I worked at a (inaudible). And then I came down to Texas to work at semi-tech, a DARPA and private industry partnership. And so, really I have been in that industry but in between, I have taken breaks and traveled. So I have seen like many people in here, I'm sure, earlier we had people from around the world a more mix of people, but we are really living in a luxurious bubble where we have all of our completely reliable power all the time. We have our Smartphones.

We have our computers. We have cell phones. Many of you may have traveled like me, to other place where is that really just is not how things work. I have put solar lighting up in Himalayas where their heating was (inaudible) and their lighting was from kerosene. Or in the Sahara where there is no grid. Right? So, the reason -- I would love to talk about all the other innovations that I want to work in as well, but I want to talk about the black swan type of event, the events that don't fit our models like a solar flare. And I'm a reasonable technologist. I'm not a prepper or anything like that. But I look at this like insurance where if you pay a little bit to prepare for an unlikely event, when it happens, you can deal with it instead of it becoming a catastrophe. So, Secretary Moniz talked about Sandy, Hurricane Sandy and how we didn't have the power to pump fuel. We all finish we couldn't pump fuel to distribute food across half of the United States, things would get ugly really fast. And so, I think with a small investment, we can prepare for this. We know how to do this technologically. Our Congress is not motivated to do this to free up the money for that. We know that. I guess I'm asking you in front of me, as you talk with industry leaders and everybody in this room, just lobby your representatives to deal with this so that we can prevent really catastrophic problems with known methods already.

That's my main point. This is something we can get done and we should get it done. Get it out of the way. And I'm talking about hardening transformers, cashing, the big power components you can't just UTS overnight -- UPS. And the second main point is regulatory. Especially in the Texas, regulation is say dirty word. I'm a progressive myself but I also want these markets signals to function properly. But, I want to inject this idea that regulation can be for the enlightened self-interest of the large industry players. I mean, it will prevent them from being undercut by to the bit players that don't care about the environment or their customers. And if they neglect that, then they get a BP oil incident or an Enron market incident that leads to overregulation. So it's in their self-interest, I think, to favor proper regulation before they are forced to. So if you could please feed that idea into your discussions I think it is worthwhile idea. Thank you.

>> CHRIS KELLEY: Thank you, sir. Any other commenters? That was the last person that signed up. Anyone else in the room care to comment? No? With that, I'd like to again thank you for your time today. We appreciate it. Our next meeting will be tomorrow in Los Angeles. Our meeting is adjourned.