

Quadrennial Energy Review
Second Installment
Electricity: Generation to End Use
Stakeholder Meeting #1
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Congressional Auditorium
Meeting Transcript

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Opening Remarks

CHRIS KELLEY: Good morning. I'd like to welcome you to the inaugural Public Meeting for the Second Installment of the Quadrennial Energy Review, focused specifically on the electricity system. Welcome to those of you here in the room in this lovely U.S. Capitol Visitor's Center. I'd also like to welcome those of you who are joining via live stream on the webs a well.

My name is Chris Kelley, I'm with Energetics. We are a contractor supporting the Department of Energy on this QER effort. 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 notes.

First, the QER Task Force welcomes comments from the public. If you wish to make a comment and have not yet signed up at the entrance desk, please do so now. And for those of you who are joining via the web, you may submit comments on a form that can be found at www.energy.GOV/QER. We have an outstanding set of speakers here today, their comments and presentations can be found after today's session at www.energy.gov/qer as well.

Before we get started. I'd like to read a short statement about the purpose of today's meeting. Pursuant to the Federal Advisory Committee Act, the purpose of today's meeting is to ask for your individual input or your organization's input regarding electricity 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, your individual advice, information or facts regarding this topic. The object of this session is not to obtain any group positions or consensus, rather, the U.S. Department of Energy is seeking many recommendations, as many recommendations as possible from all individuals at this meeting.

With that, allow me to introduce Ms. Melanie Kenderdine, the Energy Council to Secretary Moniz and Director of DOE's Office of Energy Policy and Systems Analysis at the U.S. Department of Energy. Ms. Kenderdine be introducing our next speakers.

MELANIE KENDERDINE: Great. Thank you. Thank you, thank you so much, and thank you, all, for coming. We've come a long way since we were all in this room before, on the first installment of the Quadrennial Energy Review. That was a -- we have kind of redefined quadrennial. Typically, the agencies who do quadrennial reviews do one every four years. We are doing installments, because the energy systems in the United States are so broad, and so foundational to everything we do in our economy that we wanted to get actionable recommendations. And so we decided to break this up into more discrete topics, and so, as Chris mentioned, QER 1.2, as we are calling it, is focused on electricity, the entire electricity system, and we are going to look at modernizing this system to meet our security, economic and environmental goals, including climate goals.

I would first like to introduce Representative Blumenauer and thank him for joining us here today. Last year we had Congressman Waxman, and this year Mr. Blumenauer, he is a longtime

leader in promoting investments in infrastructure, transportation, water and energy infrastructure. He represents Portland, Oregon, which is the headquarters of the Bonneville Power Administration. Obviously one of the department's important power marketing administrations. It operators and maintains about three-fourths of the high voltage transmission in its Pacific Northwest service territory. Mr. Blumenauer is a member of House Ways and Means where he has supported tax credits for wind and solar. We are pleased that you can join us today, Congressman, and we look forward to hearing your remarks. Thank you so much.

EARL BLUMENAUER: Thank you, Melanie. I will station myself exit stage left because I have to adjourn, unfortunately to - the House is in session this morning, I'm sure, doing magnificent work, and I need to be there to vote, no. But it is my pleasure to, on behalf of Congress, welcome you to this Congressional Hearing at Visitor's Center. And initiating your round two, going from the broader issues that you initiated earlier to a deeper examination of the energy sector. You may have noticed there's modest disagreement in the Capitol on some things regarding I don't know, climate science and whatnot. But actually dealing with the nuts and bolts of the electrical supply system, the challenges that we have, dealing with resilience, with capacity, with modernization, with research and development, which I think everybody understands that we are under-investing, in given the breadth, the strength, the size of that sector. And I'm absolutely convinced as a result of the work that you are doing here as we broaden the conversation, that we look deeper at what we need to do, that we're going to be building a consensus on things that we can do something about, that we will have assignments for us all to prepare the country moving forward. There will be more to do, and there will be less to argue about. I was just excited last week that the Supreme Court, by a 6 to 2 margin, decided that they would not read the Federal Power Act so narrowly as to quote, Judge Kagan, "Halt a practice that so evidently enables the Commission to fulfill its statutory duties of holding down prices and enhancing reliability in the wholesale energy market." Now why this was in controversy in the first place, I have a little difficulty with. But it's a 6/2 decision from the Supreme Court. I want us all to be inspired to think of how to build that consensus, that understanding and that movement going forward. And Secretary Moniz, I deeply appreciate your continued leadership and energy on so many things. You took away a little bit of energy from foreign policy to come back here to be able to lead this effort. We deeply appreciate your efforts and look forward to the result of the work and being your partner to get as much accomplished in the months ahead. Thank you so very much.

(Applause.)

MELANIE KENDERDINE: Thank you, Congressman. And next we're going to turn to Dr. John Holdren. John is the Assistant to the President for Science and Technology, and he's the Director of the White House Office of Science and Technology and Co-chair of the President's Council of Advisors on Science and Technology. Prior to joining the Obama Administration, Dr. Holden was a Teresa and John Hines professor of Environment Policy and Director of the Program on Science and Technology and Public Policy at Harvard. Some of you may not know, the QER process is run by the White House, and Dr. Holdren and Dan Utech are Co-chairs within the White House. And so let's turn to Dr. Holdren.

JOHN HOLDREN: Well, thank you very much, Melanie. I'm certainly pleased to be here as one of the two co-leads at the White House for the QER, for this initial stakeholder meeting in the second installment of the QER process.

As many of you know, the initial proposal for an Interagency Quadrennial Energy Review came from a report of PCAST, President Obama's Council of Advisors on Science and Technology in November of 2010. That report, which was requested by Secretary of Energy, then Secretary of Energy Steve Chu, in concert with President Obama was entitled: Accelerating the Pace of Change in Energy Technologies Through an Integrated Federal Energy Policy. And it turns out that the PCAST Subcommittee that led that effort was headed by one Ernie Moniz, then a professor at MIT, together with Maxine Savitz, who at the time was the Vice-President of the National Academy of Engineering and was a former Deputy Assistant Secretary of Energy for Conservation. And that report led by Ernie Moniz and Maxine Savitz, recommended a set of steps that would lead to a quadrennial energy review, designed as an interagency effort overseen by the Executive Office of the President, supported by an Analytical Secretary at DOE.

A lot of work was done through 2011 and 2012, both at the White House and at DOE and with the engagement of PCAST in thinking about how this QER would actually work, including carrying out at DOE in 2011 an initial quadrennial technology review looking at the technical options, their capabilities, their efficiencies, their costs. And when PCAST reported to the President on energy and climate change again in March of 2013, the group reiterated its recommendation for full-fledged QER. The President formally launched the QER a couple of months later, in June of 2013, as part of his Climate Action Plan. QER process as most of you know has been vigorously underway ever since then, using a moving spotlight approach, as Melanie has mentioned. The first focus of that moving spotlight was the nation's infrastructure for energy transport, storage, transmission and distribution. And that report, that first QER report, was released in April of last year. It was an effort of extraordinary depth, rigor and balance, and part of the credit for that, I think, goes to the series of stakeholder engagement meetings, held around the country in 2014 that started here, then, as now, in the Capitol Visitor Center's Congressional Auditorium. For me, personally there's a sense of déjà vu all over again around these events and not just because the first QER stakeholder event was held in this room, it's really because for me the relevant history goes back in time even beyond the PCAST reports of 2010 and 2013 to earlier reports by President Clinton's PCAST in which Secretary Moniz and I were both involved in our earlier incarnations. I was a member of the Clinton PCAST and served as the Chair of three PCAST studies in the Clinton Administration on Energy Technology and Energy Strategy. Reports came out in 1995, 1997 and 1999. And in the first Clinton term, Ernie Moniz was the OSTP Associate Director for Science, helped with the '95 study. In the second Clinton term he was the Under Secretary of Energy, providing moral and staff support as well as financial resources and personal insight into the '97 and '99 reports. Ernie subsequently co-led in the Obama Administration's first term, the 2010 PCAST report that proposed both the quadrennial technology review and the quadrennial energy review and now in the second term Secretary of Energy, has played such a big role in both, I think is kind of like a quarterback who throws a pass and then runs down the field to catch it. We're very fortunate to have had Ernie in both roles.

Of course, there have been remarkable changes in the 20 years that have elapsed since the first Clinton PCAST Energy Studies in 1995. Some of the most remarkable changes have happened in the last decade. Those changes affect the full spectrum of energy supply, sources and end uses, but I want to focus just very briefly on a couple of examples that relate to the electricity system, the current focus in the moving spotlight. In electricity generation, coal consumption, as you all know I think, has declined by about a fifth, while the use of natural gas and renewables has grown considerably. Since 2008, the amount of electricity generated by wind power has more than tripled, the amount generated by solar energy increased more than 30 fold. In electricity end use, lighting based on light emitting diodes, LED's was still in its infancy when Congress passed the last major energy bill in 2007, but today LED's are found everywhere and have resulted in huge improvements in energy efficiency in lighting worldwide. We're witnessing the advent of the practical use of electricity in vehicle transportation. Today there are 26 models of plug-in electric cars on the market offered by more than a dozen manufacturers; starting later this year we will begin to see the introduction of cars from more than one manufacturer with upwards of 200 miles of range on a single charge. I think that's he going to be transformative. And while it takes a while for new technologies to penetrate vehicle markets, the introduction of electric drive technologies in passenger vehicles ultimately promises to facilitate significant de-carbonization in the transportation sector. These changes are occurring in a broader context that is dominated by an increasing understanding of the scale and the impacts of global climate change.

Global climate change, of course, being brought about by human activities, most importantly the emission of greenhouse gases and black carbon particulate matter from the global energy system. As the third national climate assessment pointed out succinctly in 2014, "Climate change, once considered an issue for the distant future, has firmly moved into the present.". And I would emphasize that the basis for that conclusion is not theory alone or computer models alone, it is, in fact, a tapestry of evidence, weaving together basic understandings from physics, chemistry and biology. Many decades of observations by thousands of scientists at tens of thousands of locations around the globe. Studies of natural variations in Earth's climate over the millennia, based on sediments, tree rings, fossil pollens and ice cores and computer models that help us put it together in a coherent way.

What we know now about climate change beyond a reasonable doubt, can usefully be summarized in the form of five fundamental understandings. First, Earth's climate is changing at a pace and in a pattern that is not explainable in terms of natural influences. Second, the dominant cause of those changes is an increase in the atmospheric concentrations of carbon dioxide and other heat trapping substances caused primarily by fossil fuel burning and land use change. Third, these changes are already causing harm to life, health, property, economies and ecosystems. Fourth, that harm will continue to grow for decades, no matter what we do. Because of the momentum in the climate system and the inertia in the energy system, society's energy system. But fifth and crucially, the amount of future harm will be much smaller if we take prompt, strong, evasive action than if we don't.

All of this was already clear enough when President Obama took office. And in the first term, the administration took a variety of significant steps to address the climate challenge. Those included working with Congress to pass the Recovery Act that had in it \$80 billion. \$80 billion for cleaner, more efficient energy supply and use.

It included the first ever combined fuel economy greenhouse gas standards for light duty vehicles. It included a large batch of new efficiency standards from DOE for both residential and commercial appliances and it included the President's announcement already in 2009 of a U.S. target for national greenhouse gas emissions of around 17% below 2005 levels by 2020. All that was augmented in the second term, as I've already noted, with the President's June, 2013 announcement of his three pillar National Climate Action Plan. Again, as I think you all know, those three pillars are: first reducing U.S. domestic emissions of the greenhouse gases that are driving climate change. Secondly, increasing the nation's preparedness and resilience against the changes in climate that can no longer be avoided, and third, leading internationally, encouraging and helping other countries to do their part for global emissions reductions, and to take the needed steps to increase their own resilience and preparedness. Since the June 2013 roll out of the plan, the United States has made significant progress on all three of those pillars. In the first category the progress has included EPA's Clean Power Plan, aimed at reducing greenhouse gas emissions from the electric power sector. It's included a new national methane strategy and of course continued progress on energy and use efficiency.

With respect to increasing preparedness and resilience against climate change, the administration has launched the Climate Data Initiative and the Climate Resilience Tool Kit. It has embedded resilience priorities into the missions of departments and agencies all across the Federal Government. And it's reached out to state, local, and tribal governments and to the academic, private and civil society sectors, building collaborations to advance climate preparedness and resilience. As for international leadership, at the Paris Conference of the Party's last December, President Obama played a major role in brokering commitments by 195 nations to reduce their emissions of greenhouse gases between now and 2030. The agreement includes a mechanism to review progress on those commitments and provide opportunities for countries to increase the ambition of their efforts to combat climate change as new technologies become available.

Closely related to that agreement was a separate agreement by major emitting countries to increase the size and scope of their research and development on new clean energy technologies, coupled with a commitment by leading entrepreneurs to match that with billions of dollars of new private investment for bringing those technologies to market. The United States was a key leader throughout in those discussions and commitments. The work of this second installment of the QER, is going to be highly relevant to the task of helping our electricity system lead the world in reliability, affordability and environmental performance. The Climate Challenge clearly cannot be met, except with the help of advanced technologies for energy supply and end use, certainly including the electricity sector.

So let me close by thanking Secretary Moniz for his excellent work in helping us craft the first installment of the QER. Those thanks go as well to Melanie Kenderdine, who played a lead role in that operation. And let me thank Ernie and Melanie for the work that they and their staff will

be undertaking in the next several months to help deliver the second installment. And let me thank also the panelists that we'll be hearing from today at this stakeholder meeting and the ones who will participate in future stakeholder meetings for their insights and their cooperation in helping us make this second installment of the QER as robust and as useful as the first one was. Thank you.

(Applause.)

MELANIE KENDERDINE: Thank you so much, John. As I noted earlier, John and Dan Utech who I'll introduce next, lead a White House interagency process on the QER. That process includes 22 agencies from a management perspective, that is a very difficult but important interagency process that they lead. And they have been very, very helpful with us at the department in helping manage that interagency process. And thank you, John, I would underscore your words, reinforce your words about the importance of stakeholder input. We had a very large spreadsheet in EPSA of the stakeholder input and used many of the papers and documents and presentations that we received around the country in our stakeholder outreach effort to help put the final QER together.

Our next panelist is Mr. Dan Utech. Dan is the Deputy Assistant to the President for Energy and Climate Change. Prior to joining the White House, Dan served as a Senior Advisor to then Energy Secretary Steve Chu. That gives hope for people like me who are Advisors to Secretary Moniz on a career path. And Dan joined the administration after ten years in the Senate where he worked on a wide range of environmental and policy issues, let me turn it over to Dan.

DAN UTECH: Thank you for that introduction, Melanie, I want to start by echo Dr. Holdren's thanks to Secretary Moniz, to Melanie Kenderdine, to our panelists and to everyone else in the audience for being here today and on the web.

As John noted, one of our deliverables from the Climate Action Plan that the President put out in June of 2013, was the first installment of the QER, which came out in April of last year. And in that document we examined the vast network of wires, pipes, processing facilities, ports, water ways and railroads that transmit, store and deliver the nation's energy. We presented some 63 recommendations for modernizing transmission, storage and distribution infrastructure, to increase resilience reliability and safety of these systems. Most of the chapters of that document include recommendations that cut across liquid fuels, natural gas and electricity. The only sector that we touched on with its own chapter was electricity, because this sector underpins so much of the rest of the energy system and because the rest of the nation's infrastructure depends on electricity. Electricity is essential for economic well-being and our national security. And the U.S. has one of the world's most reliable, affordable and increasingly clean electricity systems.

At the same time that system is undergoing a transformation driven by some of the factors that John Holdren described and these include the shale gas revolution and abundant and affordable natural gas for power generation, steep reduction in renewable energy costs and increased deployment, flattening load growth due to energy efficiency gains and these are transitive and been accelerating in recent years, but I want to highlight three things that happened just in the last six months or so. First, in August of last year, the Clean Power Plan was finalized. This

framework establishes national standards to limit carbon pollution from existing power plants. It's projected to cut emissions from the power sector by 32% from 2005 levels by 2030, also cutting other harmful emissions from these sources. The plan provides states with broad flexibility to design cost-effective plans, to cut carbon emissions that are tailored to their states and their priorities. So for the first time ever we have a national framework in place to reduce greenhouse gas emissions from the electricity sector. Many of the people in this room have been constructively engaged on the Clean Power Plan and we really appreciate that and look forward to that continuing this year. Second, in early December, the world came together at COP21 around a historic, ambitious and enduring agreement to take real action on climate change. This agreement sets the world on course to cut carbon pollution and other greenhouse gases and it's a clear sign that the world recognizes that climate change is a real and growing threat and we are already feeling its impacts. John touched on some of this, but one of the key aspects of that agreement is it establishes a framework to ratchet up ambition every five years by driving down global emissions in the decades to come. So Paris signals the starting point, not the end-point of our global action on climate. And as such the Paris deal sends a strong market signal that the world is moving to cleaner sources of energy, both in the U.S. and around the globe. And third, and this is in chronological order, not in order of importance, but in the weeks right after the Paris deal and as part of the end year budget and tax deal, Congress passed long-term extensions to the PTC and the ITC for renewables. This action by Congress represents one of the biggest investments in clean energy in the history of our country perhaps only behind the Recovery Act that Dr. Holdren talked about and will provide a bridge to the Clean Power Plan in the remainder of this decade and into the next. So on top of the trends that I mentioned I think these three things that happened just in the last six months or so underscore the clear direction towards lower carbon energy, including and in particular, in the power sector.

At the same time, there are many related trends, factors, and issues that need to be considered as we think about the grid of the future. And that's what we hope to do in this second installment of the QER. So just a few examples. We know it that the grid of the future will need to accommodate an increasingly diverse mix of resources including central station, distribute generation, as well as energy storage and responsive load. An increasingly integrated system will have less distinct lines between bulk electric and distribution systems. Even the lines between the end user and the distribution system will blur with greater customer capability to interact with the grid. New technologies will alter how we manage and operate the grid, creating opportunities for more flexible, dynamic and clean system. The grid of the future will be supported by a secure communications network that transforms great quantities of data into useable information, to allow for better situational awareness of grid conditions, more precise dispatch of generation and increased resilience by enabling self-healing of grid disturbances. So to ensure that the grid of the future meets future -- excuse me, delivers increasingly, clean, reliable, affordable power that meets customers' needs, the evolution of the system must result in improvements in efficiency in terms of energy production use and retail procurement, as well as sustainability, resilience and consumer choice. Many of the attributes of the future grid are clear, but we have work to do to chart the path of how we'll get there. Whatever route is chosen, we know that we need to think about how the transmission system, distribution system, overall system planning, generation mix and grid operations need to change. This evolution may also

require new business models and regulatory approaches that sustain grid investment and continued modernization, while at the same time allowing for innovation, both technologies and market structure. So for all of these reasons, we're focusing the second installment of QER on the electricity system. As we did in the first installment, we'll develop a set of recommendations for executive action, legislative proposals, budgetary proposals and research and development needs. The Presidential memorandum established in the QER explicitly called for significant stakeholder outreach to develop our recommendations and this gathering today is the first up in what we hope is a long and fruitful discussion. Your continued participation over the next year will insure that our roadmap and recommendations are aimed at the most critical issues facing the electricity system. And with that I'd like to turn it back to Melanie. Thank you.

(Applause.)

MELANIE KENDERDINE: Thank you. And finally, let me introduce Dr. Ernest Moniz, he is, I believe, the 13th Secretary of Energy for the U.S. I think in this instance Number 13 is lucky. Dr. Moniz is tasked at DOE with implemented critical Department of Energy missions in support of the President Obama's goals of growing the economy, enhancing security and protecting the environment. Prior to his appointment as Energy Secretary, he was on the faculty at MIT where he had been a faculty member Sundays 1973. Right before he came down to be Secretary of Energy, he was Director of the MIT Energy Initiative, where I had the good fortune of working with him there, good fortune of working with him here, and off and on for about 18 or 19 years. I think that people would agree that he is an incredible Secretary of Energy, and we look forward to hearing your remarks.

ERNEST MONIZ: Well, thank you, Melanie, and thanks, John and Dan. I want to first add my welcome to all of you here in our physical and virtual audiences. I'll come back to the importance of the stakeholder input to add to the theme that my colleagues have already reinforced. I also want to thank Congressman Blumenauer and note that in fact our deputy Secretary will be there next week, a very important part of our system and clearly critical for the Northwest economy. I want to thank Norman Bayh, the chairman who is gracing us here to hear the discussion and congratulate him on the Supreme Court ruling that Congressman Blumenaur mentioned, one that is extremely important and very relevant to this QER and on the demand side here.

I thank Melanie not just for introducing us here, but how she and her EPSA staff certainly to put forward happily, I think, an extraordinary effort to get us to QER 1.1. And I want to put them all on notice and those of other offices like the Office of Electricity, EER, Efficiency and Renewables, that we should not expect any less effort in the, are, in the year ahead. I noticed some of the people who will be working very hard right here in the front row. We have kind of a I don't know, murderers' row or something with Pershing and Whalen and Hoffman and Friedman. And you should get to talk to them now before they become totally exhausted in the rest of the year. But this is a very happy effort for us. It's a big lift, but one that -- that I'll come back to this, has certainly had major consequence and we expect that to be the case going forward. I want to note that my colleague, in particular, John Holdren noted our checkered history in this kind of PCAST energy domain and I would just note that John did not say that he

was the Chair. I think he did not say that he was the Chairman of both major PCAST reports in the 1990's and observe – Melanie just mentioned the 17, 18 years but we just passed our 20th anniversary of working together on PCAST energy work. So, we are happily condemned to continue this for a year. And I suspect beyond, certainly.

So, let me just make a few major points, but elaborate on them a little bit more than has been. The PCAST recommendation, you know, really emphasized the importance of a whole of government strongly, analytically-based approach, and I think with the idea that such an approach would provide a foundation for many critical dialogues, one that spans the Administration, one that is the Administration working with states, the Administration working with stake-holders, the Administration, working with Congress. And I think all of that has been borne out, I think, because of the process that satisfied both that multi-agency and strongly analytical approach. So to say a little bit more about that, I think Dan or John, I forget now which mentioned that there were 63 recommendations in the first installment of the QER. About 35 of those were directly relevant to DOE. And I would say that we are on schedule for implementation of almost all of those recommendations. So that's one piece of moving forward.

But secondly, Congress has explicitly used the Quadrennial Energy Review Installment, the infrastructure installment in developing legislation. That was true for the Transportation Bill, the fast ACT passed last year, which explicitly drew from the QER, including passing \$2 billion for modernizing the petroleum reserve. Right now, I mean, there's many other things to say but literally today as you know, the Senate is working on an energy bill, we hope will get across the finish line as a bipartisan effort looking at energy efficiency, infrastructure, supply, conservation, again, aiming to modernize the energy system, to address our climate clean energy needs, energy security, resilience of the infrastructure, economic competitiveness, and once again, certainly, at the stage they're at now with the several amendments already acted on, and others to come, a very, very strong foundation for much of it in the QER. I might say the QER initial version also I think really helped elevate this whole focus which the President has had right from the Climate Action Plan in 2013 on infrastructure resilience, and I would just say over three weeks ago I was in Florida, in Florida Power and Light, and saw how out there in the field, real concrete steps, actually that's a pun, I guess, because they are placing wood poles, but really concrete steps in terms of hardening and using the opportunity to at the same time smarten the energy infrastructure. So I think a lot's going on. I'm sure you'll hear more of that from Tom Kuhn and others in the ensuing discussion.

But right now in the Senate I should say again, Senator Murkowski and others are very supportive of pursuing the QER first installment recommendations. Now, I say all of this from the point of view to emphasize that stakeholder input was important to QER 1.1. It will be important to QER 1.2, and asking for your engagement therefore is asking you to use your time well because we expect QER 1.2 to have a similar level of impact as we have in QER 1.1. So, again, please take the opportunity to let us know what we should be looking at and perhaps how we should address a whole variety of issues.

Now, there's been a lot said about, of course, the QER 1.2 looking kind of end-to-end in terms of the electricity sector. Why the electricity sector is so central in many ways kind of the

infrastructure system [unintelligible] in how it influences so many other infrastructures, but lots and lots of change. Certainly, the enormous growth of natural gas in generation. In fact, last year for the -- as, I'm sure this audience knows, for roughly half the year for the first time, being the dominant source of electricity supply. Low load growth, big impact on business models, the increasing deployment of renewables. The influx of new technologies and new services. The evolving energy environmental policies, the growing threats from severe weather, global warming, cyber threats, physical threats. The anticipated significant growth in distributed generation, new kinds of architectures, the storage coming on, I think, faster than many expected some years ago. The questions then how this all leads to business model evolution, to valuation of services, on the grid. We have a lot of questions to deal with, and to bring together in this, QER 1.2.

Again, we will continue. We will insist upon the highly analytical approach that I think was used. And again, I really want to note that when we formed -- we re-organized in 2013 to create EPSA, the Energy Policy and Systems Analysis Office, the systems analysis part of that name was not chosen idly. It was, in fact, to a large extent anticipating the needs of the Quadrennial Energy Review, the need to build up a strongly analytical capacity that I think frankly exceeds what we have previously seen in the department and the government. And I want to thank Melanie for her efforts not only on this but her organizational efforts in assembling an outstanding staff in EPSA.

I've already talked about the stakeholder engagement. You'll be hearing from these two outstanding panels on both power generation and transmission and on distribution and end use, we have to knit all of those together from end-to-end. And we really look forward to your statements. Some, in light of those changes just some of those framing questions, how the changing generation mix affects grid operations, planning reliability, system performance, affordable, providing affordable electricity. How do we address the growing concerns around cyber and physical security? And for that matter, other heightened risks to the grid. Whether our current market structures allow for adequate investment in grid modernization, especially in different regulatory environments in different parts of the country. How the future challenges from new technologies and new technology architectures are going to be addressed in the context of both federal and state jurisdictions, and how are those interfaces to be managed through what is a technology-driven challenge. What are the implications of increasing consumer connectedness to the grid that expands all the way to things like electric vehicles, which we continue to expect to grow in the future. All of these really -- every one of those questions is a hard one. And we have to address all of them together.

I'm just going to finish by saying -- talking a little bit -- John and Dan both talked about the President's Climate Agenda, and the tremendous progress that I think we have made in advancing that. And certainly the Clean Power Plan provides one of the important contexts for this particular QER 1.2. But I want to just close by mentioning another very, very important part of the initiative, which was the essential announcement in Paris, perhaps until we had the final announcement in Paris of the agreement with 195 nations putting forward their INDCs and commitments to reduced emissions, but I just want to go back to the very first day in Paris when

President Obama and the leaders of many other countries were there, when what was announced was a coalition of 20 countries called Mission Innovation, that entailed a pledge from those 20 countries to double energy technology R&D over the next five years. So, obviously, 20% or so per year increase. That's a total of about, let's say in the range of \$10 billion to be doubled to \$20 billion increase the innovation pipeline. In round numbers, about half of that is the United States, and I just want to say that that pledge by the United States was not made idly. On Tuesday we will have our budget coming out, and I think you will find it interesting in terms of addressing the pledge with mission innovation.

I would just note that many of us in the Administration, over the last roughly half year, half year plus, also worked in coordination with -- and communication with Bill Gates as he put together another coalition called The Break Through Energy Coalition, that will be looking to invest risk-tolerant, patient, end-to-end to marketplace resources to take advantage of the increased innovation pipeline that the 20 countries have pledged. So, I think this is extremely exciting. Again, drive these technology breakthroughs that are going to be important as we not only execute on our Paris commitments, we and others, but also, look even beyond that to driving greenhouse gas emissions to extraordinarily low levels, and that will be critical on the technology front. It will also continue to challenge all of us as we look at policy, as we look at the questions of business models, and services over many, many decades, again, providing a vibrant economy, a reliable and affordable energy system and specifically electricity system for this year's efforts. So we're excited. And again we look forward to a continuing interaction with all of you over this year. Thank you.

(Applause.)

MELANIE KENDERDINE: I'm going to turn this over to Chris Kelley for questions. Let me also close by thanking Dr. Holdren, Dan, the Secretary, the EPSA staff, and the vision of the QER. The Secretary, everyone has emphasized that we -- the QER is focused on developing analytically-based policy recommendations. Those policy recommendations, I believe, are critical to meeting our economic energy security and climate goals, and because of the urgency of climate change, we can't get the policy decisions wrong. We have to get them right. And the QER, both the last installment and this one will help us do that. And I look forward to it. I was -- one more thing, speaking of EPSA staff, we have been working on visualizing very complex thoughts, systems, etcetera, etcetera. If you have a moment, out in the lobby, some of our staff had put together posters of some of those early visualizations as we are working on this QER. And I encourage you to look at them and thank the staff that put those together. So, thank you, all, I'm going to turn this over to Chris. Thank you.

CHRIS KELLEY: So thank you, so our panel has agreed to take a few questions from the audience, we have a few folks who will be roaming around with microphones, do we have any questions? Just raise your hand and I will direct them to you. Yes. John?

AUDIENCE MEMBER: Hi. My name is John Canas. I'm with the Arent Fox Law Firm here in Washington, DC. Question is: The impact of the Paris accords and what impact that is having

on Obama Administration policy in terms of purchase of power and pricing of power within the United States.

CHRIS KELLEY: Anyone care to take that?

JOHN HOLDREN: First of all, I would say that the COP21 agreement is certainly not imposing any burdens on the United States that we didn't anticipate. We were major architects of that agreement. I think we got in that agreement a very large proportion of what we thought we needed to get out of it. And the agreement is completely consistent with our plans to meet the President's stated goals of 26 to 28% below 2005 emissions in 2025. Everything -- I would say everything the Administration is doing is compatible with that goal. I don't know whether Ernie or Dan or Melanie would like to add anything to that.

DAN UTECH: Well, just to say the same thing in a slightly different way, which is that the -- of course, under the struck that we had going into Paris and the structure that we'll have going forward the INDC is the nationally determined contributions precede the COP itself. Of course, the President had established the goal that John talked about, a full year ahead of the COP in Paris. And so that's been the focus, and, of course, that was preceded by a 2020 goal the President established in 2009. And so, as John said, I think we've been working as administration starting the first term and then in a sort of more integrated and comprehensive way under the Climate Action Plan starting in June of 2013, to try to do what we can to ratchet down those emissions and I think the Paris agreement builds on that, includes many of the elements that we want in terms of transparencies, review and periodic review and re-pledge. So we think it's a really great foundation going forward.

ERNEST MONIZ: Let me just add to that. Of course, I think directly relevant to the question is the Clean Power Plan is central to the reductions that we will need to meet our INDCs from Paris. And now, having said that, I would say -- well, first of all, more generally, I have never seen a credible scenario for our successfully addressing the climate challenge, getting -- staying below or even substantially below potentially the two degrees' centigrade target. Never seen a credible scenario that does not include a major demand side contribution. So that's going to be very important. And of course, that is directly part of the Clean Power Plan. I would notice that will come from policies, but let me also note, income from technology. So, for example, lighting is a major load; 90% reduction in LED costs in the last five, six years, an incredible story. You may have seen last week GE said they were getting out of the CFL business now. And LED's are a big part of that story. I might also add - I'll give an advertisement, on June 1st and 2nd we will host in San Francisco the 7th Clean Energy Ministerial, which is 23 countries engaged for clean energy. And we believe the Clean Energy Ministerial is going to be -- we're positioning and we believe it will become one of the premiere vehicles for kind of multi-national implementation of INDCs. I just mentioned that one of the challenges within the CEM, and it's amazing how far we have come in six months of the challenge to get to 10 billion LED deployment globally, and so that's a big piece of it. But beyond that, of course, renewables, deployment, as you saw, once again last year, the largest capacity deployment was in renewables in the United States. Without getting it in detail, another story of innovation and deployment driving cost reduction. That gets directly to the costs. Nuclear, we have challenges, a very

important issue is preserving the existing fleet, but there we will see, but a very important part of the Clean Power Plan is the flexibility it gives states and regions and we can anticipate some of that being incentives to maintain carbon-free nuclear, while we work on new technologies for the next decades that can address the challenge of the very, very large capital cost. Finally, let me just to be complete, carbon capture and sequestration remains an area that we continue to push. We will be moving to some pilots for novel carbon capture technologies, but I want to add now going beyond the electricity sector, that we have another set of potentially low hanging fruit in the CCS world, which continuing what we have already started, which is carbon capture from industrial plants which represents a major source of relatively cheap to capture carbon dioxide.

MELANIE KENDERDINE: If I could just say one thing, the Secretary mentioned mission innovation, and it meets multiple objectives, clean energy, competitiveness, etcetera, etcetera, but one other thing, it's a five-year plan. And a five-year commitment to clean energy technologies or -- clean energy innovation. That sustained commitment is very important when we are trying to make these transformative changes and that it would occur -- these investments were to occur regardless of oil prices, gas prices, etcetera, etcetera. And so that sustained commitment to me to very, very important. And that is part of mission innovation.

CHRIS KELLEY: Thank you. Any more questions? All the answers. Yeah.

ERNEST MONIZ: Yeah. 1.2 is going to be easy, we have all the questions answered.

CHRIS KELLEY: Well, thank you, please join me in thanking this distinguished panel.

(Applause.)

Panel 1

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

So we're going to move right now into our next panel. So for those of you who are joining me, please come up on stage, and we'll get the tent cards changed out, and during this transition I'd just like to remind everybody here in the room, if you'd like to include some comments at the end, and you'd like to come up to the microphone at the very end of this, the final panel will have an opportunity for you to speak. So please do sign up at the entrance, and again, for those of you who are joining via the web, please submit your comments at www.energy.gov/qer.com, so we'll get started with the first panel here on bulk power generation and transmission: How can we plan, build and operate the appropriate amount for future needs? Just in a moment.

Okay. So let's go ahead and get started. Welcome, panelists, I'll give you a little bit of direction before -- are we missing -- welcome. Before we get started here. So each of our speakers here today is going to provide some comments for about five minutes. We'll just go right down the row. And after that, there will be an opportunity for me to ask some questions of you based on the comments that we've heard here today.

So with that, why don't we go ahead and let me introduce the panel that's joined me here on stage. So we have Jerry Cauley, the President and CEO of the North American Electric Reliability Corporation, Tom Kuhn, President of the Edison Electric Institute. John Shelk, President and CEO of the Electric Power Supply Association. Sue Kelly, President and CEO of the American Public Power Association and Jay Morrison, Vice-President of Regulatory Issues, National Rural Electric Cooperative Association. Welcome.

So, did you move around on me? Oh, okay, got you. All right. Well, why don't we start all the way on the end then with Gerry.

GERRY CAULEY: Thank you, Chris. I appreciate being invited to this second installment of the QER, certainly honored to be on this distinguished panel today. NAERC's focus is on how to maintain reliability while we experience this significant transition of the nation's resource mix and we modernize our grid. I have six points; six priorities I'd like to mention in the few minutes here. The first is around central reliability services, word is we've been talking about recently. I had the good fortune back in the 1990's, we were talking about moving into transmission open access and opening up the system to competition and unbundling and I was very fortunate to be on a group of really good engineers, special engineers, we thought through this, how would the grid work, how would it stay together without this sort of command and control operation, and we determined that it would work if we did two things, figured out a functional model, who's responsible? What's the role of a transmission operator, what's the role of a generator operator? Balancing area in those things. So we did that. And that became the foundation for the NAERC's standards. The other thing we did was we said what are the essential elements and building blocks that need to be provided for reliability? And we called them, for lack of a better word at the time, ancillary services and they became the products that we saw showing up in markets and so on. As they become more scarce as we see now with a more dramatic shift in our resource mix, I like to call them not ancillary services, but essential reliability services, because they are the critical mix that makes up why this grid stays together and why it stays stable. The grid literally will not work without these essential services. This is not a bad thing. It just means we need to recognize that, and we need to provide for them. There's about a dozen, a little bit over a dozen. There's three that materialize first. We've already seen, I'm sure many stories about California and the "duck curve". The first one we have seen manifest is the ability to ramp fast enough to accommodate large swings in renewable resources, whether wind or solar. So we need to be able to have that capability. The other two early emerging essential services are around frequency response and voltage control.

We're seeing a fourth one begin to emerge in Texas, because it's a smaller interconnection where they had a period of several days where they were operating predominantly on wind and had very little large mass generating units spinning, so they had an issue with inertia. So the only challenge here is to recognize these things, make sure that we're providing adequate essential services at the right place that can be delivered to the grid as needed. So this means all new generation, all new resources whether distributed, renewable, whatever the form of resources needs to participate in this resource mix. The good news is the technology is there. I really applaud PJM, for example, introducing requirements for digital inverters on new renewable

resources. I've also noted a lot of policy shift to recognize the need for these connection requirements and provision of these products.

We just issued two reports, a technical report in December, and a how-to tutorial for policymakers, just on January 27th. I encourage you if you read the policy version, don't forget that the links in there are active and they actually go to a talking slide show movie tutorial about the services. So that's my first point. The rest I'll be more briefer -- a little more brief. The second point is we need to make sure we have adequate transmission to get these new resources from where they are to the loads and I'm really particularly concerned about this, because where the new resources are going is not particularly where the transmission is. It actually feels like it's getting harder to put new transmission in, whereas, the time from decision to building new generation is actually getting shorter. So I think over the next 10 to 15 years we're creating a gap here where it takes transmission 7 to 15 years to get built, if at all. And then it's really getting quick to put generation out there.

The third area is gas infrastructure; making sure on peak cold days and the worst and most severe times that we have the ability to deliver adequate gas supply to the combustion turbines that we are planning to depend on much of our resources.

The fourth area is in terms of cyber and physical security. I think we're doing terrific work in these areas. We have a CEO-lead coordinating council. We have one of the strongest ISAC's for sharing information, we have a giant grid exercise. We're doing a lot of information sharing, a lot of training, a lot of awareness. I think in terms of the to-do list, I would want us to continue to focus on declassifying information. There's so much information within the government that we need to be able to get to industry operators and owners that they can actually take actions. I commend DOE research on technologies for information sharing, to do automated computer to computer sharing, self-healing, due to cyber incidents and events, and we've actually had some instances of sharing technology up to this point. And I continue that further development. I applaud the recent legislation providing DOE with emergency authorities during critical emergencies on unlimited scale. I do believe on the other component of that in terms of the equipment reserve, transformer reserve that I would commend the DOE to work with, partner with and rely on the industry initiative in that arena of the grid assurance.

The fifth area of priority for me was mentioned in an earlier panel, continuing growth of the distributed resources, distributed resources and demand response. At some point it's just a very little, sort of noise level on the grid, but it's in some areas in California, and New York and other areas, it's beginning to be a significant portion of the resources. We have to make sure that the controls are coordinated. And I know that DOE is doing research in that area and I think it's so important to keep that going. How do you integrate thousands or maybe tens of thousands of resources and control points, integrate them seamlessly into a grid so that the whole grid is made whole in terms of frequency and balancing and voltage control?

The final priority for me is to continue heavy push on storage research, being an operator for 35 years, sort of mentally, it's the greatest resource we could have. It's the most valuable control resource you can have to keep the grid stable and reliable. In two closing points, continued

research and resilience. NAERC is doing a lot of work on its reliability assessments, continually pointing to natural causes, storms, natural events being the predominant cause of outages and issues on the grid, and we need to keep figuring out where do we prioritize that investment. And the last point is to recognize the international nature of the grid that we have. We have long-term relationships with Canada. I think we're expecting both capacity and energy benefits in clean power exchange. But you have to look to Mexico as well. I've had a couple visits down there now. They have a really aggressive plan to build out a very modern, clean grid, putting in a lot of renewable resources. They're also looking to draw in a lot of investment. So I think we need to count on the inner play of the energy and capacity interchange with Mexico as well, as a partner with us. So, thank you.

CHRIS KELLEY: Thank you. Gerry. Tom?

TOM KUHN: Well, terrific, I think the Secretary and Gerry may have covered just about everything, but I do want to first start out by commending the first QER. It was a terrific exercise. It came out with a lot of very good recommendations, and we're delighted to participate here in the second one. And as the Secretary mentioned, the Technology and Innovation Initiative that came out of Paris, I also want to highly commend that. You almost might call the department the Department of Innovation and Technology, it obviously incorporates energy, but -- and a lot of it is in the energy business, but it is really propelling a lot of great things in our industry. It is - electricity itself, is -- has spurred all kinds of innovation. About half the patents in the country come from electric patents. And the industry itself, because of all the technologies that are changing in our society, is in the midst of a great transformation. We have gotten together our CEOs and a Strategic Planning exercise, just this last CEO meeting and we really are focusing on three significant aspects: One, a modernized grid. And the idea of a more modern, reliable, and resilient grid, I think I'll go into that. Secondly, innovative customer solutions. And thirdly, even cleaner energy in the future.

So, start out with a more modern and reliable, resilient grid. Right now we are spending about \$42 billion a year on transmission and distribution. \$100 billion capital expenditures over all, but the distribution investment side of the equation is increasing greatly. When the administration first came in, and the stimulus program, there was a Smart Grid Initiative. We have obviously worked closely with DOE and many of our companies partnered with the government on Smart Grids. There is since that time been a major expansion of Smart Grids. We've got some 60 million Smart Grids around the country right now and it's continuing to expand rapidly. And these have tremendously helped us in maintaining and operating the system. I think the Secretary mentioned the recent experience in the blizzard. It certainly is an illustration. And you saw all the media reports praising the industry for the fact that the system is harder, more resilient, smarter, able to respond to outages, etcetera, and I think that is absolutely key and important, and certainly is key and important to the expansion of renewables in the system as well. So I think in the future, you know, utilities roles' will continue to be that of the Distribution System Integrator. They will plan, own and operate the grid. We will also be the distribution system operator that will put new technologies on the grid, maintain its reliability, and make sure that the various transactions between suppliers and customers are being carried

out on the grid in a reliable fashion. The grid is the central nervous system for the business. And is the key part of it.

Highlight a few areas that need to be addressed in order to support the grid's ongoing transformation. Visibility and operational control are needed to ensure the reliability integration of distributed energy resources and efficiency and storage and micro grids. There has to be an efficiency in the transmission planning and citing processes. We think that continues to need to be improved, as I think that Gerry's comment is right on target that we're adding new generation, distributed generation sources at a much faster pace than we're expanding transmission, and the recent provision in the Transportation Bill which we strongly supported we think will be very helpful.

I think that compensatory returns on investment, the recognized transmission development risks are important, because there still are long development timelines and public opposition that can put these investments at risk. So effective Federal and State partnerships are going to be important. Continuing to resolve jurisdictional issues are an important part of the equation as well. Gerry and the Secretary mentioned cybersecurity and physical threats. I think a partnership that has been set up with the Federal Government on cyber and physical security just a few years ago under the aegis of the Electric Sector Coordinating Council has been just a tremendous partnership that has resulted in new technologies coming on, a great deal more information sharing, and obviously response and recovery with exercises like the recent one they ran, the grid X 3 exercises. So we are now focused on a number of new areas, including cyber mutual assistance. We have, you know, we're pretty good at mutual assistance as we say from storms. Cyber mutual assistance is a different kind of animal. So we're working hard on that. Supply chain issues, transformer, transportation, etcetera, so there's lots of things that continue to need to be done. The threats continue to increase. So this is a very high priority for us.

Innovative customer solutions. The second area that I mentioned, I think customers are going to want more flexibility in their energy use in the future. A new era where customers will have greater control over their supply and their usage, and customized services. So, you know, we are partnering with major industrial and commercial and military customers. We're working with regulators, customers and technology providers and others to increasingly customize and individualize service. Lisa Wood on the second panel will cover a lot of this area so I won't go into this much more in depth.

Our clean energy future, the third area I mentioned, this is, you know, throughout our history we've become increasingly clean. When I became CEO, probably when Thomas Edison was still around - but if you even go back to 1990, you know, since that period of time, we've reduced sulfur emissions by over 70%, nitrogen admissions by over 80%. We're in the process of reducing carbon emissions, we're already at 15% below 2005 levels. And so our industry is also the largest investor in renewable energy in the United States, virtually all of the wind, geothermal and hydropower are -- and the majority of them installed solar capacity is provided by utilities. We have built about 50% of the solar in this country. We're seeing incredibly growth and opportunity in solar. Community scale solar enables us to provide solar to all customers. And actually at a lower cost than other types of solar. And just this last year alone we're tripling

the use of solar; community scale solar from about what was about ten gigabytes at the end of 2014 to what's going to be 28.9 gigabytes at the end of 2015. So among all this, we obviously worked on a Clean Power Plan with the administration to deal with the reliability issues, to make it more flexible. I think that was an extremely important part of the equation. The Clean Power Plan will be a challenge for many states. But I think that we're working with our states and our utilities to come forth with plans and you're seeing the utility transformed to a much cleaner future. About one-third of our generation is zero carbon. If you put together the nuclear and the hydro and the renewables, one-third is now natural gas, which has changed significantly as well. And that has reduced carbon from some of the older coal plants. And then we have the rest of the fleet is coal, which is a -- and the older, dirtier coal plants have been retired, 73 gigawatts we now have a much cleaner coal fleet in the future and I think we're looking in the future to carbon capture and storage and clean coal technology as well. That leads me into the final aspect which is fuel diversity. It's been a staple of our industry from day one that we maintain fuel diversity. That it is a -- the strength of the system to maintain clean and reliable and affordable electricity and I think we're going to need to concentrate on maintaining all the different aspects so that when you have spikes in prices, when you have outages and things of that nature the system can deliver what's best for the customer. So I will conclude there. And, again say that the poor vision of the industry is going to rely on new technologies, on the continuing major transformation to make sure that the industry remains clean, safe, reliable and affordable in the future. Thank you.

CHRIS KELLEY: Thank you, Tom. John?

JOHN SHELK: Well, good morning and thank you for inviting The Electric Power Supply Association to the opening stakeholder panel on the second installment of the Quadrennial Energy Review and like others we'd commend the administration for both the high level of stakeholder engagement in public involvement, but also the deeply analytical approach that the first installment demonstrated and we hope and expect will be true of the second. Of the non-DOE that I represent is the National Trade Association for Leading Competitive Wholesale Suppliers, our members represent well over 200,000 megawatts nationwide of a fuel diverse set of fleets essential to reliability. Our members are among the largest operators of each fuel type. Over half of our member assets are natural gas or dual-fueled facilities. Over one-fifth nuclear, one-sixth coal and the balance renewables. Almost all of these member assets, over 95% to be exact, are located in the so-called organized markets with independent operation of the grid and markets by regional transmission organizations and independent system operators and in many of these regions the competitive supply is almost the entire supply in that particular location. Our members, while we as an organization are focused on wholesale, our members, our suppliers are very innovative customer-facing solutions through the competitive retail affiliates that many of them have and have begun.

I think I echo what others have said that this QER 1.2 wisely focuses more intently and comprehensively on electricity to make sure that the changing and growing number of pieces in our electric systems continue to fit together at a time of all the rapid changes we've heard about and will discuss today and from our perspective that needs to include, of course, the nearly 40% of U.S. generating capacity that operators in the competitive space, not in the cost space,

regulatory space. And in the competitive arena, that means these forms of generation are dependent on market revenues and price signals to plan, build and operate the appropriate amount and type of future generation which is the topic of our panel. While the QER 1.2 timeline is out to 2040 and that seems a long time in the future, except I recall it wasn't that long ago that some of us were chatting earlier that this Visitor Center did not even exist here at the Capitol. It's very critical while the QER look out that long that it also take a look at what steps are required for critical action now on several issues that require immediate attention that I'll mention in a moment. Getting the policy decisions right at the Federal and State levels in '16, and '17 and '18 will make it far more likely that between now and the 2040 end point, the many truly exciting transformations that are underway that we've heard about this morning will reach their greatest potential but with a minimum of peril. Innovative and potentially disruptive new technologies are poised to deliver substantial benefits, that's undeniable, but equally undeniable is that this will not happen overnight. The power sector, as I think we would all agree, is in the early stages of this multi-decade series of changes, as the Secretary said this morning quite correctly, regulatory and business models should welcome and accommodate new entrants, while recognizing that the bulk power system will need to include both central station power plants and greater distributed resources. As we've heard from the presentation from Gerry Cauley from NAERC perspective, the bulk power system really is physically and financially interconnected and very deeply entwined ways that really isn't present in probably anywhere else in our economy. In those Supreme Court decision, act of Congress or executive order can repeal the laws of physics and fundamental economic principles. As resources increase, as we've heard from Gerry, other plants are required to ramp up and down to maintain reliability but with greater wear and tear, it should be compensated accordingly. Another challenge is to ensure that the newer distributed resources we've heard about are allowed to compete at a fair basis at the regulated distribution level. It won't surprise anyone from our perspective competitive markets are the best model to manage the challenges and consumer costs ahead, because by definition markets are more flexible, adaptable and place more risks on investors compared to the regulatory model. However, as I said earlier, markets depend on accurate prices and signals and revenues to earn recovery of costs at a fair adjusted risk return on investments and that's true for both new investment and for the existing fleet. With that as a backdrop, we have several suggestions in the near term, medium term and longer term horizons that are spelled out in more detail in the longer statement we filed in, I believe that's on the QER website. In the near term, let me just simply say amen to what Gerry indicated around the Essential Reliability Services but our emphasis this year is on two things, one is the electric energy pricing improvements, now being considered by the Federal Energy Regulatory Commission and the second is resisting selective discriminatory reregulation in restructured states.

On the first issue, we're pleased that Tom's group, the Edison Electric Institute, the Nuclear Energy Institute, the Natural Gas Supply Association and America's Natural Gas Alliance in supporting the ongoing work with respect to electric price energy formation. Under the Chairman's leadership and that of his colleagues, they have done a lot of great analytical work and has proposals pending and we hope those proposals will result in final actions this year as well as follow up action on topics not yet addressed. The second near term topic relates to how the Federal and State policymakers relate to each other. And, of course, the states have a very

important and critical role in regulating electricity. And when they do so they really face a fundamental choice and many of them have made those choices already. They can rely on markets for generation or, and I would emphasize “or”, cost space regulation. When a state chooses cost space regulation however, it can't obtain customer savings through competitive procurement for generation, and more should do so. However urgently is the topic, once the state does choose markets inviting competitive suppliers to put their capital at work and at risk, states really need to let those markets work and make policy decisions consistent with that foundational choice of markets. States should not toggle between markets and cost regulation for generation nor shield some of their generation for market forces buffeting everyone else. Doing so means that future needs cannot be met and given the interstate nature of the grid that states elect to participate in, it is critical to act resolutely to prevent wholesale market distortions from these discriminatory state actions. In the medium term, in addition to the essential reliability services question that Gerry covered very well I would emphasize Clean Power Plan implementation. Competitive suppliers through the entrepreneurs leading the companies and the investments they made before the Clean Power Plan existed, actually provided the basis for the major building blocks in the plan by pioneering both the deployment of natural gas combined cycle plants and renewable technologies in the 1990's when others were not doing so. At the same time capacity factors at zero carbon nuclear plants increased, the efficiency of coal facilities increased, thus reducing carbon emissions even before the plan and as everyone knows major integral building blocks in the plan. However, what we would emphasize going forward is that the tools chosen by Federal and State policymakers to preserve these worthy environmental goals really do matter. Previous environmental regulations were compatible with market pricing because compliance imposed costs that could be factored in the supply bids. However today by contrast, worthy goals are often being pursued or discussion is afoot to pursue them through subsidies and mandates that may or may not achieve the intended results certainly not on a least-cost basis. Since electricity resources compete in a given wholesale market, dispatch of any one impacts the dispatching compensation of all others. Mandates and subsidies for some resources that suppress the market prices for others competing on a purely market basis does not necessarily result in lower emissions including net lower emissions of carbon and we thinking the excellent analytical capabilities of the department and the rest of the QER team could help shed lights on the potential effects of state and federal options for policymakers to implement the Clean Power Plan consistent with the economic dispatch of the grid.

And last but not least, longer term, we actually think there should be consideration or at least a start of discussions that may be needed depending on how some of these events unfold in coming years around alternatives to the existing dispatch models. Again, given the analytical capabilities and the convening capabilities of the department and others in the QER 1.2 process, could really help us all assess the potential need as pragmatic problem solvers for potentially more fundamental changes to economic regulation of bulk power. Let me emphasize this is not, not at all a reason to resist the exciting technological changes already afoot, but rather to anticipate areas which could be addressed in time to smooth the transition. Initially comes up in two areas. First, if notwithstanding our best efforts mandates and subsidies so distort and undermine markets to impede how they need to function properly. Then competitive supplier assets, now governed by market forces, would have to be compensated in some other way because they

would still be needed for reliability. Second, and I would emphasize separately, the existing dispatch model used in the regional markets, the organized markets are entirely driven by marginal production costs and that raises the question of what happens as the proportion of zero to low marginal cost resources such as renewables increase, while the conventional plants that are on the grid today and will be for decades to come, have significant marginal costs but will continue to be needed for reliability. And here again, the QER 1.2 process should help all of us academics and those in the business community and others evaluate existing models that are based on marginal costs to see if they need to be modified, adapted or replaced as the new world comes upon us.

So in conclusion I'd like to join everyone else in thanking Secretary Moniz and Dr. Holdren for their leadership lead by EPSC the DOE EPSC and Melanie and her team. This really is an exciting time to be involved in electricity. These are largely uncharted waters, there's an incredible vast potential ahead of us to harness the ingenuity of our economic system and our national labs and independent entrepreneurs to develop these technologies to reduce emissions and improve the American standard of living. If given the opportunity through some of the reforms I've mentioned, the sector I represent stands ready to continue ready to invest to help achieve these important policy goals, including as a result of the many transformational changes underway that we look forward to the discussion with my colleagues and working with you all going forward and appreciate the opportunity. Thank you.

CHRIS KELLEY: Thank you. Thanks, John. Sue?

SUE KELLY: Good morning. Thank you very much for the invitation to speak today. I really appreciate it. I feel like I've been asked to appear in the opening episode of season two of Downton Abbey: Energy Edition. Very exciting to be here. Thank you.

APPA, for those of you who may not know us, we represent the interests of the nation's 2,000 electric utilities that are units of state and local government. If you look at the chart outside, we're the pink and the purple in the chart, which I found very interesting, actually. We serve in 49 states, there's about 2,000 of these utilities total. Some of them very large but the great majority quite small. And together we serve one in seven electric consumers, so while individually there are many of us, when we're together we represent quite a few. But equally important we are not-for-profit and we are community owned so we have a different take on some of these issues than some of the other sectors of the industry although we are aligned with them on other matters. I should note that like DOE, APPA has been undertaking its own kind of close examination of what's going on in our industry. We did a Strategic Planning process last year and that was driven by four change factors in our industry, one was evolving customer preferences. Two, new technologies, which DOE obviously is extremely interested in as well. Three, increased government regulation and four, utility workforce issues. These are all driving us to kind of take a look at APPA and what we can do to help our members the most. So we released our plan and we called it Power with Purpose in June. It sets out six external initiatives, I'll tick them off briefly because some of these will be familiar to you. The first one which may not be, is to raise awareness of the public power business model. A lot of people know they are

served by electric utility but they don't know they come in three flavors and we want to kind of explain who we are and how we're different from other sectors.

The second one we've called Public Power Forward. A lot of other people call this utility 2.0, but what it is, is our version of how to recast the public power business model and the services we provide in the 21st century to kind of truly meet the needs of our communities, large and small. The third one is increased federal regulation, those of you inside the beltway know exactly what I'm talking about, and I will speak about that later in my statement. The fourth issue is cyber and physical security and physical preparedness. We want to help our members develop an all hazards approach to cyber and physical security, disaster preparation and response. And I want to second the sentiment expressed earlier by Tom Kuhn, the Dean of our Delegation to say -- give a shout out to our government partners on cyber and physical security. And I would mention in particular DOE and Pat Hoffman and her office. We want to thank you for the close partnership we've developed in working together to address these threats. I would also give a shout out to NERC and it's EISAC. These are the kinds of institutions we're going to need to foster if we're going to work together to meet these threats and to hopefully minimize attacks, and if they do happen and they may well, to respond resiliently and quickly and get our systems back up. So I just want to say that.

The fifth initiative was increased research and development against something else that's close to DOE's heart. We have our own research program at APPA and we want to grow that to specifically assist our members in dealing with the changes they're going to be facing and the last is workforce planning and development. But I'm going to focus the rest of my short time here on the adverse impact of increased Federal regulation. As not-for-profit utilities, we at APPA care about what I call the three-legged stool, affordability, reliability and environmental stewardship and if any one of those gets out of whack, customers suffer, not only our customers but frankly, all customers. We as locally owned, community owned utilities believe in local decision-making and local control over energy decisions, and we believe the Federal Government's primary role should be to support the research, development and dissemination of a broad array of tools and technologies to help us as we meet the challenges of this century, including the Clean Power Plan. We do not believe the Federal Government should be choosing favored business models or technologies. And this includes policy decisions about resource mixes and rate designs. Three big issues that I hope DOE will focus on and understand thoroughly in second season of Downton Abbey, Energy Edition, is the impact of wholesale market issues, especially flawed mandatory capacity markets on our industry going forward. The second is the impact of the Clean Power Plan, electric service reliability and price, and the last is the impact of the increasing role of demand side resources including distributed generation, demand response and energy efficiency on resource and development infrastructure decisions, and I wanted to part here from my prepared remarks to say that I think John and his organization has taken a lot of arrows in the last few weeks over the outcome of the Supreme Court decision on order 745. The way this was cast in the press all the way and up to including *The New York Times*, was the evil merchant generators were trying to keep, you know, demand side out of the wholesale market so that they could just keep up their profits. Well, that's an over simple analysis and the fact of the matter that APPA was on the same side of the case as EPSA, along with my other comrades here,

and that was because of the principle at stake there, which was Federal versus State jurisdiction. We as community owned utilities strongly believe that retail matters are left to retail customers and retail consumers. Well, we lost that decision. We have a broad interpretation of the statute as our Congressman Speaker said this morning and I'm washing my hair and I'm buying a new dress and I'm starting all over again, you know, we're going to live with those rules as the Supreme Court has told us that they are, but I do want to make clear that those of us who favored a narrower approach to Federal jurisdiction did so for a reason and it wasn't all about maintaining a profit. So I just want to say that to you.

And now I'm going to turn around and bash them.

SPEAKER: I knew that was coming, you've done this before as you know.

SUE KELLY: Not so. I just want to note that RTO Operated Mandatory Capacity Markets are increasingly showing that they are unable to support the development and maintenance of a lower carbon resource portfolio at a reasonable price. The markets weren't designed to that do that. They weren't designed to come up with the optimal mix of resources to get us forward and promote the goals of reducing carbon intensity, promoting fuel diversity, providing ancillary services, I'm using the old term, I'll have to update my vocabulary and coordinating natural gas infrastructure with electric. They were never intended to do that and they don't do that. And I think we are going to have to figure out, going forward, what will do that. And it's really important because of the Clean Power Plan. That plan really is going to require states and load serving entities, in other words, the utilities, it's not the RTOs, it's not you know, FERC, it's the states and generators who have to figure out what to do to comply with these plans. We may have regional solutions, I hope to God we have regional trading, we're going to need it. The fact of the matter is it's on us so we need to have the tools to be able to do that. And the regime that we have now does not do that. States like Maryland and New Jersey that might want to make their own resource decisions are fighting for the, you know, the right to do that in the Supreme Court. And frankly, we're right there with them. Because the Clean Power Plan is going to require a radical restructuring in many states as we move forward. APPA believes that the final rule, while it was no doubt an improvement over the proposed rule, still does too much, too fast in many states. So we are part of the Court of Appeal challenging the provisions, but I as an appellate lawyer of long standing, know you don't count on court appeals and I found out in the last couple weeks why. So let's talk about Plan B. We have submitted very substantial comments to the EPA on the 21st of January on both the model trading rules and the Federal Plan. It's really important to us that those things work. Because we want to move forward with the states to make sure that we are able to implement whatever happens in a manner that allows us to maintain the three legged stool of reliability, affordability and environmental stewardship.

I just want to say at the end a little bit about Distributed Energy Resources. We believe they can play a very important part in compliance with the Clean Power Plan and in development of our local resource portfolios. Like Tom's members, we're actually very into community solar because we're organized at the community level. It makes huge sense for us to do that. We also want to -- we support energy efficiency, demand side, small, for example, natural gas generation, behind the meter. At our systems, to be able to help balance renewable resources and the

intermittency that causes, but again these decisions need to be made at the local level as does the pricing of that and the terms and conditions. It's a community by community decision and we oppose a one-size-fits-all federal approach to those issues. So I know I could go on but I'm going to stop there and again say thank you for the opportunity to be here.

CHRIS KELLEY: Thank you, Sue. And finally, Jay.

JAY MORRISON: Thank you very much and good morning, thank you very much for the opportunity to participate on this panel. I really appreciate it. We have always enjoyed working with the Department of Energy, we work quite a bit on policy issues, on analysis and resilience and also on research and development. We've partnered in millions of dollars of research, on cybersecurity and in bringing down the cost of distributed energy resources, and perhaps more importantly making those resources more valuable to the consumers that we serve. I represent the consumer owned, consumer governed not-for-profit sector of the industry. So I guess we are the third part of the group that Sue is mentioning. We serve only about 12% of the load but we serve about 75% of the U.S. land mass. So we have very different look at our service territories than many others do. We cover some very, very poor areas of the country. Most of the persistent poverty counties in the nation, and we serve a lot of very spread out consumers. So our infrastructure looks very different than that of many other utilities. We own or operate about 42% of the distribution system in the country.

Now, with respect to the issues that are in front of this group, our members tend to ask us to prioritize three issues. One is the Clean Power Plan. Second is reliability and security, including both cybersecurity and physical security. And the third is the set of issues around distributed energy resources, and what changes those resources might make to the industry. But for purposes of today, I really want to sort of narrow down that very broad conversation and talk about three specific areas within that. First is, we're looking for the help of the Department of Energy to help us all meet our collective challenge of implementing the Clean Power Plan in a manner that preserves both reliability and affordability of power for all consumers. We ask your help to continue to impress upon EPA that industry requires both time and flexibility to comply reliably with the Clean Power Plan. Let me give you a couple of specifics there. First of all, the EPA heard quite a bit from industry, from the Federal Energy Regulatory Commission, about the need to assess reliability before implementing the state plans. And in the final rule they say they have addressed that by asking the states to evaluate the reliability impacts of those plans before they submit them. We anticipate that the state's will conduct that analysis, Gerry will conduct that analysis, the regional reliability entities will and we will as well. But there's nothing in the Clean Power Plan about what to do if those analyses show that the state plans will lead to severe reliability problems. There's no flexibility built in to respond to that. If the states have to rewrite their state plans in order to adjust them to meet reliability requirements, there's no additional time in the final rule. If industry requires additional time to address the reliability problems that are identified in those analyses, there's no flexibility built into the final rule. We hope that -- obviously we hope there won't be any problems. We hope to find creative ways where we, in partnership with the states, can find ways to implement reliably. If we can't we hope the

Department of Energy will weigh in with the EPA and help encourage them to provide the flexibility, we need in timing or emissions reductions levels to maintain reliability.

The second issue here is with the proposed federal plan which does not include within it a built-in obligation to conduct a reliability analysis before imposing it on a state. We hope that the final reliability, federal plans if imposed on any state will include that analysis and will include the flexibility to address it.

The third very specific piece is with respect to the dynamic reliability safety valve that we asked EPA to include in the Clean Power Plan. This was an adjustment mechanism we had hoped that the EPA would include so that if situation changes dramatically with respect to the resources available on the grid, after the state plans are approved and the industry begins implementation, and those changes on the grid make those proposed -- those final plans no longer implementable in a way that's consistent with reliability and affordability, that the EPA would provide the flexibility to rewrite those plans to address the changes in the grid. So what is the best system of emissions reductions may be very different if a nuclear plant closes permanently before it was anticipated to. The best system of emissions reductions may be very different if major transmission system elements disappear for a number of years for some reason, or a major gas pipeline becomes unavailable for a number of years for some reason. What we got in the final rule was a one-time 90-day reprieve with the expectation that we would be able to turn to the trading market after those 90 days to resolve any changes in the system that may be there. We hope that's adequate. We hope that there will be a liquid market in emissions credits, we hope that those emissions credits will be affordable. We hope that those will be available in places from the resources that allow the system to still be operated reliably, and for everybody to meet their compliance obligations. But if it's not there, if the states do not implement it in a manner that leads to the creation of a liquid market and emissions credits, we hope that the EPA with the department's assistance will find a way to provide industry the flexibility required to ensure reliability and affordability as well as continued compliance with the Clean Power Plan. So we're looking for your continued assistance with that. We know that the Department of Energy has the analytical capability, has the knowledge of the industry, has the deep understanding of how the grid works that is needed to help ensure that ongoing implementation continues to be consistent with reliability and affordability.

Let me talk about the next piece if I may. When I talk to our CEOs about what they're seeing coming down the road, what they're planning for, how they are viewing the future, and, therefore, adjusting their businesses in response, what I hear about is uncertainty. We don't know what that world of the future looks like. We don't know how any individual state plans to implement the Clean Power Plan. We don't know which plants will close. We don't know who's going to rely on gas, and, therefore, need gas pipeline. We don't know who's going to rely on wind, and, therefore need transmission. We don't know that future. We don't know to what degree DER is going to grow in the future and what impact that will have on investments that we need to make today. We don't know if we invest in gas today whether gas will become the next disfavored fuel within the lifetime of the plants that we build. Most of the coal plants that we are being asked to shut down today in response to the Clean Power Plan, we built because Jimmy

Carter told us to. The Industrial Fuel Use Act was passed and effectively prohibited the use of gas for new generation. We were told coal is our future. If you need capacity, build coal. This was a period at which we needed capacity. We built coal. Will gas be that next disfavored fuel? I was reading the trade press recently. And there was an Op Ed in there from an individual speaking about a gas plant that's being built. And his argument was: Only an idiot would build a gas plant today, because that's the next fuel we will shut down, and nobody should build a gas plant. That creates a lot of uncertainty for those who are trying to find the next base load unit to replace those that need to close in response to the Clean Power Plan. I don't know that there is an answer that DOE can provide to that uncertainty. I think it simply needs to incorporate that into its analysis. It will be a lot harder for the industry to make the dramatic changes that are required by the Clean Power Plan when we don't yet know what we should build. We have a very creative industry. We have very smart people. We have folks with decades of experience in dealing with certain levels of uncertainty. As the states begin to nail down what they intend to do in response to the Clean Power Plan, as we start to see state plans, some of that uncertainty will start to drop away, and people will be able to make the investments that are needed to maintain reliability and affordability, but that's going to have an effect on implementation pace, it's going to have an effect on our ability to build the transmission that as Gerry mentioned is harder and harder to build every year in a timely manner. So, again, this isn't doom and gloom but it is a recognition that we're going to need flexibility with respect to timing in order to address the pace that's driven in part by uncertainty.

So let me address the last piece. What is our best way of managing that uncertainty? What is our best way of moving forward and ensuring that we can build the resources that we need, both the resources we need to have enough energy and capacity, the resources that we need to provide the essential reliability services, that Gerry so properly talks about, the ability to invest in the delivery infrastructure in both gas and transmission? Let me suggest that that is by allowing the entities that know how to do that to do their job. As Sue said, we very much support decision-making on a local basis. We think that if you allow the load serving entities, Tom's members, Sue's members, our members, to make decisions that allow them to manage risk on behalf of their consumers, to manage portfolios of resources: wind, solar, coal, gas, nuclear, hydro, whatever else it looks like that we might be able to build, to integrate that with the distributed energy resources that are on our system, and most importantly, to optimize across all of that, to make the optimum investments in light of our risk, our willingness to manage risk, the best investments that fit together in large-scale generation transmission, distribution, distributed energy resources. If we are given the freedom to optimize we can manage a lot of that risk and keep a lot of those costs down. But if our ability to make decisions is being pushed by mandates, by government deciding that one approach or another is the only right approach, we're not going to be able to do that. If our ability to make choices is being limited by the market, and this is where John and I wind up disagreeing, it's nice to be on the same side of Supreme Court cases, we're also on the opposite side of a Supreme Court case, hopefully we'll win this one.

John mentioned the challenge of centralized markets being focused on marginal cost. Marginal cost is looking at only what is the next cheapest resource based on the marginal cost of output, not what is the value of that resource. Not is, what is its ability to help me mitigate locational

risk, temporal risk, counterparty risk, fuel diversity risk, even cybersecurity or physical security risk. The bilateral markets do that. The individual utilities managing portfolios of resources lets you do that. If we are freed to build our own resources and to participate in the bilateral markets without the burdens that are sometimes put upon us in very narrow cases within the centralized markets, we'll be in a better position to be able to manage our risk. So what we're looking for is that ability to serve our members with the resources that they want. That does mean, in many cases, just to get a little bit into the next panel, Distributed Energy Resources. There is, as Sue said, tremendous value potential in distributed energy resources. Cooperatives were amongst the earliest and heaviest adopters of demand response and we continue to be very, very heavy users of demand response. One of our systems in the Midwest went decades without building a peaking plant because they could manage half their load. That's the kind of resource that allows us to serve our members and we are working hard to find the technologies, the communications tools, the back office tools, to allow us to integrate as much DER as possible in a manner that serves our members best. And where members want DER that's not integrated, to find a way to do that that's in the best interest of all our members. So that's what it comes down to. Give us, please, the flexibility and the timing, and the freedom to make the choices that allow us to provide our members with safe, reliable and affordable power into the future. And thank you.

CHRIS KELLEY: Thank you, Jay. So now we'll turn to a few questions, we have a bit of time for that. And why don't I just start off with some things that I heard from you, Jay, and maybe tie in a few things I heard from some of the earlier speakers, as well. So you mentioned concerns over natural gas being disfavored. Many of the other earlier speakers touched on existing resource diversity that was already available. And yet I also heard from John that natural gas represents over half of generation resources from our membership. We also heard from Secretary Moniz about recent significant growth in natural gas. So, given this particular rise, and I'll open this to whoever would like to comment, can you comment a bit more on the value or importance of resource diversity?

JAY MORRISON: Let me just jump in on that very quickly. One of the things that I mentioned was risk management. We are trying to ensure that power stays reliable and affordable for our members into the future. Not just today, not just tomorrow, but for the next ten years. We don't know what's going to happen with any particular resource; one year wind is favored, one year gas is favored, one year solar is favored. Each one has its value to the system. Each one has its values to the consumers and to the grid. If we can have a balanced portfolio on the grid then that allows us to manage that risk, and it allows us to optimize across the different values that each one can offer to the system. An all wind system would not be useful on calm days. An all gas system would not be useful if gas goes back to a \$12 a million BTUs, we want a balanced system. Each resource that gets taken out of that portfolio takes away some of our risk mitigation and takes away some of our ability to optimize the grid.

TOM KUHN: You know, last night I had an opportunity to be together with one of our international members and they were mentioning what an incredible benefit this country has from low cost natural gas. The customer being able to make the transition off the older plants, which they don't have in other parts of this country. I fully concur with what Jay is saying, you

know, there are some real efforts right now by people to say that natural gas is a fossil fuel, and we don't need any more fossil fuels so what was supposed to be a bridge to the future is becoming a shorter bridge. And that gives people a major pause to make investments in new pipelines and things of that nature, which I think are necessary because we are on a trajectory to meet the goals. I think if we can get on a trajectory to meet the goals of the Clean Power Plan and into the future, we will need natural gas. We will also need those coal plants that -- those cleaner coal plants that are still very much a third of our system. We talked about nuclear being along with renewables being a third. But nuclear is in peril, we're closing some old nuclear plants because of market conditions and nuclear has to be valued in some way or another by the state's or in the marketplace or you will not meet your global climate change targets. About more than 60% of the -- you know, zero carbon resources in this country right now are provided by nuclear plants. So I mean I think these are the challenges we have, as we look at QER two, but we -- 1.2, but we really have to make sure we maintain that diversity and with a goal of getting increasingly cleaner energy.

CHRIS KELLEY: Thank you, Tom, Sue.

SUE KELLY: Thank you, I would just say that I think we in our industry have a tendency to go through periods where we all run to one side of the boat and build one thing. Commissioner Cheryl LaFluer, who I love, said: We are guilty of serial monogamy. Which is true, first we marry one person, then we marry another. But I would support Jay's approach that, yes, we need a diverse portfolio, we just happened to build gas in the '90s and coal in the '80s and luckily they're long life assets, so we have the ability to take advantage of them of even when the fad is over. I spent the first 15 years of my career as a natural gas regulatory lawyer. I saw \$3 gas; I saw \$14.50 gas. I have a pretty clear understanding of the vagaries of that industry and the boom and bust cycles to which it is susceptible. And I am very concerned about the idea of running over to that side of the boat right now and thinking we're going to have low priced gas forever, for two reasons, one if everybody assumes that, then we won't. And two, for the very reason that is Jay notes, there is a definite, you know, view, among many in the United States that we should be moving away from fossil fuels entirely and making long-lived investments in that one fuel; if you went whole hog in that direction could be problematic. But, you know, again, the value of portfolio diversity and having all different types of fuel types, and demand and supply side resources in the quiver with the ability to use those and to calibrate them as time goes on is extremely important. So natural gas, I think, is an important part of the mix but I, you know, I would not call it a panacea or a savior by any means.

CHRIS KELLEY: Thank you, Sue. John.

JOHN SHELK: Certainly fuel diversity is a worthy goal and everybody invokes it and we actually have always had, as Sue just said, a fuel diversity. It may not be diverse in terms of the new generation in a given decade, but the overall effect has been fuel diversity and that's important and I think what Federal Energy Regulatory Commission is doing on the energy pricing reforms I mentioned earlier will actually help. We've promoted that and pushed it with, as I had mentioned earlier a very fuel diverse coalition because we think if you get the prices right and the market rules right for everybody regardless of fuel type it will help certainly many

of the resources that are at risk. The only caution I would note is that fuel diversity obviously means different things to different people. And this is, again, where the analytical work and the broad-based approach of the QER can really, I think sort have been an honest broker if you will or bring people together because it makes me concerned is sometimes fuel diversity is invoked as a reason to put thumbs and hands and feet on the scale, to then start to carve up the market by fuel type. And I think for all the reasons that Jay so articulately indicated and I was not around when Thomas Edison was here, but back in the Jimmy Carter era and the Reagan era, we first passed the Fuel Use Act, as Jay said, and then I came onboard and a number of us, Melanie included, helped repeal it. And if we hadn't done that and if Congress hadn't passed the Clean Air Act amendments of 1990 we wouldn't have had the foundation. So, the only cautionary note from an old-timer is be careful when people come in and use fuel diversity not in a rigorous way but a way to say well, carve out my particular fuel or let's have a division by percentage type, because I think that would get us down the slippery slope. No one has used that term yet. It has to be used every 15 minutes in Washington. Jay is right, we can't go down the Fuel Use Act slippery slope again.

CHRIS KELLY: Thank you, John, and finally, Gerry.

GERRY CAULEY: I think fuel diversity has a direct correlation to reliability and a lot of times we don't really understand that, articulate that and value that. I don't know that very many people put dollar values on that, but if you think of the planning horizon of five or 10 years and the uncertainty of different kinds of units that we can build, there is a lot of uncertainty what will be available. But I think even in nearer term operational terms, if there's a disruption to rail traffic and we lose coal capability or an extreme cold where we're competing with retail customers for natural gas, and we're switching to oil fuel as an alternative, there's a component of diversity that helps us get through the reliability tough points, and we don't really value that as much as we should, and I think it should be considered as part of the valuation going forward in the mix.

CHRIS KELLEY: Thank you, Gerry. So, I'll touch on something you actually mentioned in my next question here, so we heard from you and others about an apparent imbalance of policy and process. So while generation capacity continues to increase substantially, the process for implementing transmission remains lengthy, so you have the QER Task Force here before you. What recommendations or suggestions might you have for this group? Gerry, would you like to address that first?

GERRY CAULEY: Some of the others on the panel are probably more knowledgeable about the licensing process and permitting and so on, but it is getting to the point where you see case after case where the transmission doesn't get built, doesn't get approved. We are looking in our assessments as having capacity margin challenges in certain regions two and three years out now. The margins are getting tight. And the answer is, well, we can build generation in two or three years and make that up, but we can't when it is the solution is transmission, we can't, there is no way. We have almost become disconnected. We used to think of integrated planning on an eight to 10-year horizon and we would have a nice, coherent, organized system and that's going divergent. It's taking, if you're lucky, 10 or 15 years to get transmission built and we can plop

down generation in different places. Actually, in many cases can create additional burden on the transmission system and not relieve it. So I think really others on the panel more in terms of specific road-blocks and barriers getting into the way of building.

CHRIS KELLEY: Anyone like to comment, Sue?

SUE KELLY: I may not go in the direction you thought I was going to go, what the heck. I would say a couple things about transmission. First of all, it takes a long time to build it. It's a very expensive asset. People get really hacked off when you build through their - they have a statute in Minnesota called the Buy the Farm Statute; if you put transmission through effectively you have to buy their farm. So it's not an easy thing to do. So I think it's important that we make sure that we do a lot of analytical work up front to make sure we build the set of transmission facilities that are going to be needed under a number of different planning scenarios. In other words, not just to say I'm going to build this transmission out because we have anticipated this big new natural gas plant here or we're all going to use wind from this region. We should be looking at a bunch of different planning scenarios, figuring out the resources that are going to be needed under all of them, and start with those because if we build those then we'll be able to take into account, you know, as the uncertainty that Jay refers to, finally does, dear God I hope, settle out, you know, then we will not have built the wrong set of facilities, we'll have built, you know, it's like a Lego set. You build the bottom level that you can then use to add onto.

The other thing I would note is that there is in some respects a rush to build transmission, as I was talking about earlier, different fuel types. Right now there's a rush to build transmission, because it's regulated business, because while the FERC to its credit has kind of peeled back some of the more insane transmission rate incentives of the last three or four years, it's still a very lucrative proposition if you can do it and it's a long lived asset which will generate money for a long time. So there are a lot of people that are interested in building that because they see the cash-flow that they see coming from it, if they can get over the top and if they can get it built which is admittedly a difficult process. So I think we need to kind of also keep in mind is the transmission being proposed because that's what the system really needs? Or is it being built because that's the regulated return and a good place to put money right now. You know, so I just throw that caution out there.

TOM KUHN: Well, transmission is looking for today more clean energy resources, and I think as part of the Clean Power Plan, I think you're going to find that as QER looks at it, that it -- additional transmission is needed. I think the returns have to be adequate. But the situation has changed. We've talked about this issue forever, and I think that the situation has changed because you are moving toward more distributed resources, you are moving toward more intermittent resources and I think so the needs of the system are different. And it really gets down to a process of federal and state and local planning, so that you can get those questions answered up front as Sue indicated, but that you really have a will to move forward through some of the road-blocks, including some things like federal lands and other things to get these projects done.

CHRIS KELLEY: Thank you, Tom. John.

JOHN SHELK: I think this is a good argument for regionalization and the coordination between the Department of Energy and EPA and all the stake-holders and the states on implementation of the Clean Power Plan, because everyone knows by law that is a state-based system and a tendency politically and from an economic development standpoint, is to want to have the resources that Tom mentioned and other mentioned, to comply with the plan located within the state, yet in fact one can find and this is happening in the west, who would think that here you are in the year 2016 and discussion is underway for a more regional market approach in the west. Not exactly the way they're doing it in the east, but I think if we don't have some and this is probably the over used phrase, but the coordination is really important so that the states aren't going it alone, independently. They're looking at the ability to tap markets regional or operational of the grid, independent operation of the grid because some of the resources on the renewable side for example might be located across the state border but that would be less expensive yet the states are kind of looking at it potentially in a more balkanized approach if we don't emphasize the importance of transmission in areas where it would make sense to tap the regional market. And then I think we do have to have an honest discussion as a country and the department as well, positioned to help lead that intelligent discussion around infrastructure, not in my back yard, has taken on other forms. I think it's just very, very difficult to not even talk about infrastructure in some cases at FERC and elsewhere, and there needs to be a greater awareness and education around why not just transmission is needed in certain places, but all of the infrastructure that makes up the grid.

SUE KELLY: Can add one thing? Talk about going it alone, I think it's very important that if you are going to get new transmission of size constructed in a region that it have diverse participation, that it not be limited to one or two for-profit transmission companies, there are a lot of other entities who are interested in investing in transmission including my members and including some of Jay's members I'm sure, and I think one way to have a more diverse project to spread the risk and to make sure the project is needed under a broad variety of scenarios is to include diverse ownership. I wanted to get that on the table.

JAY MORRISON: If I may do a couple of things. One is to clarify that the challenge is largely with the higher voltage, longer lines, smaller facilities, local facilities, incremental improvements are being made, all three sectors of the industry are making investments in those, those are easier because they are being done in a manner that is immediately consistent with the needs of the consumers and the voters in the areas where the investments are made. The risks are relatively limited. The decisions being made can be made fairly locally without much concern. The challenge is for the really long range transmission, the transmission needed to move wind out of Kansas to someplace where there's load, for example. We have members in Kansas who already have more wind than they can integrate. They are forced to ramp down a coal unit that's required to provide inertia to most of the Midwest. There's a lot of worry about the reliability implications. It's a great wind resource, but the transmission isn't there to move it to someplace where there's load. There's very few people in Kansas, as wonderful a place as it is for the folks who are there, it cannot absorb the amount of wind that is available there.

So a couple of things. One is, I thought it was interesting that John mentioned -- I'm sorry, Tom mentioned both the increase in variable generation and the increase in DER. This is part of the theme of uncertainty. Is this a future where we are moving vast amounts of wind from the Midwest to load in the east in Chicago area? Or is this a future where we don't need that central station generation anymore because it's all going to be local whether it's rooftop or community solar? If you're going to build billions and billions of dollars' worth of transmission to move that large scale wind, you're looking at the growth of DER with concern. If you are in our members' position, you're trying to figure out: One, which is actually the most cost-effective approach for our members in the long-term and therefore which one would they really like us to see and will government let us choose the more cost-effective approach. But that's -- even so, that future is somewhat uncertain.

On the second thing I want to do is just talk again about being realistic in light of these challenges about what we're going to accomplish, where and when and how. The Executive Director of Environmental Issues on our team would be very mad at me if I did not mention that there are a lot of assumptions in the Clean Power Plan's model that are built into the base case about how much transmission is going to be built. It's just assumed that it's there, and then the Clean Power Plan additional transmission on top of that is fairly moderate. So they're assuming an enormous amount of transmission that is not yet being built. And so when we do the modeling, when we do the analysis of what are the reliability impacts of the state plans, we have to factor into what is the transmission that actually will and can be built, as much as we want it can we realistically expect it? At what pace? And put that into our reliability analysis and into our estimates about how long it's going to take us to reach different goals so I just wanted to make that point.

GERRY CAULEY: I have one more case example in Texas where they had built so much wind and it really got ahead of the curve. It was bottled up, just like in the Kansas case, but they were able to get the transmission built to get it to the load. It's a positive contrasting example where it can work, but they have to be strategically coordinated together to make it happen. I think that opening up big pockets of new resources is going to drive where we need that transmission.

CHRIS KELLEY: Thank you, I'd like to turn to another topic, and we're running a little bit low on time so we may only have time for one or two commenters on this and I'll give you one last chance to address the QER group but it's the topic of cybersecurity. All of you, I think, touched on the importance of cybersecurity and the measures that are being taken by your various organizations, so I took note of a concept that was new to me. I don't remember who said it, but something about a mutual aid for cybersecurity. That was a new one for me. Sounds interesting. I'd like you to talk a little bit about your sense or your members' sense of whether or not enough is being done on this front or if more should be done. Anyone care to take a crack at that? Yeah, Tom.

TOM KUHN: Well, I really think the partnership has spurred on a lot of action investment coordination with each other. And so I think we are moving at a very deliberate pace. Gerry and the team at NERC are relooking the whole EISAC to improve its operations and information sharing. I mention the other things were being done, the idea of a cyber mutual assistance is that

back in Hurricane Sandy, we brought together some 67,000, you know, line workers and tree trimmers, well, if you have a cyber-attack you don't need probably that many line workers and tree trimmers, you need more IT people and folks to restore the information technologies that are out there. So cyber mutual assistance is a different kind of an animal. That's an example. But I think that there's so many things going on with respect to the partnership of the FCC and I would certainly endorse what Sue and the others said about Pat Hoffman the team at DOE and the Co-Chair of the FCC, it's just been a terrific thing. But all the other agencies too, DHS, is participating at the White House and others. The electric sector is probably the most important of the critical infrastructure sectors, and we're being put up as a model by the National Infrastructure Advisory Council. that we're doing probably more good things than a lot of other industries but that doesn't give us a lot of consolations, because there's still a lot to do.

CHRIS KELLEY: Thanks, Tom. John, did you have a comment?

JOHN SHELK: I would just say, they're too modest to say it but EEI and APPA, also NAERC they have really been in the lead and we're a member of it. But I think the Electricity Subsector Coordinating Council as Tom said, I think the public would be proud of the work that CEOs and leaders within our companies, our members are putting in on a very regular basis and Gerry's able leadership and deputy Secretary Sherwood Randall, and it's an important issue, it's not just cyber, it's physical security, but while we may disagree on certain policy issues, I'm really, really impressed and the credit goes to the folks who chaired eight at EEI and APPA to make it work.

SUE KELLY: Gerry, I am going to say something but I'm going to defer to you. I would just say that last November the industry, and I mean the industry, very broadly across the country, participated in an exercise called Grid X Three. And I think that was kind of like going to the dentist when, I don't know if you remember this when you were kids, you'd go to the dentist, you'd brush your teeth and then you'd do your red disclosure tablets and it would show you everything you missed. That's kind of what Grid X Three was like. We realized where we were strong and we realized where we needed to improve. And thank, you know, I'm glad we did it that way rather than in real time in a real event. So I think we've all taken lessons back from that and we are working to improve the cybersecurity posture of our members and trying to work with them to develop the tools and the technologies and continue to work with the government on that front. But, you know, we would be foolish to think that we have, "Done enough." It's extremely difficult to ever do enough. Because you know the threat that we're addressing is growing by leaps and bounds, and getting more sophisticated. And we have to, you know, we have to stay up with that. And that we have to protect everything. They only have to get in at one entry point. So it's frankly it's daunting, but we are doing everything we can do. Thank you for that shout out, John. We've spent a lot of time and energy on this, this, as I said, is one of our six strategic initiatives for the next three years and you know we are going to do everything we can to try and avoid being on CNN.

CHRIS KELLEY: Thank you. Gerry?

GERRY CAULEY: Yeah, I appreciate all those remarks and sometimes for me, it's best for me when it comes from the industry leaders, so I appreciate that. In terms of the QER, I can't

emphasize enough the need to continue the research and the tools, the group, once they saw some of the tools available to protect, the government wanted to really have access and the partnership has built that trust where they can share those with us and we are deploying some of the tools now in the industry. They're extremely helpful. It's nothing like having a lens into what's going on and being able to see the bad guy activities, and have that firsthand information, turn it into useful intelligence that we can act on. So I just think continuing to leverage that, build that, whatever additional research we can get in that area will be pretty much appreciated.

CHRIS KELLEY: Thank you, Jay, did you have a comment.

JAY MORRISON: What they said.

CHRIS KELLEY: Thank you. Appreciate that. So, we are running a little bit short on time. But I want to give you all one last chance and we'll just run down the list here to address the QER group that you have in front of you. So, given that we're limited on time, I'd ask that you just keep your comments to one minute. And maybe highlight the key point that you'd like to leave this QER Task Force with here today, so, Jay, we'll start with you.

JAY MORRISON: Thank you very much. What I want to do is I want to thank the department for conducting this process. We have very good people who run very good cooperatives. They know their businesses. But you all know technology. You all know the grid is a whole. You all have tremendous capacity to help us with tools, with technology, with research. To bring down the cost of the technologies that allow us to serve our members better. To help us to analyze how to solve the problems that we have and how we can best optimize the system for the benefit of our members. So please focus in those areas. That's where we need your help. That's where we've always enjoyed working with you. It a pleasure to work with such an experienced agency, and we look forward to continue doing so.

CHRIS KELLEY: Thank you, Sue?

SUE KELLY: I'm going to be extremely short. I've pretty much said everything I wanted to say in my opening statement. I'll just say that I really appreciate the analytical effort that's going on at DOE. I feel like the EPA has kind of given us the ring and told us to take it to Mount Doom and we've got to do that. We've got a lot of things to negotiate from the time we get from now to there and we will look for all the help we can get from agencies like yours and the White House to get there.

CHRIS KELLEY: Thanks, Sue. John.

JOHN SHELK: I'll end where I started and that is to make sure that we keep in mind the 40% of the generating fleet that is on a market basis, the competitive community embraces the technological changes we've discussed. There's incredible potential. It's exciting, we look forward to it. But the important thing, I think you've heard it from all of us in different ways is the various pieces have to fit together, it's not going to happen overnight. It's really in the interest of those who want that new future to arrive in a way that's economically efficient and environmentally responsible and most of all, has public acceptance, to understand the importance of doing it in a way that keeps the pieces together. And the last point in that regard is, and I

believe this is on the issue list, but it's important to hear from investors, the financial community, the RTO's and ISO's and their market monitors as sources of information and perspective as you move forward and again appreciate the opportunity to be at the first installment. Thanks.

CHRIS KELLEY: Thanks, John. Tom.

TOM KUHN: Well, I think that this doesn't sound at all like the presidential debates, we have one minute left and everybody is kind of nasty to each other. We could be, but, you know, there's been a lot of consensus up here, some differences, obviously. But, again, I think that the department's role with the QER, the first one was terrific. I think this one, I think, has a lot of important areas to deal with and the aftermath of the Clean Power Plan and the technological transformations that are going on within the industry. So we look - very much look forward to working with the department on the analytic work that's going to come out of here that I think will help direct energy policy for I think the next 15 years anyway.

CHRIS KELLEY: Thank you. Gerry?

GERRY CAULEY: I'll go back to my number one theme, the central reliability services. You know, in the 20 years that we've kind of understood ancillary services, we're getting to that point and I think California was the first example, where we went from a 20 years of -- they're all plentiful; to now they're scarce and when they hit the ramping issues we started to deplete one of those services. So I think it's a partnership going forward in terms of the industry, in terms of policymakers, regulators at the Federal and State level and of markets to recognize them, to understand the analytics behind them. They're not mysterious, we've published a couple technical reports. Understand them. Be able to respond. But it will take money, it will take investment. It will take understanding of how this grid really works to put it all together and make it work. Thank you.

CHRIS KELLEY: Thanks, Gerry. So please join me in thanking this distinguished panel here today.

(Applause.)

CHRIS KELLEY: As we changeover here, I just want to remind folks in the audience that have an opportunity to provide comments at the end of this next panel. If you haven't already signed up at the lobby, please do that. Again, for those of you who are joining via the webcast, you can submit your comments via the web on www.energy.gov/qer. For those of you in the room, just a reminder, we have restrooms available in the lobby on the right and left-hand side. We'll get started here in a minute.

CHRIS KELLEY: Okay. So I just asked the next panelists to join me here on stage and we'll get started in a minute.

Panel 2

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

CHRIS KELLEY: So welcome back. Looks like we've rallied the troops here so we'll go ahead and get started with the second panel. So our second panel is on electricity distribution and end use; how do we manage challenges and opportunities? So joining me here up on the stage are Steve Nadel, the Executive Director for the American Council for an Energy Efficient Economy, Tom Kimbis, General Counsel and Vice-President of Executive Affairs, Solar Energy Industries Association, Lisa Wood, Executive Director, Institute for Electric Innovation, David Springe, am I saying that right.

DAVID SPRINGE: Springy.

CHRIS KELLEY: Springe. Executive Director, Executive Director, National Association of State Utility Consumer Advocates. And Robert Powelson, Pennsylvania Public Utility Commission and First Vice President, National Association of Regulatory Utility Commissioners.

So we're going to follow the same format as the last panel. So what we'll do is we're going to go through each of the speakers, you'll be given five minutes to present, I believe some of you actually have presentation materials with you. We'll get that up on the screen and you'll be given a clicker to click through your slides if you have those and then we'll turn right into the questions from me. So why don't we go ahead and get started with Steve.

STEVE NADEL: Okay. Thank you, and thank you for the opportunity to talk here about these pressing issues. I have a number of slides that relate to the whole opportunities and challenges in terms of the electricity distribution system and use. These are all online. I'm not going to spend a lot of time talking about each of the points. For example, I won't be reading this slide, but I'll be elaborating a little bit on it. And I refer you to the QER website for further details. So, I work for the American Council for Energy Efficient Economy, we've been promoting energy efficiency savings for 35 years through all sorts of programs, policies and market interventions. First I would note that energy efficiency tends to be the low cost utility system resource. This chart shows the range of energy efficiency cost to utility per kilowatt hour from one of our studies, compared to estimates by and others' studies, as you can see energy efficiency is typically half the cost of other resources, so it's an important resource. We've gotten a lot of savings from energy efficiency over the years, this chart using EIA data shows in the blue the incremental savings from measures installed each year, at a national level up to about 0.7% savings per year. That's 0.7% of total electricity sales. But if you look at the measures installed this year, plus were installed in earlier years or are still in place, those are the red bars and as you could see we're up to nearly 5% energy savings. As a percent of sales from utility sector energy efficiency programs and it's been growing nicely in recent years.

I mentioned 0.7 is the average national. This chart shows some of the leaders with Vermont and Massachusetts over 2% a year but quite a few others well over 1%, showing what is possible and many of these have been sustaining these level of savings for years. Now, one of the questions we often get is: Okay, that's all well and good. They're doing a lot of CFLs, they're doing a lot of commercial lighting, aren't we about to run dry? In our opinion, the answer is no. This is from a study we released late last year, we called it New Horizons, we looked at a variety of new, I'll call them emerging measures, and together with found that those measures in our medium case could reduce energy use in 2030 by about another 22%. This chart shows the biggest measures as the percent of total electricity sales, biggest ones are started to look at plug-loads, all the little miscellaneous loads we by and large have ignored as the IEA once called them, "things that go beep in the night". Conservation voltage reduction, another real big one, very much related to distribution system planning, I won't go down the list, people can look at this later. I'd also note that many people will be talking about distributed energy. Some of the people right after me that will. I would note that CHP, combined heat and power, is part of that distributed energy.

Resource, that means generating both heat and power at the same time. And much more efficiently than if you generate them separately. This chart from an American Gas Association ICS study shows the technical potential. You can see in some of the leading states, there's more than 8,000 megawatts of technical potential. On average they found about a third of the technical potential has a ten-year pay back or less, so, yes, those numbers will have to be reduced. I point out also that energy efficiency saves energy, but as part of the economical calculations there are also a variety of non-energy benefits, whether it's helping improve health and safety, reducing tenant turn overs, here are a couple of slides which I won't go into the details on, about some of the non-energy benefits both for homes, as well as for businesses. I urge you to keep they say in mind as we're thinking about cost-effectiveness, but also, how do we encourage the customers to do these measures, it's not just the energy savings, people do things for a variety of reasons and how do we lever these non-energy benefits as well.

One important opportunity is to use energy efficiency as part of distribution system planning. Typically, we've used it for generation, but they are on the order of a dozen or so utilities that have used it to actually reduce loads on particular distribution circuits that are getting tight. ConEd is one of the leaders, in my more detailed presentation, I include a variety of slides on this, but here is just one showing for some of the projects that they did, what they expect the benefits to be relative to the cost. As you can see, the costs in this particular case are less than the T and D savings, even ignoring the energy savings or the other savings; but if you add them all together it's pretty compelling. The Brooklyn/Queens Project which I suspect you have heard about is another example.

As we heard in the last panel, the utility industry is changing in fundamental ways. As a result of this - I'll call it restructuring, it's not regulatory necessarily, but restructuring of the industry, utilities will have to look for new creative ways to provide services and to keep financially sound. We see a significant role for utility value added services. If they do them well. it's an opportunity to earn profits. In our space, we believe it really should build upon their existing expertise whether it's energy efficiency, electric vehicles, some of the larger DG systems,

whether it's CHP or community solar, places where they might have some particular expertise. We need to have a level playing field with competitors, they don't need to be unduly advantaged, nor unduly disadvantaged, and a lot of details that state regulators will have work through, but we see that as an important venue or mechanism for promoting these savings. There are opportunities to increase electricity use and also provide value to society, electric vehicles as a classic case. This one compares a hybrid vehicle on the right with electric vehicle in the center and left. The electric vehicle tends to be more efficient, particularly if you're talking renewable power or very efficient central station power. The emissions profile depends on the emissions of the power plants, it can be a major emissions benefit with clean resources, not so much with dirty resources, so, again, we need to look at the energy system in conjunction with the move toward cleaner energy. Another opportunity is heat pumps. This chart from the EIA REC survey shows the percentage of homes by state with electric furnaces. In many of the southern states more than 30% of homes have electric furnaces which means they have ducts but use electric resistance heat. They can cut their energy use by more than half by installing a heat pump. And this might be a major opportunity.

CHRIS KELLEY: Steve, can I just ask you to wrap it.

STEVE NADEL: Okay, in terms of challenges, why don't I mention one challenge here, which is that energy use and GDP have tended to be in lock-step but in recent years as you can see they've started to decouple. So this is for a study we did last year, looking at the EIA reference case, the upper line. If we accelerate efficiency, if we accelerate PV, if we accelerate EV, even with all of those, we figured in our medium case it would still be level. We are going to need resources to replace what we have now. When it gets retired, we need cleaner resources, we may need TND, but we need to be careful not to over build and over invest because that will just raise costs, energy efficiency can be an important part of that solution, so thank you.

CHRIS KELLEY: Thank you, Steve. Tom?

TOM KIMBIS: Thanks. There we go. Are we losing it? If not, we'll go without it. You want to.

CHRIS KELLEY: We should be able to bring it up.

TOM KIMBIS: I'm going to go ahead anyway in the interests of time. It's up. Magic. It's just a touch. Thank you, thank you to the Administration, to the Department of Energy for undertaking this historic effort of the QER. I'm Tom Kimbis, Vice-President and General Counsel of SEIA, we're the National Trade Association for The Solar Industry within the United States representing about 1,000 companies and now over 200,000 American workers. Recall some key pieces looking back at some of the critical energy legislation pieces that went into effect over the last 20 years or 25 years, EPAC '92, '05, stems from work done at the Department of Energy that really shaped the energy portfolio that we have today. So we have to take this process very seriously and really appreciate the engagement that we are seeing today and I think you have planned for many cities going forward. In talking about solar though, very little is similar today that existed back in EPAC '92 or even in '05 with a new energy bill on the floor today in 2016, we see solar energy not as a distant hope, but as a clean, reliable, affordable electricity choice for

Americans today, whether there are homes and businesses across all 50 states, from Wal-Mart or the U.S. Navy to homeowner's in suburbs of New England, to community solar projects that you heard about in the first panel. In inner cities of the Midwest or West. Today you may have noticed in some of the great charts, if you didn't take to chance to see them on the way in, please do so. You will note that last year solar, natural gas and wind really accounted for the new generating capacity in the U.S. That's not the total generating capacity, but the new generating capacity in last year and recent years really has been dominated by those three, which is a very interesting trend. Meanwhile over the last few years the cost of solar has plummeted to a fraction of what it was at the beginning of this administration alone. Yet we're still small. Solar is still small. We're still only 1% of the electricity mix in America and although we're growing fast, we've got a long way to go, a lot of hard work ahead and we look forward to working with our colleagues here, and across the many stake-holders that are out there. By 2020 we'll have installed 100 gigawatts of solar capacity. That's enough to power 10% of American homes. So I want to hit on just our top points in quick order here.

Many of which comes down to two themes, one is education. We need to do better with education, whether it's talking about consumers, policymakers, you know, utility executives, whoever it is about solar because we're new. We're the new kid on the block here. And second, how do we interface with the existing infrastructure. You heard a lot about that in the first panel. Something, you know, hit on today, and I think others will hit on, on this panel. Call our technologies disruptive or innovative it Doesn't really matter. They're there, they're going to flourish going forward. I think it's our choice to make sure that we take the road of innovation and celebrating that American innovation and I'm confident that as a nation and under this process and under state processes, we'll make the right choices, and I think the roll of DOE and the National Labs is going to be enormous in that. So very quickly you see these, I don't have to iterate them very much, except to say that solar market is really divided into utility scale power and distributed generation. You hear a lot about distributed generation, it's the catchy one in the news, it's the one you see in your subdivision. And yet, as Tom Kuhn noted in our first panel, utility scale solar accounts for roughly 60% of the solar going into the U.S. today and probably over the next several years. On utility scale solar they're very different issues than in distributed generation. First we need to ensure that states really fully understand solar characteristics, what solar can do and what solar can't do as an intermittent resource in developing Clean Power Plant compliance plans. And without this understanding we've heard, you know, we have a federal discussion today, we're here in the Capitol Visitor Center, but so many decisions are going to be made at the state level. And this gets into a theme of federal/state interaction that is so critical. It's a critical role for DOE and the National Laboratories to continue to provide the unbiased technical assistance through studies or whatever's needed by the states to make their decisions and make them wisely. Second for states that are seeking a richer, more diverse electricity mix through renewable portfolio standards, we want to make sure that those choices that have been made and put into place aren't scrapped too far in advance of the Clean Power Plan anticipated implementation such that you get kind of a jagged market moving forward within that state.

Lastly, solar is still the newest and smallest of our electricity providers, needing to make sure that utilities that do want to integrate solar in their portfolios and you heard from many of them

in the first panel, they receive assistance in developing those integrated resource plans. Again, with that 60% of solar build in the next several years, we want to make sure that it's done in an effective manner. That Clean Power Plan, you heard the panelists mention affordability and reliability over and over again. Those are critical. I want to inject two more things. Diversity. Diversity of energy supply and national security. And second, the environmental benefits, it's the Clean Power Plan. So let's make sure we talk about all four of those things going forward and there's no doubt in any of our minds a Clean Power Plan is going to be difficult, it's going to be a challenge but let's take it on and not shy away from the hard decisions.

In distributed generation, you see three goals, we want to make sure that net metering, the ability to sell excess energy back to the grid, which we believe is a fundamental value proposition for American consumers; it helps boost competition among electricity providers and recognizes the value of distributed energy is preserved. We all heard about the debates going on in the different states, no matter what side you're on or what state we are talking about, they're thorny issues and this is a good role for QER and for the Department of Energy to be able to step in and provide that unbiased information to help states make the right decisions. Similarly, in state rate design proceedings we don't have the ability here to look at the costs and benefits the way that you do in a net metering proceeding, but we must ensure that the rate design principles are designed and applied fairly to establish energy providers alike. Lastly, final point for me is just something we didn't talk about earlier, I know one of the questions, moderator questions was -- had to do with the consumer and what is the role of the consumer. The solar industry has really stepped it up in the last year because we know we're new and we know as we ramp up, just like we had ramp and up in cellular phones, Internet, consumers are very interested in technology, it's a hot, sexy technology, you see it in the front of *Time Magazine*, etcetera, but there's a lot of confusion as to what it can do, what it can't do, so we have taken great strides to provide consumers with a significant increase in the amount of education regarding solar choices in the last year. We're committed to ensuring that consumers fully understand solar transactions. So we're working with state Attorney General's, we're working with state, you know, Better Business Bureaus, as well as Federal entities like the FTC and FCC. Thank you very much.

CHRIS KELLEY: Thanks, Tom. Lisa.

LISA WOOD: Okay, thank you. Good afternoon, everyone, I'm Lisa Wood, Executive Director of the Institute for Electric Innovation and Vice-President of the Edison Foundation. So our members are the nation's investor and utilities, same as EEI. We also have about 25 technology partners representing both large and small companies that are actively working with the electric utility industry in the transformation that's underway. So we are the foundation arm of the Edison Electric Institute. So thank you to DOE for the opportunities to be part of this discussion today about electricity distribution and end use.

I'm going to focus on two topics today, first I'm going to talk a little bit about major trends and I think Tom Kuhn talked about that. He covered that a little bit earlier. And I'm going to talk about some regulatory issues, and as Tom mentioned, a lot of these issues are state regulatory issues but they're very important issues for this transformation of the electric utility industry. So, first, I want to just focus on the three megatrends that we look at right now in terms of changing

the electric power sector. And I'm just going to hold up a copy of this book that we put out in December called *Key Trends Driving Change* that actually focus on these three areas. So -- and Larry has copies if anyone wants a copy. The first trend is the transition to a clean energy future. As a nation, we are investing increasingly in renewable energy. We're also obviously transitioning from coal to gas, and we're continuing pretty much on the steady pace with nuclear and also pursuing energy efficiency, as Steve mentioned. In fact, the electric power industry is responsible for the great majority of energy efficiency that's achieved in the U.S. year after year. At the same time, we're modernizing our grid. So modernization and digitization of the grid will enable the integration of more renewables, both large-scale and distributed. In fact, as Tom mentioned we expect exponential growth in solar over the next couple of years. And by 2020 it will probably be about 10% of our capacity which is hard to imagine just a couple years ago.

TOM KIMIS: It's very hard to imagine.

LISA WOOD: So, yeah, so, today, the power industry is actually the largest investor in clean energy in the U.S. as this number's been thrown around a few times earlier today. We do provide about 60% of all the installed solar capacity. And that is large-scale solar, community solar, and also in some states, where we are permitted to do so, we also provide rooftop solar. And we also basically are responsible for almost all of the wind energy in the U.S. So we are investing today about \$9 billion per year in solar, and we expect this to continue over the next several years. So solar is definitely the power source I think that we're all expecting to grow enormously. So the second -- so the first trend is that transition to a clean energy future.

Second trend is a more digital and distributed power grid. And most of my remarks regarding regulation will be related to the digital industry, will be the power grid. The power grid is becoming smarter. We're putting in a digital communications overlay, millions of sensors that will ultimately make the grid more controllable and self-healing. The industry is investing about \$20 billion a year in the distribution grid. Our CAPEX over all is about 100 billion, but our distribution grid investment is about 20 billion. The latest number is actually around 22 billion, but I just sort of stick with the round number. That will enable the connection of distributed energy resources as those resources grow, as well as the connection of new devices in our homes and businesses. Some of which we have today and some of which we don't even know about yet. So many of these resources and devices will interact with the grid. And this will basically result ultimately in a more reliable, resilient and efficient grid.

So the third trend I want to just focus on is what I think of and what we call Individualized Customer Services or Customized Customer Services. As the grid becomes increasingly digital and distributed, we're seeing customization of services starting to really take off. And what do I mean by that? If you think about the electric utility industry, for 100 years we've talked about industrial customers, commercial customers, residential customers, you know, we provide electricity. But now what we're seeing is customers starting to ask for tailored services or specialized services, for example, large commercial customers are asking for renewable energy services to meet their corporate sustainability goals. Cities and towns are asking for help with micro grids, smart city services, and also renewable energy for their sustainability goals. Residential customers increasing want renewable energy either to just buy renewable energy or to

put it on their own rooftops. So all of these things are basically pointing towards a much more customized service model for the electric utility industry in the future. We're not -- we are starting to make those changes but a lot of regulation will need to change to really accommodate those customer needs.

So now I want to turn to that and just say a few things about regulation as the power grid evolves. So the speed of transformation of the power sector will depend to a great degree on where the regulation evolves to accommodate the changes. The business model of electric utilities is already changing. If you look at just five years ago, our power mix has changed significantly in the U.S. But in order to really push this change forward we have to have regulatory change to go with it. So having regulation adjust to facilitate these changes is absolutely critical. I'm focused here primarily on state regulation because a lot for the electric utility industry at the distribution level, a lot of it is about state regulation. So, over the next decade, in my opinion, regulation will have to provide the path for utilities to achieve these new corporate goals and policy goals to meet the changing needs of customers.

So the next thing I want to just talk about is the value of the grid. The value of the distribution grid, not the transmission grid, just the distribution grid, because that's the piece of the grid that's becoming so important as we bring in more and more distributed energy resources. So we're seeing this movement towards a more digital and distributed power grid; we're also seeing the need for more reliable and resilient grid operations, greater efficiency and control and for the connection and interaction with the so-called Internet of Things. This creates challenges, it creates new roles and it creates opportunities. Five or six or seven years ago we started deploying smart meters, today in part with the help of the Department of Energy. Today we have close to 65 million smart meters deployed, digital smart meters in the U.S. That represents about half of all U.S. households, that's one key building block to the digital and Smart Grid. Now we're integrating more and more distributed energy resources. In California, Pacific Gas and Electric actually has 25% of all the rooftop solar in the U.S. in their footprint, in their service territory. So utilities are playing an absolutely central role as the integrators and enablers of this grid of things. So as I mentioned earlier, we are currently investing \$20 billion annually in the distribution grid. We expect that to continue over the next seven years. But for the grid to continue to evolve and provide the services that customers want and to integrate an increasing number of distributed things, all customers that use the grid will have to pay for the grid services that they use. And this is the crux of the net energy metering debate. So Tom mentioned earlier there's a lot of energy metering debates around the country and selling solar back into the grid, but the elephant in the room is not selling solar back into the grid. The issue is paying for the grid services that you use basically every minute of the day as you import power, export power and balance power for your rooftop solar system. And this is a fundamental issue that will have to be resolved, I think, over the next couple of years. And state regulators are focusing on it.

So I want to say a few things about paying for the evolving power grid. So utilities today are providing safe, reliable, affordable and increasingly clean electricity. Tomorrow's utilities will be providing even cleaner electricity, more individualized customer services, and integrating and

connecting more and more distributed energy resources, and providing greater reliability and resilience. The fundamental question to me is this: How do we change current rate making and rate design practices to accommodate the increasingly important role of the distribution grid and the services that it provides? Alternative regulatory approaches can lead to the appropriate recovery of costs associated with maintaining, operating and investing in the grid. Any approach adopted needs to provide stability for the recovery of cost of the grid and the services it provides. Must hold the utility accountable for delivering specific customer benefits and services, and must ensure that all customers who use the grid continue to pay for the grid services that they use. As distributed energy resources grow, which is what we are seeing and what we expect to see over the next decade, and become increasingly important to our power mix, the ability of the utility to recover the cost associated with providing grid services will become an increasingly significant issue. In my view, maybe the most significant issue that we have we have to come to terms with from a regulatory perspective.

So, a couple things in conclusion. We're seeing a lot of change in the electric utility industry driven by technology, driven by policies and drip by customers. There are lots of opinions on exactly where we're going and how long we're going to get there and what this change is going to look like, but I do think that many of us would agree on a fundamental vision of what our utility sector will look like ten years down the road. And I'm going to just describe it in five points.

CHRIS KELLEY: Can you please turn to your closing comments.

LISA WOOD: Okay, I'm at the end here. We'll have a cleaner generation mix, power grid will increasingly integrate a mix of central and distributed resources, the grid will be more digital, controllable and more interconnected. We'll have a mix of entities, utilities and other companies, providing supply and demand side distributed energy resources and suppliers both utilities and others will offer customers a wide range of individualized services.

So my last comment before I close is that I think in order to move forward, we need collaboration. We need good public policy, and we need appropriate regulatory policies, these three items are critical to a successful transformation of the electric power sector.

CHRIS KELLEY: Thank you, Lisa. David?

DAVID SPRING: Thank you. I appreciate the opportunity to be here today. I took over the Executive Directorship of NASUCA just very recently and so I'm still trying to find my way around the subways and few other things out here, so I very much appreciate DOE and the Secretary reaching out and asking NASUCA to be a part of this panel, I think it's extremely important. NASUCA, the National Association of State Utility Consumer Advocates, is an association of utility consumer advocates from about 40 states and the District of Columbia. We also have some affiliate and associate members. The majority of our members are statutorily tasked with representing customers at the state level. We live at the ground level with our fine brethren from the Commission side. Where these decisions are being made, where the cases are going to be argued, where the policy is going to be set and where the consumers and the bills they pay are going to be set. So this is very important to us. One thing I did want to mention quickly about NASUCA, just so people understand; I think sometimes we get looked at as

simply advocating for a very small slice of customers and that's not actually true. About half of the NASUCA member states represent within their portfolio, all classes of customers, which I'm sure makes some interesting policy debates within the office, given some of the natural clashes between different interests, but you know we aren't just a small subset of customers with most of our members represent all customers and then some represent smaller subsets. I also have to give a little bit of a caveat. Obviously it's a very diverse membership, so as I speak here on behalf of NASUCA, I'm not speaking on behalf of any of my individual members and certainly not indicating what any of them might or might not want to do in any of their local jurisdictions. Trying to stick to some broad themes about the types of things that I'm hearing as I speak to our membership and the types of things that we should all have in the back of our mind. First of all, NASUCA believes that all customers deserve access to safe, reliable and affordable utility service, it's just that simple, it's not a complicated thing and certainly changing technology could present some opportunities for customers, but the opportunities cannot be provided at the expense of other customers. So there's sort of an inherent conflict in how we design our system. Certainly the changing technology may present a challenge for operators of the grid but we can't let the operators of the grid use these as an excuse for investments that can't be shown to benefit all customers over all. If we're simply making investments that are only going to benefit a small subset of customers at the end, we should really be thinking about what we're doing. And finally at the end of the day, as we go forward, we look out over years, it's certainly possible that some customers are going to find alternatives to the level and type of services that they currently purchase from our utility system. And that's fine, and I think that's probably our objective at some degree but I don't think that you can then just turn that -- that potentially into the notion that the utilities should somehow be allowed to recover every cost they have ever spent. At some point they have to have some skin in this game and there should be some opportunity or possibility of loss if the system changes, there's no necessary guarantee in this process nor, and touching on Lisa's point, that the potential of this happening at some point in the future should not be used as some pretext to argue for sweeping changes in our regulatory structures, whether cost recovery methods or rate design. The types of things that have served customers well for years. We get very nervous when there's talk about changing regulatory structures, because functionally if you actually look at it, the regulatory structure chain usually to do with making sure that the utilities get paid, not necessarily achieving objectives that may be laudable from so society's standpoint. I think there's a fundamental conflict there, too. We do acknowledge that the increased level of distributed resources both at the residential and large CNI level certainly present some challenges to the status quo. There is some discomfort happening at the state level. We're having lots of discussion and lots of venues. But I also want to, I guess, caution against the level of hype that is -- that we see. There's just an enormous amount of hype right now, talking about technology and changing Customer Services and distributed, green energy, the utility 2.0. There's sort of an echo chamber that's happening right now. And you have to be very careful. And I thought it was interesting when Lisa also brought up smart meters. I was the President of NASUCA for two years back in about 2007 to 2009 and this was sort of -- right in the heart of the smart meter debate and I spent two years, conference after conference after conference trying to dispel some of the exuberance with which smart meters were being talked about, and if you were around in those days and remember, customers were going to use them

for so many things and we were going to have entire houses full of talking appliances and just the amazing things that were going to happen, and most customers don't want that and they aren't going to use it, but there was just a sort of, I guess to be a little more cynical perhaps a vendor-driven exuberance going on about what these meters could do. Now, that's not to say that the meters in and of themselves are bad technology and we shouldn't be putting them on the system and they aren't proving useful from a utility standpoint in terms of operation, telemetry, customer services, reduced truck rolls, there's any number of things that the digital meters actually do well. But at the beginning of the debate the exuberance was really, I think, misdirected and misplaced and so my caution especially to DOE right now and to others in the room, is to be very careful because I feel that level of exuberance happening again and I don't think that we're -- we're certainly not against technology moving forward, we are certainly not against the type of opportunities that the future may bring, but we also want to temper the exuberance with which we find ourselves faced with over and over in forums like this.

I think one of the things that we would urge DOE to be thoughtful about, as we go forward and both today and ten years from now and 40 years from now, is really what constitutes basic utility service. What really is it? I mean the vast majority of utility customers simply need safe and reliable service, they need it to be affordable. They don't need access to next generation technology, they're not requesting the ability to sell or generate and sell to the services. And, you know, some level they shouldn't necessarily be asked to absorb the cost of rate increases to create a system that will facilitate all of those things for the few people that do. I think that at some level, one of the directions I think we have to go in the future, is start to look at customer segmentation and trying to define what is just basic service. I always -- one of my favorite customers that would call me, you know, when I was -- consumer advocate in Kansas, a little senior citizen and she lived down in the senior citizen apartments. She had a little apartment and little black TV and sort of a later version of the black AT&T phone, but you could knock somebody out with this thing. You know, her electric usage hadn't changed in 20 years. I mean, really, her load, her characteristics, what she's doing, hasn't changed in 20 years, but her bill keeps changing and she keeps calling me up and saying why is my bill going up, I don't need, you know, why is this happening? So at some fundamental level, we have to remember that we are an amazing country. We can build and do anything. If you can find someone to pay for it. You know, ultimately, if we make basic service unaffordable by pursuing all of the things that are being talked about, we fundamentally, I think, have lost our way and missed our objective.

Now, again, we are not anti-technology. We think there are some really interesting things going on. In the instances where we can cost-effectively add technology to the grid to provide better efficiencies, to lower costs for consumers, we think that we should do so, so we're very supportive of that. But we also have to stop and think a little bit, you know, we didn't have cybersecurity problems with the old analog grid. It worked pretty good. So to some degree we are creating our own challenges and creating our own problems with the direction that we're going. That shows up I think in rate cases, too, one of the last two rate cases I did in Kansas before I left, we had issues with, certainly, expenditures on digital meters, but the digital meters no longer last 30 years, they last seven. So that has pretty large depreciation impacts when you get to the actual rate proceeding. That's a direct impact on customers. That shortened life. And

in one of the rate cases we were putting in version 2 smart meters and we hadn't actually depreciated out version 1, and we have stranded costs and so this was an issue that we had to deal with in that case. And so, I used it as -- when you look at the types of technologies that are available, that's great, but you also have to think about what the technologies, the Lifecycles, the obsolescence, the replacement, the rate making impacts of those technologies are going to have at the state level when we have to wrestle those down so I just urge caution.

CHRIS KELLEY: Can I ask you to turn to your closing comments?

TOM KIMBIS: I'm right at the last paragraph.

CHRIS KELLEY: Good timing.

TOM KIMBIS: The final thing I would urge DOE is to recognize that many of these decisions are made at the state level, and really only at the state level and only I think through detailed evaluation of data and evidence with robust representation by all parties and the weighted judgment of our good commissioners do we come up with I think good policy, so I would urge DOE to be careful not to presume answers that may be out there and to avoid putting its thumb too heavily on the scale. I think DOE has a great role to facilitate discussions like this and we certainly appreciate being part of that. But let each state find its way and I think that we'll end up at a good place at the end. So thank you very much.

CHRIS KELLEY: Thank you, David. Robert?

ROBERT POWELSON: Good afternoon, everyone, it's great to be with you all in our nation's capital. Just for the record, the Secretary and Vice-President Biden were in Philadelphia to roll out the QER, a few - I guess over a year now at PICO Energy. And maybe it's a great pleasing here that I'm the last presenter here because I will curb my enthusiasm, but I want to give you kind of a realistic approach of what's going on across our 50 state jurisdiction representing NARUC, and I thank our Executive Director, Greg White, former Michigan Commissioner, he's at the helm now running NARUC. I'm wearing a lot of different hats here today. One is First Vice President of NARUC, two, a Public Utility Commissioner in the great Commonwealth of Pennsylvania, and three, a member of the Electric Power Research Institute Advisory Board. And I just want to say, I mean, let's think about this for a moment. And it ties into some of the earlier presenters. When you think about 15 years ago, and if I said to you: You ever hear of a company called NEST? EnerNOC, Sunrun? Tesla? Generac? Gamesa? Opower? And none of us in this room would raise our hands because these companies weren't in existence. And today, we talk about the tectonic shift in the customer. And yes, I agree with David, you know, Pennsylvania, by the way, as James Carville once said: it's Pittsburgh, Philadelphia and Alabama in between. Okay? Well, the Alabama in-between isn't into CFLs, they're not into demand side products. They just want \$0.07 power, all in by the way, and they want it delivered safely and reliably and affordably. But I live in Southeastern Pennsylvania, and we're kind of into things like iPhones, and open table, and Uber and Honeywell thermostat checks and Abion and all this stuff that you can really have a lot of fun with. And there is a segment of customers, in particularly my state, which is traditionally viewed as kind of a - you know, we're an energy production state, but I think it was said earlier, the states are really the energy incubation labs.

And I want you to think about that for a moment. If I took you across 50 state jurisdictions right now, whether it's an open docket on net metering, yes, believe it or not I actually regulate Uber. By the way, five years ago we didn't know what a transportation network company was. So I want you to imagine this 50 state overlay, and we have governors and legislature's, and states like Pennsylvania, believe it or not, have a renewable portfolio standard. We also have a statewide energy efficiency program that was signed into law in 2008. The RPS was 2004. And you look at these markets and how they're evolving, and it's amazing that there are segments of customers, and it's not just the industrials anymore, that the rank and file residential customer is embracing this technology, and I firmly believe that these technologies are providing, they're empowering the customer. In a very positive way. And I share that with you because many people think, well, and especially from the consumer advocate perspective, that there is basic default service. And we have to protect that for those customers that simply want as my former consumer advocate, the great one, Sonny Proposki said: they just want a vanilla product, okay, Rob? We don't need sprinkles and all of the twists and turns of a good exotic product. They just want vanilla ice cream product. So I get that. But look at my market. Look at the market of Pennsylvania, it's a little microcosm of what's going on again across 50 states. We have 2.2 million customers in a competitive electricity market that are out there who have retail choice and they're out there and they're buying a green product, participating in a demand side product that's offered to them as a regulated as a utility customers and yes, energy geeks like me playing around with thermostats, but what is that doing? It's empowering customers to take ownership of the thermostat and what's going on behind the meter.

You know, Pennsylvania, again, another great story and Greg, I know I'm getting in trouble because I'm getting too Pennsylvania centric here, but we like to brag a little bit. But I mean we have a statewide, you know, we will have full smart-metered deployment in Pennsylvania in 2020. Now, where I live, we're fully deployed in Pekoe. And I will say this, and Tom Kuhn's a friend but the worst thing the electric utility did, ever, the industry, was to put the word "smart" in front of the word "meter". Because it's brought out a whole segment of customers. I won't get partisan here, but I call it the extra Y chromosome of a particular party, and people coming out of the woodworks talking about EMF. I felt like it's the old cell phone debate. I've got EMF exposure and yes, unfortunately we did have a couple of homes catch -- the stucco caught on fire, but at the end of the day the meters are deployed and Pennsylvania to its credit, didn't do this opt in, opt out. We went forward. And now behind that meter, customers are seeing dynamic pricing options for those that want it. Yes. I think the industry to its credit is, you know, it's not often that we have to deal with Category 5 hurricanes. And customers are beginning to understand that the outage management and the benefits of those meters. So I just share that with you because across the utility customer food chain within the NARUC membership, the states are really leading this change. And I think that the work that the DOE has done, and I commend the Secretary, although he's a Red Sox's fan and I'm a Phillies guy struggling, there is a real spirit of cooperative Federalism that the DOE recognizes, and by the way, not only recognizes, you know, in Pennsylvania two of my utilities, one of them got one of the largest stimulus grants offered to use early acceleration for metering deployment. And these are all good things. And I think David used the term echo chamber and believe me, I can well appreciate that. Because as I said earlier, there are segments of customers, especially at the

residential level, where that customer just wants \$0.07 power and I can't socially engineer on them to put another rider on the bill for the alternative energy portfolio standard and the refrigerator pick-up program or the load control device on the air conditioning unit. There's a segment of customers that, again, I recognize, in our different 50 state purview, there are customers that just want that basic service and they are not going to opt in or participate. But I think it's fair to say that the revolution is upon us in a very positive way. Where customer attitudes are changing. Customers are embracing this technology, it's not just an industrial product anymore. And I guess I will not get off this panel without talking about the alignment of the rate making mechanism to support these technologies. I heard earlier there was a shout out for the support for order 745, the recent ruling from SCOTUS. Many of you who are followers will recognize it. Pennsylvania joined California and Maryland in supporting the demand side resource industry in this country by really taking a heroic effort in supporting a cert filing with the FERC. And I think in my state if you just look at demand side resources are or demand response resources from school districts to municipalities, all the way down to the residential customers this is a very robust market. And it is creating an environment in Pennsylvania that not only are we seeing direct investment in these companies coming into the market, but we're also seeing huge energy savings for customers, and that's really what's driving this. It's the value proposition. We can talk about grid resiliency, but it's the value proposition and customer choice which is changing, where customers in certain markets want a green product. And those customers should have the ability to access that product. And state regulators need to embrace, and I don't criticize this because – NARUC just designed a subcommittee on alternative rate making. You know, I've learned very quickly as an Uber user, as you heard me say, I have a confessional that not even five years ago, it was like 36 months ago we didn't -- Commissioners didn't know what TNCs were. But imagine the Uber model in the electricity industry and that disruptive competition that's coming in, one colleague once referred to as called Uber anarchist, which I was, calm down, let's embrace them here. But states are realizing that these 1950, antiquated just using Uber, common carrier regs don't cut it anymore. Well, the same holds true in this 50 state patchwork of, how do you design a rate mechanism that supports things like in Pennsylvania now, we're dealing with combined heat and power systems. We'll, guess what? The last time state regulated utilities on the electric side they have -- some of them haven't updated their standby tariffs in over 20 years. So that mismatch, that misalignment of a standby tariff with a Governor and legislature that wants to plop down moneys to support CHP development, well the regulator has to step in and say, come on, we have to up the standby tariffs to support this emerging industry. You ask customers, and I use New Jersey that has a grid resiliency bank, customers are willing to pay to build resiliency and redundancies at their homes and at their businesses. I use those examples, because not to be critical of my industry, but through the efforts of NARUC now, we're realize that this model is changing, it's not your old utility anymore and we as regulators need to get ahead of this curve. And I will say -

CHRIS KELLEY: Could I ask you to wrap up?

ROBERT POWELSON: Yes. I will say respectfully, some of this is very reactionary, but I think to the efforts of the solar industry, the renewable industry, the demand side resource industry, the generator community, that this is all coming together, and what I -- and I commend again the

DOE in really forming this collaborative outreach with the states. It's been a great partnership and I look forward to our Q&A here. Thank you.

CHRIS KELLEY: Thank you. So with that, yes, let's go ahead and turn to the Q&A. Thank you, all, for your comments. Let's start with this one. So, several of you mentioned significant investment that's been done at the distribution level. In things like advanced grid technologies, I guess I'll hesitate to call them Smart Grid technologies since that's not in vogue but programs like SGIG from the Department of Energy contributed to that greatly. So looking back over the past six years, do you see that customers and utilities truly are benefiting from this investment? I heard a bit of that in your comments at the end there, Robert. But do you see more change needed? And maybe we can start with you down at the end.

ROBERT POWELSON: I do see a customer benefit and those customers and obviously - I agree on the mega trend piece. We're moving toward a cleaner energy source and sources and those sources now are coming behind the meter into the home. And I think customer, again, customers are embracing it and I think there's been a corollary on price where customers that are accessing those products, who you know, obviously pay a monthly electric bill, are seeing real savings in embracing that, so just an observation from a state perspective.

CHRIS KELLEY: Thank you. Other comments.

LISA WOOD: Just I would say a couple things from the customer perspective with -- we think of I guess the meters as a building block for the Smart Grid, but I think the biggest change for customers has really been this outage management and restoration and the ability for the utilities to know they're out when a customer's out, and I mean, that's a fundamental thing that's really been important in different service territories across the country. So there's that. The second thing is the ability to integrate distributed energy resources with the meter. So that's important. Both supply side and demand side. And the third part from a customer perspective and I do agree with what David said earlier, there is a lot of hype, like seven or so years ago about all of these Smart Grid technologies, but I think we're actually now seeing some technologies behind the meter that customers are able to take advantage of. So I think that's just starting to grow but I think we'll see a lot more of it.

CHRIS KELLEY: Thank you. Other comments.

DAVID SPRINGE: I guess I would add, you know, I think certainly in terms of the outage management, the technology has proven useful. But I'm not sure that that was again what it was intended, so I guess my suggestion is that it's I think always good to go slow, to do pilot projects, to try things out and see what really works versus what doesn't work, and I think we've gone through that process, and we're learning some things. The reality is you can talk about customers, I -- intentionally asked over and over again to the utilities and I haven't seen a lot of them lately, but when you put it in the meters, almost every utility said, look, we've got this fancy new website, we've got this dashboard for you to use, you can get your information. You know, how many of the customers on your system actually went to that website and looked it up? And I've yet to see a utility who said it was more than 25%. And here's the more subtle piece, is if you asked them how many of those 25% went back four months later and looked, and that's

when they start changing their heads and not really -- you know, mumbling to themselves, and, you know, so, there is some, I think, interesting technologies out there, but, again, don't over sell what really I think is going on out there. Give us some time to experiment with some of the different things that are out there, and, again, you know, we got to have a plain vanilla. I hate making telephone and electric industry analogies, but at the end of the day, if a customer just needs a very simple phone and a few minutes of time, if that's all they need, they can buy that product pretty cheap. It's a little flip phone and you get 100 minutes for 20 bucks and you're good to go. A customer has a very plain vanilla phone and he doesn't need and doesn't want and doesn't pay for the type of technology that's sitting, you know, on this desk right now, I mean, I think in terms of the industry, we have to look at the industry and think about it in that way, going forward, because there's -- you know, from a technology standpoint, and I'm not a technology guy, but, you know, I've been told that simple smart inverters on the customer's side of solar really eliminates a lot of the need for some of the grid and sensor technology that we need on the grid side of the - so which maybe makes more sense? Getting some smart inversions as part of the solar package or rebuilding our entire grid for the 10 or 20% of people that want to put solar panels on? One of these is going to work out better for the utility customer. We urge caution.

CHRIS KELLEY: Thank you, David. Steve.

STEVE NADEL: I agree with Lisa that added management has been very useful. I've looked at the different utilities out there with the smart meters. Some of you have done pretty well and done some pretty creative things, but on average there's more opportunity, many of them are not really using the capabilities, that I think if the utilities and the industry, once people embrace and support this technology, we really need to up our game and make sure everybody who's installing these are really using the many capabilities, that it's a lot more than just automatic meter reading.

CHRIS KELLEY: Thank you, Steve. Tom, did you have a comment or pass on this one, great. So, Lisa, you mentioned that utilities are undergoing this significant change to -- or pressure to provide some customized services for customers, industrial, residential, commercial customers such as energy efficiency measures or DER, micro grids so they're asking for this and I think you also mentioned the need for regulatory change to enable these services. But I wonder if you can comment also, and this is open to others as well, but comment also on what the industry is doing with respect to enabling these services as well, and if there are it ways for the Federal Government to support this position.

LISA WOOD: Yes. Okay. There we go. Sorry. A little bit. So customized services and I'll use the example of some of the large commercial customers -- Google, Apple, Microsoft, companies like that, companies that have corporate sustainability goals, that are asking for renewable energy. One hundred percent renewable energy to meet their corporate sustainability goals. For them it's corporate sustainability. It's marketing. For the utility, it's how can I provide that, because it's a customized service. So we're just starting to see some examples of success stories over the past, I'd say, year, around the country. One example is there are a couple of examples actually in Nevada, NV Energy with Switch is one example and another example is

NV Energy with an Apple, again, providing either solar or wind to that specific facility. So that that company can meet its corporate sustainability goals. There's another example in North Carolina at Duke and Google and Mid-AM has some examples in Iowa. So this is something that's being worked on by utilities, it's actually being working on by the World Resources Institute, the World Wildlife Fund and these commercial customers trying to create a customized product. But I think this is what we're going to see more of, in the future. And I agree with what David said earlier. The bottom line is affordability for everybody. There's always going to be a plain vanilla product, but for people that want something different we also need the flexibility to be able to provide that.

CHRIS KELLEY: Thank you, Lisa. Other comments? Yes, Steve.

STEVE NADEL: I would just add that I agree that customized services can be very valuable. And we're going to need to have a balance between allowing the utilities to do these without undue constraints, but not giving them a special leg up. I know the states are grappling with this, but conceivably - I don't know whether its NARUC or DOE, they want some model regulations, because I've seen people going too far on both one end or the other, making it so that the utility can stomp on the competition on the one hand or at the reverse, the competition can make market decisions and the utilities, any time they want to do something have to have six months of hearings and then they're left in the dust. So how do we fairly allow the utilities to participate in a robust market will be a challenge.

LISA WOOD: Yeah, I just want to add to that, because these are larger -- I mean, again, these are megawatt's -- we're talking about megawatt's -- but again just -- because I didn't answer it before, the of DOE's role. Because there are so many different -- this is basically at the beginning, I mean, it's been the last year or so where this has started to grow so I do think model ways to do it and that's what the WRI is trying to come up with, model ways to put rates in place to move these things forward and to do it in a way that's not shifting the cost onto other customers that aren't doing it, that aren't interested in this.

CHRIS KELLEY: Thank you. Any other comments on the customized?

ROBERT POWELSON: Just to pick up on that, I think again, the neighborhood collaborative right now on rate design, we'd love to come out of this process with recommendations of best practices around alternative rate making. There are to your earlier point, Steve, I think you said that, you know, it's the -- you've got the -- some states that have gone the wrong direction on this, and there's a multitude of reasons why. And there are, to your earlier point, Steve, I think you said, there's other states that have gone the wrong direction on this and there is a multitude of reasons why and there are other states that have absolutely done nothing around net metering. So what we're trying to do as the National Association, is really use this newly formed committee to kind of say what are the best practices out there, and we want to hear from, you know, all sectors of the utility food chain. And I want to talk -- you know, on the micro grid piece and I say this respectfully as a utility customer. I don't look at utilities as bastions of innovation. Okay? What I want from a utility is called doing the boring good. The boring good is transmission and distribution of electrons to people's homes and businesses. Let the Opowers, the Teslas, the

Googles, the Bloom Energy's play in that space and we struggle with that, because I have a -- not an open docket, but a couple of utilities coming at us with this whole notion of micro grids and I sit there and I go: Who's picking the vendors? How are we picking these locations for micro grid? And you just take those two questions and you realize right now it's kind of like the monopolistic mentality of: Let the marketers come in and play in that space. They can partner with you, I'm all for that. But that's really some of the different struggles that are taking place in states where we're dealing with things like micro grids right now and how should we be harnessing that technology, who should be harnessing that technology, who are the providers, how the customers are going to pay for it. So these are all the things that we struggle with as state regulators.

CHRIS KELLY: Lisa.

LISA WOOD: I just want to add just one point to that. I agree, I mean, there's lots of players that can provide these services. I mean, for our industry we have examples with the military, we're working with the military on micro grids, there are, you know, are other examples where other entities are involved. So I think it is important that -- I mean, the future is going to be lots of players providing services. In some cases, utilities aren't the right player and in some cases they are. The one thing I do want to say is -- and, again, if you think about rooftop solar, in most states we're precluded from providing it. In states where we do provide it we make it accessible to all customers in good standing on their electricity bill which is different than a private company would make available.

CHRIS KELLEY: Thank you. Any other comments? Yeah.

TOM KIMBIS: Yeah, sure, just -- so back to, I think some of the comments Lisa made during her presentation, tying that in, I think, you know, she and I actually agree maybe 95% on the net metering situation, which it is for distributed solar at least, the most credible issue out there. That I think you know is addressed within this -- within these walls. Now, obviously, these are state decisions. What this comes down to, folks, is looking at distributed generation, looking at net metering and analyzing the benefits and the costs. The solar industry, there might be some extreme, you know, voices out there, but the mainstream solar industry agrees there are -- there are benefits and there are of the costs associated with putting solar DG onto a distribution line. The question is: How do you value that? What's the process, the right process for doing it, what are the right sources of information? And then how is it applied fairly across a customer base? So I think as we face 50 different jurisdictions making rules, and I don't envy the Commissioners' job in setting values on electrons generated on rooftops from schools to homes to firehouses, but this is what's happening. And for the solar industry, this is very tough. To me, are I don't think either the solar industry or the utility industry at large wants to face rolling the dice 50 different times and then having states go back and say, well, it's time to redo it and let's just keep rolling. That kind of uncertainty isn't good for any business and it's certainly not good for the consumers either because whether it's talking about the costs that they're going to pay or whether they're even going to have the choice of their power supplier.

So no one has seen and nobody expects perfect, you know, PUC proceeding. These are hard decisions by smart officials, but I think they can be improved and this is an area where the QER and where DOE can play a critical role is by supplying, in continuing to supply information. It's so heartening to hear about the new NARUC alternative rate making committee that you mentioned. And this is so important. And this is not, I don't want to get into the details here but we saw, you know, two very different instances in the last few weeks between California and Nevada, for example, and how they treated net metering, and, you know, one state, I think, came out -- the solar industry, you have different components and we have complained about both. But I think what California did, they affirmed the structure of net metering, but they allowed the utilities to collect certain fees. They allowed them to collect interconnection fees and other non-passable charges and I think the mainstream solar industry said, hey, look, this is a workable model. We can work with this; it means that solar generators are no longer exempt from paying interconnection charges or the fees that are associated that other customers in the rate base have to pay. That's fair. Okay? On the other side, you had Nevada taking a more extreme view, I won't get into all the details, but it was imposing lots of fixed charges and essentially zeroing out or coming close to zeroing out the value of rooftop generated solar. It was a little bit of a bizarre fashion and I hope it's not repeated and we have the utility and the energy, Lisa you mentioned another context, actually going in to try to work backwards some of what happened in the Commission in terms of its retro activity. But I do mention these cases to illustrate that we have a spectrum here, and there's a distance between them, and I think we can find common ground. I think DOE can provide some of the unbiased information that can help regulators, and Commissioner, please, tell me if I'm wrong on this, but the more information provided the better. These are going to be state decisions, don't get me wrong, but I think we should try to avoid the uncertainty that's created going into states where they might not have as much familiarity with solar technologies and come out you know, without fully appreciating what the impact could be for the future.

CHRIS KELLEY: Thank you, Tom. Steve, did you have a comment?

STEVE NADEL: Yes, just briefly. I agree that the rate issue has become very heated, it needs more attention, I'm glad NARUC has a committee on it. I agree DOE can provide some objective information and analysis that may help and can we diffuse this, we need to look at creative solutions as opposed to well, it's the way we've always done it or well, it's a high fix fee and there's nothing else. Just to throw out one for people's consideration, I think there's room for a lot more time of use rates now that as we heard the majority of households have smart meters, and in terms of net metering that has the interesting factor that as utility peaks move from afternoon into evening, you can still do net metering and well, in evening, it's not nearly as valuable as it is in the afternoon, and so there are maybe some creative ways to help deal with the situation. Each utility, each region will be different. I just use that illustratively as opposed to saying everybody is moving to evening peak.

CHRIS KELLEY: Thank you. Lisa briefly.

LISA WOOD: I will just add one more thought about the role of DOE. I guess the way I think about it is we -- I think two things are essential, I think all of us think distributed energy

resources are going to continue to grow and they are going to grow in a big way. I think we also probably would agree that we're going to have a grid for a while in the U.S. and it's essential infrastructure for our lives and our economy. So if we're moving towards a hybrid power industry in the U.S., then how do we make those things both work? And that is the fundamental question. These are a lot of the state regular -- a lot of the issues that we're dealing with around that metering is that sort of tension between the grid, having the grid be there, and available, and having also a distributed energy resource, so I think those are the two fundamental issues that DOE can provide help to all of us on.

CHRIS KELLEY: Thank you, I think you've started to address my final question, which is again, just like with the last panel, I asked them this, that you've got the QER Task Force in front of you. That extends beyond just DOE. What do you see or what advice would you give to them or suggestions would you make to them in light of your areas of expertise and I'll start at the end here and maybe we have time for a minute and a half each.

ROBERT POWELSON: That's a loaded question, and I think, you know, again, you could get, if you had State Commissioners up there you could get 50 different perspectives but I'll try to frame it this way. I think, one, through the leadership of Secretary Moniz and the key technical staff, I think this collaboration with states is so critically important, because whether we're talking regulatory certainty, harnessing renewable investment, net metering, investment in grid monitorization, it is so critically important that DOE does this outreach. I'll start with that. My one recommendation is, we need to continue these kind of dialogue and that dialogue is a big ten, it's EEI. It's my friends from EPRI. The American Gas Association, the solar renewable community and having us all talking because I think that's one of the things that I find in this business we're too wrapped up in our individual silos where we don't get these good ideas out there, again this is a credit to my association, this alternative rate making subcommittee, I think it's so critically important. I wish it was done three or four or five years ago, but it is what it is and we're moving forward. So, again, I just commend the DOE leadership for convening all the thought leaders in the energy industry to kind of showcase what we're doing in our individual states.

DAVID SPRING: Thank you, I'd echo many of those comments, DOE plays a crucial role in facilitating, getting the members and the different industries and the different parties in a room and talk, it's where the bread and butter meets. And I think they should do that. And certainly, it is always, I think, fun to have someone like DOE out on the frontier of the thinking. The technologies and the ideas, you can certainly cultivate those. I just urge again, caution on those, I mean, once you've thought of them, that doesn't necessarily mean we should do them or that you should put your thumb on our scale to make us do them. You know, at the end of the day a lot of the decisions and things that are going to happen are really going to depend on state level rate making and policy, and that's really not your wheel house. That's ours. So, you know, giving us tools, giving us information, and facilitating dialogue is I think where you go. And then, I would just always ask when you're doing this and you're thinking, ask one simple question: Is there a cheaper, better way to do what you're doing? The opportunities and possibilities are boundless. The wallets are not. So I'd ask you to keep that in mind.

CHRIS KELLEY: Thank you, David. Lisa.

LISA WOOD: I'll just, because I just made that comment before, I'm just going to kind of summarize again the same thing. I do think that keeping that vision of what's this future look like, and if we're going to have the hybrid industry where we have the grid and we have a lot of distributed energy resources I mean, there's a lot of details under that umbrella but keeping those two things in mind as we move forward and change the power sector in the U.S. I think how do we do that in an affordable way. In the end we could go the way of Germany. You don't want to do that. We want to do this in an affordable way that makes sense.

CHRIS KELLEY: Thank you, Lisa. Tom?

TOM KIMBIS: First of all, this is fantastic. I will just echo the comments – keep the discussion going. Sounds like he plans to do that. It's very valuable for us to talk, we don't get a chance to talk to each other as much as we should and we don't have the audience listening as much as we should. Follow that Clean Power Plan along with the core analysis needed by the State's to make the right decisions. It's a big lift. And it's going to take a lot of work by each and every state. So please make sure that you're dedicating the resources of the National Laboratories, universities, etcetera to do the analysis needed by those states and their different committees, the legislature, the PUCs to make the right decisions. Third, don't forget the need for diversity. You look at energy bills back from the '60s all the way through to today. We want to have a diversity of fuel resources, can you imagine if we were back in the 1960s today and had a huge dependence on oil for our electricity generation, would we be talking about in terms of fluctuation in prices, we don't have that right now. We made some good decisions, let's make sure we continue to diversify. And lastly, consumers, we talked a little bit about consumers, I think we need a little bit more discussion on consumers and consumer choice, please encourage that consumer choice.

CHRIS KELLEY: Thank you, Tom. Steve, last comments.

STEVE NADEL: I wanted to make three points. One, consumers care about the bills not so much the rates. Bills obviously being the product of the consumption times the rate. So let's really concentrate on bills, energy efficiency can reduce bills in a couple of ways. One, if you reduce your consumption through efficiency, then you have a lower bill, because you're using less. Two, if energy efficiency allows utility to build less generation to have to reinforce the distribution system less in certain areas, then rates go down for everyone. It's obviously going to depend very much on the local system, but often energy efficiency can be a critical part of providing a reliable but cost-effective grid. To get this energy efficiency, the market is very powerful, but we also need policies that will help channel the market and whether it's, you know, decoupling, performance based rate making, energy efficiency resource standards, etcetera, keep an eye on the policies that will help channel the market to make this all happen. I'm reminded of California in 1994, those who around, they did the Blue Book, that will take care of everything, well, after a couple years they discovered it didn't. So let's not go into the déjà vu all over again, and how to complement the market with the policies. And third, what we're finding is that in recent years, electric demand has been level. We are projecting that that will continue for many years to come due to efficiency. Due to a distributed generation, you know, kind of

counterbalancing the economic growth and even the growth in EVs, it's going to vary from area to area. It will be a more complex grid that needs to be carefully managed. We will have to invest in that to make sure that could happen. But let's do it smartly. Lisa said don't do it like Germany where they over invested in conventional generation and now some companies are losing their shirt or like Australia where they over invested in the transmission grid and rates have skyrocketed. We should learn from that. Do it smartly and cost-effectively.

CHRIS KELLEY: Thank you, Steve. So that concludes our second panel. Please join me in thanking our panelists.

(Applause.)

(Pause.)

Public Comment Period

CHRIS KELLEY: So now we come to the next important part of the meeting which is an opportunity for you to provide comments. So if you haven't already, please do sign up to provide comments. And I'd like to, again, remind those who are joining via the web that they should please provide their comments at www.energy.gov/QER. So as we're preparing here, for those of you that are -- that do intend to provide your comments, we have microphones stationed at the front of the room. What I'll do is I will -- I'll call you out based on the order in which you signed in provide your comments. You will have five minutes to provide your comments. And we're going to keep precisely to that time. So we have a timer set up. Do we have the timer set up so that the people who are speaking have an opportunity to see it? We'll bring it around? Okay. So we'll get that set up for you. So we'll get started here in a moment.

CHRIS KELLEY: Okay much so now let's turn to the public comment period again. I will call on the folks to make their comments here in the room. Please, we only have a few commenters who have signed up so if you could just step to the middle microphone here and make your comments when I call on you, you'll have five minutes to make your comments. So joining me here on stage to listen to your comments are members of the ESSA team on behalf of the QER program. I have Karen Wayland, Kate Marks, and John Richard's at the end there. So our first commenter is Jon Caniss -- coming down?

AUDIENCE MEMBER: Hi, everybody, my name is Jon Caniss, I'm a partner with the DC law firm Arent Fox, I and my partner former Senator Byron Dorgan represent a [unintelligible] Power Authority. That is a power authority recently formed by seven Sioux tribes in South Dakota. And the goal here is to pool their resources to develop a one to two gigawatt utility scale wind production and transmission facility across their reservations in South Dakota. Early on in the tribes, we've been doing this for the better part of three years. Early on, the tribes decided they needed to go big in scale for a couple of reasons. First, there is no real local market today in South Dakota. So in order to attract large buyers, utility buyers or enterprise buyers out-of-state we have to develop a large project that can offer a significant quantity of power. The other most important reason is we're going to have to build a lot of transmission. And in order to

economically spread the cost of new transmission, we need a lot of megawatt's over a long period of time. So that's why what was focused on a one to 2 gigawatt project. It will be funded by public power bonds. We're members of the American Public Power Association and they worked with us to put together our charter and to set up our association. So the model there, the economic model, public power bonds, based on power purchase agreements, it's some of the lowest cost of capital in the country. In addition, the tribes as sovereign nations are tax-free, and, of course they own their own land. So they're going to be contributing that. When you put those three things together, you're looking at a model for the lowest cost production of wind power in the United States. Now, we know that for the next four years we're going to have the wind power production tax credit available and we're in active negotiations now with potential tax equity investors to help us realize some of the value of that, so we can bring down the cost of our power. But after that credit expires in four years, our model will be the cheapest cost way to develop wind power in the United States. We've had great support from the Obama Administration. President Obama convened the White House Council on Native American affairs and we've had very good support from the Department of Interior, USDA, agriculture, and particularly, from DOE. And I want to do a shout out to Krista Cheney, Doug McCourt, Matt McGovern, all of whom have been really helpful to us. Currently both ENREL and LAPA are doing studies for our group to help us finish all the predevelopment work we need to do, so wind studies, transmission studies, market studies and economic studies, we've also developed really good relationships with two strategic partners, one is one of the largest turbine manufacturers in the world. The other is a large multi-national construction company. Both have been -- with a lot of experience in wind power development. Both have been working with us for the better part of a year on a pro bono basis, helping us to complete all the predevelopment work that we need to do.

Now, to my comments for the QER, three things, two sound like production but they're actually very transmission related. First is South Dakota is the cheapest power market in the United States. If you want to sell to WAPA, you have to sell at about \$0.02, 2.2 cents per kilowatt hour, that's because their power comes from hydro and coal. We were very heartened to see press reports recently that the Obama Administration is considering procurement changes that would recognize the externalized costs of coal power. If that were the case, and the cost of coal fired power in South Dakota was not \$0.02, maybe it was more of a competitive rate, you could create a very substantial market for renewable energy in South and North Dakota. And just FYI, our initial studies show that we'll be selling in the low three to mid-\$0.03. That's competitive pretty much anywhere else in the country, but not in South or North Dakota. Number two, a related issue. We, for federal procurement, we need 20-year power purchase agreements. And the reason is, we're going to be issuing public power revenue bonds, those are 20 year bonds. And we need that PPA to be co-terminus with the power bonds. So, you know, right now you can get three-year contracts, five-year contracts. If you're lucky you can get a ten-year contract. We really need 20. And that would require new policies from the government. And then, finally, transmission.

CHRIS KELLEY: And that's five minutes.

AUDIENCE MEMBER: All right. The WAPA.

CHRIS KELLEY: I need you to wrap it up, sir.

AUDIENCE MEMBER: Yes. WAPA's transmission infrastructure program extremely helpful to what we're trying to do. WAPA and Southwest Power Pool are in particularly good positions to help us in planning and for new transmission and also talking about heading up their own facilities so we can have economically viable make or buy decisions.

CHRIS KELLEY: Thank you.

AUDIENCE MEMBER: And then finally they can help us coordinate with other private developers of transmission so we can coordinate our joint efforts. Thank you very much.

CHRIS KELLEY: Thank you, thank you. Our next speaker is providing comments is Barbara Tyran. Barbara.

AUDIENCE MEMBER: Thank you very much. I'm Barbara Tyran, Director of Washington and State Relations at the Electric Power Research Institute known as EPRI. EPRI is an independent, non-profit organization that conducts research development and demonstration related to the generation, delivery and use of electricity for the benefit of the public. I'm very pleased to offer EPRI's support with the second QER as we offered with the first. And want to reinforce that at this time. EPRI supports DOE in its development of strong technical and analytical work to identify the industry's needs as well as the economic impacts to support good, sound policy making. EPRI has been doing relevant analysis in technology innovation in many areas that are within the scope of the second installment. As known, EPRI has been working on the integrated grid, first with the release of a concept paper and then a benefit cost framework and currently working on pilot projects, which will translate that research into action and we will be pleased to share those results with the department as they become available. In addition, we have developed some other materials that we will be pleased to offer, for example, in 2016, EPRI anticipates the release of three White Papers that relate to conductivity, flexibility and resilience. And we will make sure that when they become available they're submitted into the record and pleased to follow-up with any further dialogue that might be helpful. In addition, EPRI is working on a model that assesses energy demand, generation portfolio, economic growth and environmental goals. We're very pleased to have this information available, as with cleaner generation assets, in the transformation of the electric industry, it will be critical to have technology based asset management that is associated with long-term operations. Electrification will also enable a clean and diverse energy supply to fuel the economy. Finally, none of this would be possible without the electric grid. EPRI's work in this area integrating distributed energy resources has led to insights that will allow technology to address the important issues. All of these changes may be driven by technology, but ultimately they arrive and originate with consumer expectations. EPRI's customer behavior research identifies how to reach customers to make sure that the most positive impact is felt on the system that consumers understand the least-cost options and that the reliability and the resiliency of the grid is sustained. EPRI, like the Department of Energy, takes its public benefit mission seriously and looks forward to providing future insights on the future of the integrated energy system as well

as understanding the customer. Thank you for the opportunity to participate and to offer EPRI's future technical support.

CHRIS KELLEY: Thank you. Anyone else care to provide comments? Okay. Well, thank you, all, for your comments, and thank you, again, to our panelists, DOE reviews all the comments that are provided during these sessions and those that are provided by the web as well. So they take every comment into consideration. So, thank you. So now I'd like to turn to Karen who will adjourn our meeting.

KAREN WAYLAND: Thank you very much, Chris, I want to thank all the panelists and the remaining audience both here and online for participating. Today, as well as kicking off our public stakeholder meetings, begins the formal comment period which will run from February 4th, today, until July 1st. In addition to our Public Meetings, you can upload comments, data, reports, throughout the comment period, as many as you would like, by going to our website at energy.gov/QER and you'll be guided to a form, an online form where you can upload information. You can also email us at QER comments at HQ.DOE.GOV. And again, we'll be checking the input every day to make sure that we're following all the information that's provided to us during this process.

I will say that last year's stakeholder engagement process was highly informative and invaluable to the development of the, both insights in the report and then the recommendations and I found myself saying both to the White House, to the Secretary, and to our internal analysts and others how all of the things that we were hearing from the stake-holders, so this is a really critical process, as both the Secretary and Dr. Holdren and Dan Utech have noted.

So I'd like to thank the EPSA staff that helped put this together as well as our consultants, BCS and finally Chris Kelley for running a fabulous meeting, and with that, that concludes the first stakeholder meeting of the second installment of the QER. Thank you, again.