Quadrennial Energy Review

Second Installment

Electricity: Generation to End Use

Stakeholder Meeting #3

April 25, 2016

Salt Lake City, UT

Western Electricity Coordinating Council
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Opening Remarks

CHRIS KELLEY: Good morning, everybody. I'd like to welcome you to the third public meeting of the second installment of the Quadrennial Energy Review, focused specifically on the electricity system from generation to end use. Welcome to you in Salt Lake City at the Western Electric Coordinating Council. I would also like to welcome those of you who are joining us via live stream on the web. My name is Chris Kelley, I'm with Energetics, we are an energy consultant working with the Department of Energy on this QER effort. I have the honor of being the facilitator for today's meeting.

We will be hearing from a number of speakers today. 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 you haven't signed up at the entryway, please do so at one of the breaks. And for those who are joining via the web, you may also submit comments via web form that can be found at www.energy.gov/QER. So we have an outstanding set of speakers here today. Their comments and presentations can be found after today's session also at that same site, www.energy.gov/QER.

Before we get started, I'd like to read a short statement about the purpose of this 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 helpful for us for you to provide these recommendations and information based on your personal experience, your individual advice and information or facts regarding this topic. The object of this session is not to obtain any group position or consensus, rather the US Department of Energy is seeking as many recommendations as possible from all individuals at this meeting.

So with that, allow me to introduce Dr. Karen Wayland, the Deputy Director for state, local and tribal corporations. Dr. Wayland will introduce our next speakers. And just a word, I should do a safety briefing quickly. The table that you're sitting at here is on wheels. So if

you're going to make a very forceful statement, do it vertically, not horizontally. Karen, it's yours.

KAREN WAYLAND: Thank you, Chris. I want to thank WECC for allowing us to use this amazing room. This would be the 17th stakeholder meeting we have done around the country and this is one of the most unique and interesting conference rooms we have used. It's a beautiful building. So thank you very much. And thank you to Mori for being patient and tolerant as we try to align the schedule of the QER meeting with the other meetings because we wanted to take advantage of all of the stakeholders that are going to be in town across the Western region so we can really get a good sense of the issues confronting the Western region in electricity. So thank you very much Mori and Western Interstate Energy Board.

When the presidential memorandum came out in January 2014, to directing the administration to do the Quadrennial Energy Review, there was a whole paragraph on robust stakeholder engagement. I want to emphasize that at the end of the three panels that we have today, we'll have an open mic session where we really are hoping to get public comment based partly on what you hear today, but also on your experiences in your everyday work dealing with electricity issues. So please do stay if you're interested in speaking, there is sign in sheet and we will call you in the order as you come. All these comments are as important as these discussions of the panel and they all become part of the public record. They are tagged and analyzed and read multiple times by staff of the Department of Energy.

So with that, let me turn to our first official from the administration, Mr. Dan Utech, who is the Deputy Assistant for the President for Energy and Climate Change and the White House Domestic Policy Council. He is a Top Advisor for Energy and Climate Change and he coordinates policy development and implementation of these issues across the administration. He joined the administration in 2009 and was at the Department of Energy first of all as a Senior Advisor to then Secretary Chu, and then moved to the White House where he is a key player in advancing many of the President's top energy and climate initiatives. Prior to joining the administration, this is where I first met Dan and began working with him, he worked in the Senate for 10 years and worked on environment and energy issues there as well. So with that, I'll turn it over to Dan.

DAN UTECH: Thank you, Karen, good morning everybody and I want to start by thanking Melanie and Karen and the entire DOE team for putting this session together. I want to thank WECC for hosting us and I want to thank everyone for being here for what we hope is a really informative and interesting discussion.

So I want to kick things off by doing two things. First, a little bit of background on the Quadrennial Energy Review itself, where it came from and what it is about. And then second, a little bit about what we want to talk about today and what we hope to accomplish in this second installment. So first a background on the QER. As was referenced, the President announced in June of 2013, a Climate Action Plan that has been guided a lot of our work in the administration since that time and one of the things that was announced at that time was the direction to move forward with a Quadrennial Energy Review. This was an idea that had been forwarded previously and the idea was to take a cross-administration, interagency, cross-jurisdictional approach because so many of the issues really do cross all of those boundaries and so there was a presidential memorandum in January '14 that laid out more of the purposes and also the scope of the first installment of Quadrennial Energy Review, which was to focus on infrastructure for transmission storage and distribution of all forms of energy. We decided to take kind of a moving spotlight approach and focus different parts of the system at different times rather than try to take it all in one bite. And we focused on infrastructure in '14 and '15 because the pipelines, canals, transmission lines, ports, rail lines, are all capital intensive, long-lived components of the energy systems that they facilitate and perhaps more importantly, once in place, these will tend to dictate future energy policy decisions into the future. So, that first installment of the QER was published in April of 2015, about a year ago. In that document, we looked at the vast network of TS&D infrastructure as we came to call it. Looked at the crosscutting nature of the nation's energy systems for movements of liquid fuel, coal, natural gas and came forward with a set of 63 recommendations for modernizing transmission, storage and distribution infrastructure to increase resilience and safety of these systems, to maximize the ongoing transitions to clean energy economy and continue reliability and affordability of energy. The only sector in that document that got its own chapter was the electricity sector. In part because of a nexus between a primarily private sector electricity transmission system featuring infrastructure crossing public lands and also because the electricity sector underpins so much of the rest of our energy systems. In discussions and debates leading to this second

installment of the QER, 1.2 as we are calling it, John Holder and the Director of the Office of Science and Technology Policy and I, Secretary Moniz, Melanie and others and people from across the administration, concluded that really what deserved the focus next was a deeper dive into the electricity system itself. We came to this conclusion as a logical outgrowth of the analysis that drove the first installment and specifically, because of that inner dependence I talked about, increasing interdependence of all the nation's critical infrastructures and the economy itself, affordable, reliable electricity.

So, as we undertake this comprehensive review of the nation's electricity system from generation through transmission, distribution, to end use by consumers, our systems based approach will consider not only physical infrastructure, but also a range of actors, technologies and institutions and many of which are newly involved in the set of facts, physics and policies that allow most Americans to not give a second thought to the truly complex business of making sure the lights come on when they flip the switch. So, we'll take a look in the second installment at field choices, distributed generation, policy directions, by Federal, state and local governments and nongovernmental regional authorities, evolving expectations of consumers and how the utility business model unchanged in some ways since 100 years ago, has to adapt to new realities. And today, we have got three excellent panels that are going to look at different parts of this equation.

The first panel will look at bulk power, generation power and transmission and the second will look at distribution and end use and our third panel, our experts will discuss some of the vulnerabilities in greater depth to cyber and other threats in some greater depth and perhaps we have touched on them before. We face serious challenges and vulnerabilities and we'll talk about those today, but I think a lot of changes coming our way are already here are really positive and present a lot of opportunities as well, a good set of problems to have, I think. When I look back at the last seven plus years that I have had the privilege to work in the administration, developments like the shale gas revolution, providing abundant and affordable natural gas, dramatic expansion of renewable resources and the drops in costs, looking forward with extension by Congress last December and production tax credit and investment tax credit

for renewables, the implementation of clean power plan that we are looking forward to. We have a lot of exciting activity and I think that also a lot of challenges.

So, we are greatly looking forward to digging in today to a number of questions and I want to look at briefly highlight some of the topics and questions that we want to get at, some today but all of them in the broader QER 1.2 effort. How will the future accommodate greater fuel diversity, DER and take advantage of improved storage technologies and various demand response strategies? Will we see blurring of the lines between bulk power and distribution systems? What are the effects of that likely to be? How are those in the sector adjusting for and adapting to greater consumer choice and higher consumer interest and electricity usage, efficiency and adoption of new technologies? How well are new technologies being integrated and to what extent are systems able to adapt technological advances not yet off the drawing board but still foreseeable? To what degree should we consider TeleCom advances or deficits to the electricity sector issues? How can we make sure vulnerabilities we have seen with the security of our computer systems does not impact the grid? So these are some of the questions we want to get at and one of the purposes of the sessions like this and the others around the country is to seek answers to these questions and also to seek out additional questions that people think we ought to be addressing through this effort.

So, as Karen mentioned, one of the focuses of that Presidential memorandum was stakeholder outreach and that is really what today is all about. So I want to again thank everyone for being here. And I'm looking forward to hearing from the panelists and from everyone else who is here in the audience. And I know we have some folks tuned in on the web as well. So with that, thank you, Karen and Melanie for the opportunity to be here. I will turn it back to Karen.

KAREN WAYLAND: Thank you, Dan. As people mentioned and you can find it on our website, this is one of six regional meetings. We kicked off this series with one meeting in Washington. We are designing these meetings; they are very similar meetings around the country. The first two panels are the same in each region we have chosen as well a third panel that is a very topic specific. We did this similar meeting structure around the country, so we could really examine the very regional characteristics of the electricity system and it's not just differences from region to region, but within states and state policies, there are even

differences between the electricity issues confronting urban areas and electricity issues confronting rural areas. This is an inner agencies process with over 20 agencies involved in some equity in the electricity system, but only a few that have very strong equities and one of the strongest partners with us in dealing with electricity issues at the Federal level is the U.S. Department of Agriculture.

So I'm quite pleased to have Josh Cohen here, the Deputy Administrator of the USDA Rural Utility Services. Josh was appointed to Deputy Administrator in October of 2015 and before that he was in state and local government for many years as the Chief Administrative Officer for the Maryland Department of General Services and then as the Mayor of the beautiful city of Anacostia. And he – Annapolis, not Anacostia. That's a river! Starts with an A and I'm drinking coffee. Not enough yet. Before working in rural development he was in the criminal justice field working to keep us honest. Working as a parole and probation agent and a trainer for police and correctional officers and as a Grant Director for Crime Victims Resource Center. My pleasure to turn this over to Josh.

JOSH COHEN: Thank you, Karen. Good morning everybody. It is a pleasure to be here in Salt Lake City and on behalf of the Secretary of Agriculture, the Undersecretary for Rural Development, Lisa Mensa and my boss, the Administrator of the Rural Utilities Service, Brandon McBride, I bring you greetings from the USDA.

As Karen mentioned, one of DOE's key partners in the energy space is Department of Agriculture and so, one questions that I'm asked a lot is what does USDA have to do with energy and America? Unless we are talking about methane gas from cow pastures. Where is the nexus there? And the answer is that USDA has a mission area called Rural Development and some of you here, I know are familiar with it. But Rural Development is a great success story about Federal Government and Federal partnerships with the private sector that is really not told that much. And, essentially what Rural Development is, is a big lender where we have tremendous loan and grant authority that is given to us by Congress and not a lot of people know that the USDA really has a very large financing arm to support rural America.

Before we get into my remarks about Rural Utilities Service. I want to share a story that Tip O'Neill once told about lenders; Tip O'Neill, the former Speaker of the House from Boston. He

likes to tell this story at banquets, conferences, to bankers. So, his story was, there is a young couple recently married that want to take out a loan to get a mortgage on a house and start this next chapter of their lives. So they go to their local banker and he is sitting back reclining in his chair smoking a cigar. They sit down in front of him. The direct sun is shining directly on them and he is grilling them about their finances and their credit history and what their plans are for future income. And giving them a tough time. And at the end of this grilling, he says, I have one more question for you. And if you can answer it correctly, I'll be more favorably inclined to give you this loan. And he says, many years ago I lost one of my eyes in an accident. Can you tell me which one of my eyes is the glass eye? And then without skipping a beat, the wife says, it's the left eye. And he says, yes. How did you know? She says, that's the only one that had any warmth to it. [Laughs] So, he loves telling this to lenders and I figured I could tell it.

Like I said, RUS is a lender but if that is your stereotype of what a lender is, we have a very -- we view ourselves very differently. We are authorized by Congress and we exist to serve a public purpose and it goes back to 80 years ago. You can see it's hard to read but at the bottom, it says REA Co-ops are member-owned and controlled. And so, 80 years ago when our country was still in the mix of the Great Depression, electricity was starting to power America and starting to be able to turn the lights on. But there were huge swaths of the country that lacked electricity. And so, FDR as part of the New Deal, he created this administration, Rural Electric Administration in order to finance to provide the financing arm to support member-owned rural electric cooperatives to wire the countryside and bring electricity through the countryside. So, we got our start, RD, Rural Development got our start 80 years ago as the Rural Electrification Administration. And even though we expanded since then, Dan mentioned fiber and TeleCom. We do TeleCom loans, we also cover water and sewer. Our core service has been and continues to be electricity. So, a few aspects about electricity in rural America. So, depending on how you categorize or define rural, rural America has over 40 million residents, comprising of 75% of the U.S. land area. So it is a lot of people, but relatively speaking, it is a relatively small portion of the population covering huge area of the country. So the population density obviously is lower than in urban or suburban areas. What that means is, there is a higher cost to provide service to the end user. The average energy bill for rural households is 400 dollars higher than urban counterparts. And most rural electricity is distributed to the end user by these rural electric cooperatives. Over 900 rural electric cooperatives including some

generation, but the vast majority of them are distribution co-ops. So what does RUS do? How do we fit into this energy space? We participate in policy, planning and finance. We participate with our counterparts in other departments of the government, looking at policy issues as well as the private sector stakeholders. We work with our borrowers to help them plan for the future for capacity, for sustainability issues. The biggest thing we do is finance. What do we finance? We finance all aspects of the electric system from generation to transmission to distribution. In 2008, the Congress gave us the authority to finance energy efficiency. We financed Smart Grid. We finance all types of generation. We haven't financed new coal recently but we continue to finance enhancements to existing coal plants, natural gas, not a lot of nuclear lately. And we cover the gamut of renewables, so long as it is proven commercially available technology. Solar, wind, hydro, biomass, geothermal land fill gas. We also finance some storage. So, we are a financing arm for all aspects of the electric energy system and we also do some grants. This is not a big portion of what we do in terms of our overall dollars, but we do offer some direct grants to communities that are solar mode or have particular challenges that their energy costs exceed the national average by 275%. Who do we lend to? We lend to co-ops. We lend to municipal utilities, tribals, we lend to for profit, investor-owned utilities. We lend to nonprofits and we also have a guaranteed program where we guarantee loans made by non-profit lenders, CSE, the National Utilities Cooperative Finance Corporation and Co-Bank, which is based out West here in Denver.

The key to all we do is that the target area has to be rural, which for our purposes, for the electric program, is usually defined as under 20,000 populations. Since we began 80 years ago, we have financed more than 120 billion dollars of investments, more than 40% of the entire U.S. electric energy system is or was financed directly or indirectly by REA or now as we are called, Rural Utility Service. Currently we have 46 billion dollars in loans to our borrowers, almost 600 of them. Our delinquency rate is less than one-half of 1%. We are not a white elephant, a giveaway. We are a very good investment for taxpayers; not only do we serve a public purpose and provide financing, a lot of times the private sector won't do it. But we also actually protect those taxpayer dollars very well and this year we have six billion dollars in financing authority. National reach - this is a map from NRECA, the National Rural Electric Cooperative Association. This is their members and even though you see 20 or 25 color areas,

there is actually -- if you breakdown, there is over 900. And it goes to show that in almost every state, 47 states, there are Rural Electric Cooperatives providing electricity to folks.

So this is our favorite slide. Our rates are crazy good. And they are about as good as they ever have been. It is hard to read. Essentially, we provide loans that are at treasury plus one eighth of a percent. So, for a 90-day loan, it's .23%. For a 30-year loan, it's 2 2/3 %. Our loans, mostly, not always for energy efficiency, which is a shorter loan term but most of our loans go out to 35 years. Our borrowers, most of them, 90% of them choose set it and forget it. Whatever the loan rate is, boom,that is going to be the fixed rate for the term. But we also offer folks the opportunity to roll over their interest rate for shorter terms, sometimes 90-day loans at whatever that rate is, at no cost and if you feel like the rates are creeping up, then you can lock it in for the remainder of the term at that point. So our financing is really remarkable. As we look ahead, it is interesting.

Talking about the 80-year history of REA and RUS. We started out trying to get as much electricity out to folks as we can and now like the rest of the energy sector, we are kind of focusing on broader issues now that we have a nationwide electric network. Even though RUS – the key point is RUS does not own the physical plant, the infrastructure, ourselves, but we have standards in our loans and grants that our borrowers are obligated to meet and right now we are participating with other departments looking at recommendations to make sure that our nation's rural electric infrastructure can withstand natural disasters from wildfires and tornadoes and flooding, not just Federally-owned but Federally-financed facilities requiring annual inspections, requiring updated emergency restoration plans. We also are financing Smart Grid and I'm not going to focus on this a lot right now because there is going to be a much more in-depth discussion later, but Smart Grid as we know, offers a ton of benefits but also means more vulnerabilities for the system. One of the benefits I want to mention is in terms of rural TeleCom and broadband. There are a lot of rural telephone cooperatives, the Verizon’s and Comcast’s that don't get out to all the rural areas. You have rural electric cooperatives that have infrastructure and they have the fiber already going to the home. So we are seeing rural electrics are partnering with rural TeleCom utilities. We are the rural electric that provides the fiber and the rural Teleco provides the service, so that folks even in very hard to reach remote areas can get good quality broadband and to paraphrase the President, he said

broadband access today as essential to economic development as electricity was 80 years ago. So that is a neat partnership we are seeing.

Looking ahead, these are some of our buzzwords, we looking to support cleaner fuel. We finance the transition from dirtier fuels to cleaner fuels. We are looking to finance greener energy. We are looking to take our system further to still make sure that we are expanding to remote and rural areas of the country. Smarter technologies and we are looking to finance a stronger system where we finance upgrades to existing systems and as I mentioned, we are requiring our borrowers to make sure they have plans in place for resiliency and sustainability.

I'm going to close with a slide about RD, our mission area. I mentioned rural utility service. We have our electric program. We also have TeleCom and water and sewer programs that we finance in rural areas and I know some of you here may be in the electric space or may have clients who are in rural communities. We also have two sister agencies, the Rural Housing Service, which finances affordable housing and community facilities in rural areas as well as the Rural Business and Cooperative Service. So if you have a client or if you're in a community that is rural and you have ideas and you have plans but you're struggling with how to finance it, it's worth a call to rural development because we may have solutions that can fit your needs.

So with that, I'm looking forward to the panels throughout the day. And I'll conclude my remarks here. Thank you very much.

KAREN WAYLAND: Thank you Josh. It's my pleasure to introduce my boss, Melanie Kenderdine, who came to the Department of Energy in 2013 as the Energy Counselor to Secretary Moniz. She then set up the Secretary's policy office which is called the Energy Policy and Systems Analysis Office. The systems analysis part of that office is not a secondary part. It's really an essential part of the office and part of the reason that we are the Secretariat for the QER, doing the analytical work for the reports. She's served in a variety of roles in government. She was at the Department of Energy administration from 1993 to 2001. She served as Chief of Staff for Congressman Bill Richardson before he became the Secretary of Energy, so she worked in Congress and also worked in academia as the Executive Director of the MIT Energy Initiative, and at the Gas Technology Institute and her many, many years working in the energy industry got her the distinct award of being noted as one of the top five

women in Washington shaping energy policy by the *National Journal* and the other four people in that very illustrious cohort were two cabinet-level officials, a ranking Senator and a chair of a Senate committee. So, we are honored to be able to be working with Melanie and learning from her experiences in energy.

MELANIE KENDERDINE: Thank you. Thank you all very much for coming today and thanks to Dan Utech and to Josh for setting the stage for the conversation, highlighting the key challenges that we are facing. I would like to give a special thanks to Karen and her fabulous team for putting this together this event. As she noted this is the third, for QER 1.2, we had 13 or 14 and QER1.1 and Karen and her team are now kind of on a permanent road show for the next couple of months as they do these meetings around the country. They are however, incredibly valuable. I have been to all three this year too and extremely informative. We take these very seriously and they have provided major inputs in shaping for the QER. We are in Salt Lake City today in part to discuss the diversity of Western markets and this region's experience in security and emergency preparedness and the opportunities at the seams of urban and rural systems in our office. I'm from New Mexico, so I'm always a big proponent of paying attention to rural areas, not all of our solutions, vulnerabilities, challenges or opportunities are specific to cities. And I think Josh very ably illustrated why we need to pay significant attention to rural areas. When I first came back into the government from MIT, almost immediately, we had a propane crisis in rural America. And how people get their heat, electricity, et cetera, et cetera in rural America is -- the electricity is obviously something we are looking at in this second installment of the QER.

I'm going to talk a little bit -- I don't know if you can read this or not. About the first QER Dan mentioned and gave highlights of this. There were 63 recommendations in it. You won't be able to read the diagram there. We call this our flower diagram within EPSA in my office. And what you're seeing there, high-level national goals, economic competitiveness, energy security, environmental responsibility. It's a variation of a VENN diagram because these are all related. And the rings around the outside are overarching and crosscutting issues, jobs, environment and citing. You add your natural gas, liquids and -- excuse me, electricity. Those were the systems we looked at, but we did -- these were all chapters. They were crosscutting by-and-large increasing resilience and reliability, improving share transport infrastructure and rail and

inland waterways et cetera. Modernizing U.S.S. energy security infrastructures in a global marketplace and then as Dan noted, modernizing the grid. That was our concession to one specific sector and I'll say a little bit more about that in a second. But, these 63 recommendations, I believe that 43 of them or something like that, are in process or will be completed. Congress has in part, or in its entirety, passed legislation supporting 14 recommendations that were in QER 1.1. The most notable is two billion dollars authorized to modernize the strategic petroleum reserve and our office has briefed 33 countries and the EU at their request. And I give you those statistics because people take the QER very seriously and so your input going forward will likely be briefed to other countries and in your future.

And one other thing before I go. Let's go here. We at DOE, we manage the Secretariat. A huge interagency process. The whole QER is managed by the White House, but we run the Secretariat, kudos to April Solace, she is the Director of Our Secretariat. QER 1.1, 22 agencies had input into QER 1.1. We expect similar input from QER 1.2 and we received and adjudicated 1500 -- sorry. It was a late night. 1500 comments from agencies, and that is one of the things the Secretariat does. The fun has just begun for April. This is QER 1.1, the major transformation of the electricity sector, changing generation mix, low load growth, increasing vulnerabilities to severe weather and climate, new technology services and market entrance, cyber and physical threats and aging infrastructure and workforce and growing overlap between jurisdictions. And again, as Dan noted, given the centrality of electricity as a nation, this transformation merits closer examination. That's why we are looking at this in QER 1.2. This is where we were linking QER 1.1. That is where we were 1.1 and this is where we are in 1.2. Looking at electricity all the way from generation through transmission and distribution to end use. And so, that kind of the -- it's a big job. We feel like we have caught the bus. We have basically a year to get this analysis done. This will year you won't be able to read either. This is our process timeline. It kicked off the QER in that period of time through December of 2015. This is where we are now. We are developing a set of baselines. We did that for QER 1.1 as well. I think in this instance, for electricity, there will be intrinsic value in the baselines just putting all of this information in one document, in one location, more so than in QER 1.1, where we were new and we had wide variability in the quality of the baselines. These we are being very rigorous. Most of these are being done by our laboratories and these baselines are generation, distribution and end use markets and jurisdiction and environment. And so, we will

take major sections of these and put them into the QER itself, but these are substantial documents and have their own value.

We also have about 135 analytical products that we are working on. Again most of those are with national laboratories, some with consulting firms and from those analytical products and the baselines, we are getting findings and insights. You can see down there at the bottom, it doesn't correlate perfectly the former stakeholder outreach and coordination where we are right now. We are at various stages of getting our baselines done and looking at our analytical products and deciding some findings and insights from them, some key issues framing and outlining integration, is where we will be a very shortly. We are in part there. We then develop a policy analysis and policy options and then those go into interagency review and we hope to have the final report out by December of 2016. I leave on January 20, 2017. I hope to have the QER 1.2 done by then. We will. You can't read this either.

These are the issue areas and work streams we had, 13 of them. And other Federal agencies that have expressed interest in those. We have had a lot of bilateral meetings with these agencies. I'm just going to read them to you 13 areas. We just had read outs from each of these teams. End use, grid ops, generation, markets, jurisdictions, environment, finance, innovation technologies, resilience, security - physical and cyber, North America jobs and workforce and evaluation. These are the QER 1.2 meetings we are having across the country and in Canada and Mexico. Here we are, Salt Lake City on April 25th. We were in Boston on April 15th. We were in Winnipeg, Manitoba in Canada on February 11th. We then went to Mexico City on February 25th. I went to New Delhi, India in-between and had a cold ever since, that's why I can't talk. Austin, Texas and L.A. So, not as many meetings this time, stakeholder meetings, but very focused and looking at all the different markets including the North American electricity markets.

We have technical workshops that we are also doing, cost benefit of resilience solutions and low carbon energy futures and electricity end use in rural or isolated areas. We did that with the National Academy. Future of energy efficiency. Electricity markets and potential policy options. We recently had a technical workshop on CCS. We have one coming up here very shortly on evaluation, a critical workshop for what we are doing and the value add we hope to

bring with this QER. Financing clean resilient and affordable electricity. Energy productivity. The gas electric interface. That has risen in importance with the canyon issue in showing the reliability relationship between gas storage and electricity. Then North American regulatory harmonization and North American grid security. Those are the -- I just talked to the Canadian Electricity Association and we have a tri-lateral leaders meeting coming up here in June, so we are all doing a lot of work in advance of that on North America.

So, I would like to -- we close -- before I read what is on this slide, I wanted to address the panel's topic which is security and underscore the importance and its promise in the second QER. I think as I mentioned evaluation, I think it is an area where we are going to have - the QER is going to have value-add in our analysis. I think the security issue is another area of critical importance. Right now, we are putting together a notional flower diagram for QER 1.2 like we did for 1.1, this is an outline. It is both a VENN diagram and an outline and we are just at the stage where we are moving things up to the Secretary to discuss with him and then we will take it to the White House. But the crosscutting issues that I think would or could be chapters in QER 1.2, are markets, finance and business models. Innovation and R&D. system integration and grid ops, institutional arrangements and policy, evaluation and North America. I think those would be likely candidates for crosscutting chapters in the QER. Last time QER1.1, all of our chapters had findings and recommendations. I think these might be more informative. We don't know yet. But more informational and then the crosscutting objectives that we have looked at for the center pedals of the flower diagram are enabling a clean energy future, increasing consumer value and equity. We had a long discussion and an off-site with the EPSA Directors. We discussed putting in access and equity in access and we thought equity might cover access. We know it's an issue but it is also a term of art in electricity. And so, but that has been a long discussion in our office. The third pedal improving system resilience and reliability. That is more focused on longer-term resilience, immediate reliability and looking at things like increased weather events et cetera.

And then, finally, ensuring security in an electricity reliant economy. Dan talked about this; how all of our critical infrastructures rely on electricity. There is a lot of overlap between that one and resilience and reliability. I don't know how all of that will shake out but, the distinction I would make is in the ensuring security and electricity reliant economy, is looking at the low

probability, but high consequence events that are associated with cyber and physical security and an economy that relies on electricity. So, what I did last night and this morning very early this morning, is pull a couple of quotes about that, and the things that keep me awake at night. And first is from Admiral Mike Rogers. He is the NSA Director, National Security Administration Director, Agency Director. And this is when he spoke to The House Intelligence Committee in November of '14. His quote was, there shouldn't be any doubt in our minds that there are groups out there that have the capability to shut down or stall our ability to operate our basic infrastructure, whether generating power or moving water or fuel. So the NSA is thinking about this and is very concerned. And then The Center for Naval Analysis, this was very recent, November of 2015, reliable electricity underpins every facet of our lives. The design of the grid and its inherent vulnerabilities are known to our enemies foreign and domestic. And so, this is a growing concern, security concern. And Josh alluded to this as well on the distributed energy is terrific and provides a lot of flexibility in our systems and enables renewables. It also adds a point of access to the system. And so, as we are moving forward and thinking about issues, security which we are today, those are some issues I would love to hear about. Love to hear if the industry and that responsibility for reliability and resilience share the concerns of Admiral Rogers and others who are worried about the low probability, but extremely high consequence events out there and how do we deal with that?

So again, thank you all for coming and love to hear everyone's comments and look forward to the day.

KAREN WAYLAND: We are going to open up the panel for questions. I want to remind people we do value your contributions in the open mic session at the end of the day. So please do feel free to share your reactions, insights and recommendations for Federal action. If you can't be at the open mic, there are places where you can, on our website, to make comments. You can up load them at energy.gov/QER. And our comment period is open through July 1. With that, Chris, would you like to moderate some questions from the audience?

CHRIS KELLEY: Absolutely and before we get started with questions, I know there were some comments that Melanie made about the visibility of the slides. Those slides will be posted at energy.gov/QER so you will be able to see those. So, let me open it up now. Our

panelists have graciously offered to take some questions. Any questions? All questions have been answered? Too early in the morning? Well thank you. Please join me in thanking our panel.

[Applause]

Panel 1

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

So this point we will transition to our first panel, which is on bulk power generation and transmission. So I'd ask the panelists for that group to please make your way to the stage.

We are going to get rolling right into our first panel. The subject is bulk power generation and transmission. How can we plan, build and operate the appropriate amount for future needs? So joining me up here on the stage are our distinguished panelists for panel number one. We have Jim Robb, who is the Chief Executive Officer for The Western Electricity Coordinating Council and our host here today. We have Ron Darnell, the Executive Vice President for Public Policy Resources Incorporated. Doug Hunter, Chief Executive Officer and General Manager Utah Associated Municipal Power Systems. Julia Souder Prochnik, Director of Western Renewable Grid Planning, Natural Resources Defense Council. Bryce Freeman, Administrator, Wyoming Office of the Consumer Advocate.

So the process for our panel here today is that we are going to have each panelist give a presentation. Some may have actual slides that they'll show. Some may be from notes. Each has five minutes. I will remind you all. I'll let you go to seven, but I may bring out the hook at that point. But also point out that up here at this white table we have a series of colored lights to see. The red light will turn on at the 5-minute mark. We'll go down the list and at that point we'll come back to me and then I'll have a chance to ask questions. So, all good? Ready to go? So before we get started, I wanted to mention the views expressed by the panelists are their

own views and not the views of the administration, including the US Department of Energy and U.S. Department of Agriculture. Let's get started with our first speaker. Jim?

JIM ROBB: Thank you, Chris. And let me welcome everybody to Salt Lake City in the Hardware Building. We are delighted to host the meeting today. I'd like to give a little bit of the lay of the land of planning and planning issues in the West. First of all, some of you may be asking who WECC is. I asked that question myself three years ago when I was recruited to this job. We're are the regional entity responsible for sharing year long term reliability of the bulk power system across the Western Interconnection. We are a 501(c)4 social welfare organization, funded through load serving entity assessments, authorized by Section 215 of the Federal Power Act, but we are accountable to the general public in ensuring a bulk electric system that is reliable and will have power when they want to flip the switch. We don't own or operate any bulk electric system assets, but we have played historically a very central role in helping to coordinate and facilitate transmission planning and resource planning across the Western interconnection and planning occupies a significant amount of our mind share.

Western Interconnection is pretty challenging with some unique characteristics that always important to know when we have visitors from the east, because we are different than in the Eastern Interconnection. Though BES in the West is designed with the significant degree of interstate interdependence built in. Unlike the East, where we tend to move fuel to load and generate locally, in the West, we generate where the resource are. Whether that is Northwest hydro, coal plants in the Rockies and we transmit power over very long power lines to load centers, which are typically concentrated along the coast as you would imagine. That leaves us with very, very long transmission lines built over very environmentally sensitive terrain and creates a unique set of planning issues as well as transmission stability and operational issues that we are very attuned to. We have two organized markets in the West. One in California and one in Alberta. The rest of the interconnections is traditional IRP-type utility markets. One of the more important and unique characteristics of the West is we have 38 different balancing authorities across the West. That creates a tremendous number of seams issues that good integrative planning is really, really important to address. And of course in the West, water resources are scarce. So that makes any sort of resource development very, very challenging.

So what are some of the current challenges facing the inner connection out here? First the resource mix has been and is going to continue to evolve towards a very, very different type of resource mix than we have known in the past. Traditional base load resources are disappearing. Over in the next 10 years we expect between 15-20% of our coal plants to be retired and that is without the implementation of the Clean Power Plan, which would probably drive those numbers higher. Most of the resource additions that have occurred in the past 10-20 years and we project to occur going forward, will be renewable resources particularly wind and solar. And natural gas. Our current resource mix in the West right now is about 12% wind and solar and we expect over the next years that number to double, which creates a very, very different kind of electric system than what we ever managed before. This policy creates a number of very unique challenges. First of all, fuel security is declining. Nearly 40% of our resource base is hydro, wind or solar and obviously very dependent on near and long-term weather patterns. In addition, another 40% of the capacity in the West is natural gas. Natural gas is also susceptible to interruption when based on weather patterns across the country. And all of this is happening at a time when we know that weather patterns are changing. So that creates real planning issues and dilemmas for us and the authorities for resource advocacy to think about what the right resource mix needs to be. Behind the meter resources like rooftop solar are growing to significant amounts and these resources are completely invisible system operators. The significant amount of solar creates challenges to the balance of the system. These inverter-based resources do not provide reactive power to support transmission stability. They tend to be binary on and off resources with no inertia and they also tend to act in coordinated manners, so when one panel trips off and creates instability, other panels start to trip off as well. So we now have very, very large blocks of power that start to act in unison and they turn off very quickly and of course something else needs to ramp up just as quickly to preserve our ability to serve load.

The expansion of natural gas in the transition of natural gas from a supplemental resource to the primary resource in the system also creates a number of challenges that policy needs to catch up to. First natural gas infrastructure as we know has proven to be enormously reliable over the years. We need to be clear that it is not designed to meet electric sector reliability considerations. Natural gas infrastructure has been built on an economic basis, and as a result tends to be optimized for economics, that resulted in very, very large single elements where if

any problem supports occur with them, could significantly disrupt the power system and we are seeing that play out in Southern California right now with the canyon gas leak. And of course major disruption of the key pipeline could interrupt fuel supply for a large number of generating assets.

So let me closes with laying out a few things that I think are the planning needs of the future and things where I think the DOE could be very, very helpful to us. First of all, we need better planning tools to adapt to the needs of the emerging 21st century grid with high penetrations of variable energy resources and natural gas and a lessening reliance on coal and nuclear fuels. We need to be able to assess system flexibility and we need better models of weather patterns and predictive weather pattern models and we also need to rethink resource adequacy. Most of the resource adequacy constructs we operate under were developed in the 1950s when we had a very different economy and a very different resource mix. I think that is an area where some wood needs to be chopped. Secondly we need better analytics and computing power. We have terabytes and terabytes of data that we collected out here through the program that the DOE helped to finance several years ago. But we really don't know what to do with it and how to analyze it to develop any sort of predictive capability. I know there is a rich plethora of insights we can get from that data, but we need help and capacity to work on that. Third, we really need better integration of gas and electric planning and operating protocols and policies. It's clear the natural gas system across the country is going to become the fundamental foundation on which the electric system will be built and it is built under a very different set of constructs than we think about electric system. And then I'd like to close with continuing to thank the DOE for the partnership that they have shown with us in particular. We have done a number of joint projects with some of the national labs and we would like to see that support continue in the future. Thank you.

CHRIS KELLEY: Thank you, Jim. Ron?

RON DARNELL: Good morning. I'm Ron Darnell, the Senior Vice President of Public Policy for Public Service New Mexico resources or PNM. I appreciate the opportunity to be here today and to contribute to The Department of Energy Quadrennial Energy Review. PNM is the largest electric utility in the State of New Mexico. We own or lease 2800 megawatts of

generation capacity and have over 15,000 miles of transmission and distribution lines. Today I will address from the PNM perspective, the challenges and opportunities presented by our rapidly changing times. PNM is required to complete an integrated resource plan every three years, in addition, the RP requires PNM to plan using commission-determined assumptions for carbon emissions. The purpose is to identify the most cost effective portfolio of resources that minimize revenue requirements over 20-year planning horizons. Over time, PNM has changed its energy supply and demand balance. We have significantly reduced the environmental impact of providing our services and change how we reliably provide electric service. A great example is the successful energy efficiency programs offered by PNM, which have resulted in more than 1.9 billion kilowatt hours of electricity saved since 2007, put in context that is equivalent to over 20% of our retail sales measured from 2015. PNM is meeting New Mexico's renewable energy portfolio standard which is at 15% today, moving to 20% in 2020. Further, PNM will be significantly reducing coal generation, when half of the San Juan generating stations, which is a 1850 megawatt coal fired facility, located in Northwest New Mexico, is retired at the end of 2017. So, again half of that capacity will be retired at the end of 2017. Additional reductions and base load generation may be limited however. Coal fired generation can be a source of essential reliability services, particularly load following, regulation, reserve capacity, rapid power supply and frequency response. Base load coal plants are running most of the time and can provide these services while running. Going forward, PNM is projecting to meet future needs primarily with a mix of natural gas, peaking and solar and New Mexico solar is a reliable resource during daytime but naturally limited to capacity factors in the 30-40% range. New natural gas peaking must run less than a base load unit as required by the new source performance standards under the Clean Air Act. This translates to about 40% capacity factor limit on simple cycle natural gas generation. So a combination of solar and peaking resources alone leaves a gap in the ability to replace the essential reliability services provided by coal-fired generation. Utilities may need to rely on natural gas combined cycle technology or improvements in the cost and capability of technology such as storage or smart inverters. While PNM is reducing its carbon footprint, New Mexico could contribute more to the national renewable energy supply. New Mexico is ranked second in the nation for solar generation potential and tenth in wind generation potential. Taken together, and without considering the geothermal energy potential, New Mexico has more renewable energy potential than any other

state. By contrast, New Mexico is 39th in total electric sales. PNM's transmission system sits between the wind resource on New Mexico's eastern plains and the electric demands to the West and expansion of electric transmission, New Mexico could link the wind resource with the larger markets in the West. There are approximately 500 megawatts of wind generation interconnection to PNM's transmission system, 200 megawatts are merchant generation serving customers out of state. An additional 800 megawatts of merchant wind farms have recently signed power purchase agreements with customers in California and have or are in the process of acquiring transmission service from PNM. Integrating additional wind farms on PNM's transmission system will require the transmission system to be expanded. There are potential risks with cost recovery. Getting approval to recover from retail customers, transmission investments made primarily for wholesale purposes is a tough sell. The New Mexico PRC will review cost recovery requests against the need for additional transmission to serve PNM customers, not the opportunity to provide renewable energy to the West. Since PNM supply and demand balance changes have been resulting in smaller generations closer to load, while demand growth is slowed by energy efficiency and customer distribution, it's difficult to a show need for transmission to serve PNM's customer needs.

I'll finish by saying that transmission is a very lumpy investment. And saddling wind projects with an expensive transmission system improvement negatively impacts project economics. What we see in New Mexico is a game of chicken between developers who are looking to interconnect, bear those costs and a system whereby future developers pay into that and reduce the initial investment, would be something that would really improve the economics and possibly the interconnection of the renewable resources that we see in the southeast part of New Mexico. I'll close by saying that we believe that both cost recovery and citing issues must be addressed to enable the transmission system expansion necessary to tap New Mexico's renewable energy generation potential. The DOE initiative to define national interest energy corridors is a good approach to reduce permitting risk across Federal lands. Today cost recovery issues have not been addressed at the state level, since wind resources in the West are not located near the load. Regional agreement and cost would be beneficial. Again I appreciate the opportunity to provide these comments today and I look forward to the remainder of the discussion.

CHRIS KELLEY: Thank you, Ron. Doug?

DOUG HUNTER: Good morning. Thank you. I'd like to thank the DOE also for this. We are working closely with The Department of Energy on small modular reactor deployment in the state of Idaho and they have been very helpful with this. We think this is a key to all of the situation we are talking about right now. Let me just say, UAMPS, we are a joint action agency of 45 municipalities in eight Western states. We are not for profit and we do not require our membership to buy from us. We are project based. So I think we come at this a little differently. I'm not going to couch the problems. I think everybody really understands them. I'm going to tell you quickly what we are doing to alleviate these problems so that our communities can move forward.

First, it does start with communities. I really believe that. The community is the best place to implement energy efficiency, distribute generation obviously by name and demand response. Because I think it could be done more efficiently on electrical basis as well as a cost basis. That is if the customer is willing to invest in the future with us, utility doesn't have to make that investment and they can supply the requirements to get to it. Obviously that's not going to meet all the power supply needs in a community. There are larger loads and larger loads that are connected outside of communities that would deal with this. So what we really want to move forward with is educating our customers, our members, in terms of all technologies, both the use and nonuse of electricity, the implementation of that, and the operation of it. So they can make a decision at the community level on what works with them and we are actually integrating that right now in UAMPS through our carbon-free power project, power supply. I don't want to be in a world of natural gas only. And renewables. I just don't want to be. Natural gas, don't trust it. I have been in this business since 1979 and I have seen the price of natural gas and the availability of energy gas move all over the place, such that I would hate to bet my company on the future price and the availability of natural gas. We believe in diversity and we know coal plants –an owner in San Juan is shutting down - half are shutting down, 17. And we see other coal plants shutting down in the near future right after that, regardless of the clean power plant as mentioned. So we are right now currently working on investing for 2024 online date, in small modular reactors up at the Idaho National Laboratory, in southeastern Idaho. The reason we are doing that is we see these things are small, 15 megawatts. They are scalable.

They meet the needs of the community that is dealing with energy efficiency and demand, response and generation so we don't have to overbuild the capacity and don't have to bring in potential standard investment for us and the waste, the fuel that comes out is very manageable as compared to carbon-based systems that we come into. There is a renewable best friend, because the best friend for renewables a robust grid that has power supply on it that will immediately respond to the lack of generation for whatever reason. So we don't have to use as an excuse to put renewables on. And we have a study we did with national renewable energy labs to show that our reactors will follow renewable right to the load curve.

And then finally, I like to make a plea on regulation. Nobody likes regulation, but it is required. It's something we have to have to be in society. We have to know what the rules are. One of the things that seems confusing to me in the business and again, I have been doing this for a while, is the lack of coordination between the regulatory bodies. And I would suggest if we could focus to something akin to NEPA-- I know how people don't like that either, but akin to NEPA, as to regulation in the electric and energy business. Something like NERC, could be that body to produce such a document that would focus to not only rates and access to the system but reliability of the system because really most important thing we do, I hear all the time, is keep the lights on and the beer cold. Thank you.

CHRIS KELLEY: Thank you, Doug. Julia.

JULIA SOUDER PROCHNIK: Good morning, everyone. It's an honor to be here on behalf of Natural Resources Defense Council, which is an environmental advocacy organization. It's humbling too, because Larry was my boss at DOE. Larry! There he is. It is very wonderful to come full circle. As I was preparing my remarks, I was sitting at the playground -- I have two kids and life speeds by and I was looking at the parents with their iPhones and some of the kids. I was thinking, 10 years, less than 10 years from now my kids will have iPhones or the equivalent. What are those going to look like? We know it is going to happen. They are going to need to be reliable. They will need to be cost effective and efficient. And they are my kids, so they will be powered by green energy and their friends also will want the same. So having that kind of parallel looking at the future of the grid, this modernization, what do we want? We want reliable service, we want it to be low cost, and with a climate aspect and the culture

shifting that is going on today, we want it to be green. We want it to be efficient. So how do we get there? I think you heard from the first panel and from my colleagues here that planning is critical. Planning is essential. And we have a lot of tools to do it right. And we need to do it right. So we need to plan. We need to act on it and we need to plan well. And so how do we do this? The QER has been great. The recent publication in April already highlights the fact that - I think it surprised a few, but it's a reality that half of the generation that came on in 2014 was renewable. This is a reality now. No more of just kind of like the future. This is now. This is our grid. We can be more innovative and take it to the next step. In addition to renewable energy integration, you also have solar costs that came down 20 fold. This is another statistic that came from the QER, from the 2008 to 2014. That is huge. I think that surprised a lot of people, so with a lot of these new realities in front of us, we can modernize the grid. We are modernizing the grid and being innovative. For this industry to be innovative, that is huge. But we are doing it in small steps. And I think it is critical we take this document and this coordination and this planning opportunity and really push it and one way to look at this culture shift is another analogy, is taking a bicycle wheel, the hub. This is the grid. You have all these spokes - wind, solar, energy efficiency, demand side management, storage. All these different points. Coal is disappearing. A little gas. All of these different aspects, it's a new grid. So the success of this is bringing all of these players to the table. Utilities, regulators, consumers, advocates, developers, having all those different personalities at the table, with different experiences and different mind sets, is what is going to make planning and all these technologies successful and it is so important going forward.

A key aspect is that in proven example with all the American reinvestment and Recovery Act funding that DOE got and gave to both the east and West in planning groups, those millions of dollars in tax money was so well spent. They gave the opportunity for all these different types of stakeholders to come to the table and be involved in planning to create new tools like the environmental data viewer tool which is being used today. This tool that takes environmental data for zones and GRS data and lets you see cultural sensitivity areas to be aware of. Environmental sensitivity areas to be aware of and build the infrastructure in the right places. This tool has been used by independent developers in regional planning meetings to show, here is the line you want to build and you have taken the first step of where to put it. This couldn't have been done a while ago and it's also showing proactive aspects to get to the grid of the

future. You've got the regulation, you've got the planners and the different components and the tools. We have to be smarter about how to use all this. And so, that kind of goes to the whole initiative smart from the start. I know there has been many interagency discussions about this. That where you look at these renewable energy zones, because of noted earlier, you have wind and solar in different areas and you have load centers in different areas. We don't want to see spaghetti lines and transmission lines all over the place, but you want to see the most efficient and the most effective lines.

So how do you make this work? The other aspect too is about the coordination of transmission planning, is the fact that you have the load shaping and the fact that wind blows in certain areas and solar -- different times of the load and you have the uncorrelated variability, which is critical and having this planning and tools is really important to understanding this. And so as the QER states, that transmission and distribution investment is going to continue to grow and there will be a continuing push to acknowledge the carbon sequestration and carbon CO2 emissions aspect and increased quality of integration. And that the challenges, and that was mentioned earlier by Melanie about the data and access, we need data to do good planning. But if you don't get the data because of security concerns, then you have huge walls, and I think that balance is really important. You have to have good data to do good planning and the fact you can't use cybersecurity as a constant wall, you can't get to the data because there a security aspect. This has to be a fine line and it's the components of the state regulators and interagency coordination to work on how to make this coordination happen, so you can get the data to do the good planning you need to do.

And that the other challenges is cost allocation. It was one of the major components of the four quarter 1000 to bring the states together to coordinate, how to build these transmission lines? How do you bid the facilities and coordinate this? I think that there is a tool that we can use to better promote this in that one of the groups in the West, one of the regions, Westconnect, has done a really good job. It has a new governance structure, again where they bring all these different components to the table; regulators, advocacy groups, consumers, developers, utilities, all sit at the table, discuss the regional plans together and vote on this. This is unprecedented. It doesn't exist anywhere else, but it's starting something and it's really important. So the coordination of all these different regions is important, you don't want to

vulcanize it. And another thing that Natural Resources Defense Council really promotes is the regional system operation discussion that is happening. The fact that in the West, we are saying regional transmission organization again, that doesn't happen a lot. That's huge. It's another aspect of the changes that are happening - innovation and new technologies and discussion that is need to happen and that must happen to make sure that we have the grid of the future. And so some of the other successful components going forward are to continue the stakeholder process, get people in the room. Get them talking. Bring those different ideas together. Learn different ways to share the data. You need that access to have good planning. It's critical. And then the funding that DOE provided to different groups and the committees and WECC and other entities was critical and how could DOE and other agencies continue to fund more stakeholder involvement? Without having the stakeholders in the room, you don't have a good plan and also to continue to support in the dialogue for the regional system outreach. It's critical. No more -- in the West, as many of you know, we have 38,000 authorities. Consolidating these balancing authorities and really trying to work on a smarter grid. And allowing the discussions to happen. And then also the interregional planning groups. There is still a lot of challenges there. Cost allocation is new. Public Policy incorporation is new. Clean power plan and where it takes all of these entities is new. But you have to have these discussions, these open forums, to really work through the challenges to make sure that you can really plan for that grid. Plan for that new iPhone, new Samsung, whatever that device is that you're going to have in your hand that you know is coming. Make it something that is worthwhile that you want to own and that you want to be a part of. Thank you very much.

CHRIS KELLEY: Thank you, Julia. Bryce.

BRYCE FREEMAN: Thank you. And thank you for the opportunity to be here this morning. The Wyoming Office of Consumer Advocate is an independent statutorily chartered office whose obligation is to represent the interest of all classes of customers in the utility matters before the Wyoming Public Service Commission. In this charging of statutory duties, the OCA, is required to consider the interest of utility customers and Wyoming citizens in the provision of safe, adequate and reliable and affordable Public Utility service. The Wyoming OCA appreciates the opportunity to be here today and provide its unique perspective on the issues outlined in the Quadrennial Energy Review, the second installment, regarding planning,

building and operation of the bulk interstate electric generation transmission system. We have long been involved in the planning and development of the bulk electric system in the Western Interconnection. Our involvement dates back to the Federal Energy Regulatory Commission's issuance of its open access and standard market design rules and includes involvement in various past regional market initiatives including Indigo, Grid West and RTO West. How many of you remember those initiatives?

More recently, the Wyoming Office of Consumer Advocates has been involved in Interconnection wide planning initiatives under taken by Western Electricity Coordinating Council, WECC. And the regional planning being conducted by Northern Tier Transmission Group. They also have been closely involved in development of the energy and balance market in the West between Civic Corp. and the California Independent System Operator and are currently heavily involved in the stakeholder process surrounding Pacific Corp. and CalISO's initiative to fully integrate Pacific Corp. System into the CalISO market. Our experiences over the last 15 years in these areas inform my remarks today.

We believe the issues and questions raised in the second installment serve to accentuate the growing complexity and uncertainty at the intersection of policy, planning and operations of the bulk electric system in the West. 15 years ago, the simple question was, is there adequate capacity in the bulk electric system to reliably serve expected future loads and if not, what generation or transmission investments need to be made to ensure reliable service? Of course these questions back then were premised on the assumption that all new loads would continue to be served by traditional central station generation resources. Fast forward to 2016. The questions are far more complicated and now we must decide not only how much new generation capacity is needed, but what type of generation should be developed, where it should be located and the ancillary investments that must be made, including transmission system upgrades and flexible generation capacity to ensure that the system remains reliable. We must make these decisions in an environment in which disparate state energy and regulatory policies are often in conflict and occasionally overlap and conflict with Federal energy policies. This uncertainty is only heightened by Federal Regulations related to greenhouse gas reductions, criteria pollutants and ash disposal and clean water standards and so on. In the current highly uncertain operational policy environment, the OCA believes that it

would be all but impossible to rationally plan, build and operate a no regrets bulk electric system in the West. The best that can be achieved at this point at least until the broader policy issues are addressed, is an honest evaluation of alternative futures based on how broader policies might affect those futures under differing assumptions. A stochastic analysis of various plausible futures, although not planning in definitive sense, at least gives us the ability to identify common elements and themes across all plausible futures. WECC has undertaken much such analysis over the last five years or so beginning with a grant that was awarded under the American Recovery and Reinvestment Act. But there is much left to do. Particularly as it relates to our ability to assess the short and long term reliability implications of the various futures. OCA would strongly urge DOE and sister agencies at the at the Federal level through grants and in kind contributions, to continue to support WECC's ability to fully analyzed various futures as energy and regulatory policies evolve at the state and Federal level.

The highest priority for the Wyoming OCA is to ensure that Wyoming customers continue to receive safe, adequate and reliable and affordable utility services. We believe that the only way to do that is to build the capacity of Western stakeholders to develop robust and analytical tools and datasets that will inform policymakers regarding the economic and reliability implications of the various policy choices. This will require time, effort and adequate funding, all of which seem to be in short supply. However, we are concerned that without a concerted and sustained effort over an adequate period of time, access to affordable and reliable electric service for Wyoming citizens will be in jeopardy.

CHRIS KELLEY: Thank you. So with that, I'm going to turn to questions, but I realize I'm at a bit of a disadvantage because I'm not facing you. So let me see if I can move around here and at least look you in the face when I ask my questions. So, my first question is really around transmission planning. So, I heard from you that it is increasingly challenging because more of this distributed generation and renewable utility scale generation is coming online. At the same time, citing permitting process could be lengthy and challenging. So do you agree? First do you agree with that thought there is a conflict there? And then maybe can you expand a bit on that particular challenge? Anyone care to take that one?

DOUG HUNTER: I think I have a different approach. I understand what you're saying, but I think we may be making a mistake by looking at expanding the bulk transmission system into -- a lot of green field sites, that already have transmission into them and already have water resources and labor resources, they have waste resources, if you will, to deal with generation of all types. And then if we focus around utilizing these retired coal plants gas plants, and some of the nuclear sites in the Midwest, that we can cut down on. I'm not again transmission, I want a robust system, but I'm afraid we are going to invent a new one and invest too much in increased investment on the backs of the consumer again.

JULIA SOUDER PROCHNIK: I take a different perspective on that. I understand where Doug is coming from, but one thing to look at is that you have existing tools out there. You have the state IRPs and you have FERC order 890 and others, to try give those stepping stones to how to you take state plans and how do you take regional aspects and how do you bring it all together? That is starting to happen. And with FERC order 1000, all these players are coming together with these different components. We are not trying to say build a brand new grid, we are trying to say, how to make the best of what we have? Look at what STP just did when they voted to decrease their planning reserve from 13.6 to 12%? That saved them 900 megawatts. That's huge. If we start doing that more in the West, you would have a lot more capacity in the system to better use and manage. It's taking perspective of how better can we do this and use a lot of tools we already have.

CHRIS KELLEY: Thank you.

JIM ROBB: I don't think it's possible to underestimate the complexity of designing, citing and getting approval of a large transmission line and that is going to be particularly true in the West because of the distances and the nature of the terrain that such a line would have to cross multiple constituencies and multiple governance structures and the like. I think the one thing that is important to keep in mind is that we are seeing a very radical shift starting to take place in how the resource base is going to need to be developed over time. We are also seeing lots of changes in the characteristics of loads with a lot of behind the meter resources, demand side management programs, expanding, potential deployment of large amounts of storage at the distributed level, all change the nature of the beast here. I think one of the things that concerns

us as we look at planning the grid for the next 50 years, because that it's how we have to think transmission. It's not a 10-year investment. These are very, very long term, long-life assets. To have a clear view of where we think the loads and resources should be or could be but then be very humble to acknowledge the fact that we are going to be wrong because there will be so many changes between now the next 20-30 years, that we need to create an infrastructure to serve a wide variety of futures with a lot of optionality and the further ahead we can look, the better off we are going to be. And like I said, I don't think you can underestimate the complexity because of the size of the system and the scale of the system and the number of very fundamental changes going on that planning will continue to be very, very complex.

CHRIS KELLEY: Thanks, Jim. Bryce?

BRYCE FREEMAN: Thank you. I would just add that as a consumer advocate, I'm always in favor of limiting investment in utility infrastructure to that which is actually needed and used and useful for serving customers. Certainly customers don't want to pay for things that aren't actually required to serve them. So, if there is latent capacity in the transmission system that we can make better use of, we ought to do that. The problem as I see it, we don't know actually know what we need at this point. Planning in the current environment is a little a little bit like planning in a blender. There is so many things coming at us that it is hard to plan in the classic sense, about what transmission you need because you don't know what the loads are going to be. One of the things that always fascinates me is we have a discussion about the electrification of the transportation system. Is that going to be in five years? 20 years? Is that never? It would add a tremendous amount of load all over the system, so how do you plan for that? I think we need to be careful that we aim before we fire here and the way we do that is to gather more data and take more time and make sure we understand what the consequences are, not only economically but in the sense of keeping the lights on from a reliability perspective before we embark on some of these things and in my mind, some of the larger policy issues are just going to have to get worked out before we go too far down this road. Otherwise, we are prone to make mistakes.

CHRIS KELLEY: Thank you. Ron did you have a comment?

RON DARNELL: I wanted to say first, I hope Doug is right. There is a lot of existing capacity in the system. You know, for states like New Mexico that do have a strong IRP process, you can't over estimate this notion that if the system itself is being planned to serve the New Mexico load, not to build out for the region. And cost allocation and I agree with Julia, WestConnect has made some phenomenal steps forward, but until those costs actually confront a decision-maker when the rubber meets the road, that is when we'll see how effective we are in changing this grid. And I guess we may have to wait until a line is built pursuant FERC order 1000 to work this out. But I can't over emphasize from an investor and utility perspective, how important it is to de-risk the capital process.

CHRIS KELLEY: Julia did you have another comment?

JULIA SOUDER PROCHNIK: While we are waiting for that line you built and hopefully in the right place and right time, there are so many other tools at our fingertips with the energy efficiency demands, all these other things. Again that encompassing perspective of using all these different tools we have that we can move forward with.

CHRIS KELLEY: Thank you. So my next question is around generation. You touched on this a little bit already, but I want to expand on it some. With respect to reliability and availability of electricity, I heard about and many of you commented on increasing investment and the variety and forms of generation. So whether that is solar, wind, small modular reactors. So do you expect these generation types together with maybe even fossil generation to remain a part of ensuring adequacy and reliability in the future? And is this feasible by given the nature of renewables for instance? Anyone care to take that on? Bryce?

BRYCE FREEMAN: I for one certainly expect that either we are going to have to continue to have large rotating mass on the system that is powered by coal to some extent or something that looks like it. I don't know how many of you have been on a turbine deck at a coal-fired power plant and seen what those machines look like. They are fantastically complex. They weigh 200 tons. They are 30 feet in length and 10 feet in diameter. You can set one in motion with your hand they are so finely balanced. They turn at 60 times per second. 60 Hertz. Something that big running that fast. And you don't move them around very much. You can set them in motion with one hand, but you can’t stop them. They have to spin down by

themselves. That is what creates inertia on the system. That's what provides the services that we rely on to keep the grid running. That provides frequency response, voltage support, reactive power, all of those things that we relied on for the last 125 years, are provided by large, rotating machines. They will have to be there or something that looks a lot like them.

CHRIS KELLEY: Julia –

RON DARNELL: I tend to agree with Bryce. I said it in my prepared remarks. It is getting harder and harder to justify coal economically. What matters to customers is reliability, keeping the beer cold, watching the Super Bowl, and for us it looks like combined cycle gas at this point because it has to keep the lights on.

JULIA SOUDER PROCHNIK: As an environmental advocate, I wouldn't be doing my job if I wouldn't be able to debate a little bit. I think that there are a lot of examples of wind and solar promoting the fact that they keep the lights on, its variable generation and not intermittent. So many times wind saved the day. The fact that I brought up earlier about having the wind and solar, having the interconnected grid where you can pull resources different times of day to flatten that California duct that everyone is freaking about. That duck curve. These huge dips. With adding renewable energy, it compresses. You have a flat reliable line. You have that aspect where you have new technologies that bring in the reactive power. All these pieces are coming together. There are tools that are out there that work today. Renewable energy is cheap, reliable and it is green and doesn't - as it's producing energy it doesn't put plumes of black smoke into the air that are pollutants. The last thing I want to point out too, is that the energy balance market that the West is working on, this is an opportunity to make sure that the renewable energy integration does provides those reliable sources we need. This is another tool at our fingertips to push forward so we have the green grid of the future.

CHRIS KELLEY: Thank you.

DOUG HUNTER: I think one of the points we tend to miss all the time is all these kilowatt hours are equal. And they just do different components. And what we want to do is have an integrated diversified system that allows all of this to work and I think we spend too much time in the utility business and I think the environmental community spends too much time

apologizing for this intermittency or whatever you want to call it on renewable. They produce kilowatt hours. So we need to get used to the fact we need to integrate this and inertia and mass allows this to happen. So we need to shift over from carbon-based fuels to provide that inertia, that constant battery if you will, that virtual battery out there, to something like reactors that can provide all of that and it's not polluting and the amount of waste coming out is very small and manageable and we can continue the lifestyle that we all have become accustomed to. So, I really think we need to just recognize the fact and one of the keys I think we are missing a pointed on, is that we are not treating renewables like a real generation source. I think the utilities and we are doing it from our group here, we want to know where all the solar panels are. We want to know what size they are. We are putting meters on their production. So we can deal with that. We want to know the demands and response is at. It's useless if it's a battery in a Tesla in somebody's garage that I don't know that I can pull on. I need to be able to know all of this stuff and it speaks to what Julia said about planning and doing that. It's going to take more money. Germany has already done this. Germany has got model down in spades. Now I don't agree with their subsidies if that is different thing, but the technology is there. I have been in their control rooms. I have watched how they deal with the so called duck curve. Their integration is seamless. It is beautiful to watch. They have gotten so used to it. They can move their machines back and forth around on a daily basis based on weather patterns they are going to see in the North Sea or sun shining in Bavaria. If Germany were in North America, it would be in Canada. I think there is a lot of ways we can deal with this and integrate all of these.

CHRIS KELLEY: Jim.

JIM ROBB: So I'm required to be officially in different to resource choices, so I don't have to weigh into that debate. One thing I'd like to point out though and I think this is reflected in the flower diagram we saw earlier. The energy industry is always going to be balancing conflicting priorities and the issue is always about where do you strike that balance? And it is very easy to move to one of the polls, but that never serves us well. I think the value of resource diversity is very, very important and very, very important we keep that in mind as we go forward. I have always believed with enough time, money and insight that a team of good engineers can solve any problem that we throw at them and one of the things that I want to be a really strong advocate for is the that we have our eyes open to the nature of the system that we are

designing, because I do know that a reliable stream of power is absolutely the lifeblood of the economy. And dealing with even momentarily outages is no longer acceptable from an economic perspective. So, I think it is important that we maintain balance in our perspective, I think we should have balance across various resources, maybe different kinds of resources that we can barely imagine right now. And if we do all this with the notion of trying to keep the lights on, the Internet working, and all those things in which our life depends on at this point in time. So planning, insight and foresight is very, very important to build the grid that is going to accommodate all the kinds of resources, particularly those kinds of resources that the public will right now want to see more of, renewable and low carbon emission resources.

CHRIS KELLEY: Thank you. Any other comments? Okay. So let me turn now to the concept of data and tools. So I heard a few of you, I think Julia you mentioned some tools that need to be developed or potentially are developed now. So, concepts like robust analytical tools that are needed for planning, integration of new generation operations, and support of cost recovery. So this sounds like a lot of stuff to accomplish in everything but the kitchen sink. Where do you see the biggest need if we were to pare it down to the types of tools and analysis that are needed? Where would you see the biggest need being?

JIM ROBB: I'll start. I see two main areas of opportunity. The first is around modeling the flexibility of the system to accommodate all these variable energy resources that we are putting on it. We did a study this past year with DOE support, we worked with NREL on it as well as a consultant out of San Francisco. It took us 9-12 months to model this system, to really answer the question, is there enough flexibility in the system to accommodate 10, 20, 30% renewable across the interconnection. Happily, the insights to that I think were very powerful but the amount of time it took to build and run models to do that was limiting. And I think as we kind of move towards more and more deployment of those kinds of resources, being able to analyze that quickly and turn scenarios around quickly is very, very valuable. The second one and I'm a big believer in this; I mentioned the data and so forth that we have right now. Being able to turn all of that information or data into information and insights to create a predictive analytics around where we are likely to see equipment failure, or other sorts of issues that would create a disruption to the bulk power system. The more we can get ahead of the curve on that, it is sure a lot easier to do source control than to do remedial damage control afterwards and that's an

area of great opportunity. Again, as I said, it is terabytes and terabytes of data. The amount of computing power that you need to analyze that and to be able to analyze that in the time efficient manner I think is a real challenge and something that we could work on together.

CHRIS KELLEY: Julia.

JULIA SOUDER PROCHNIK: Just to build on that. It is so important to have good data for planning and many of the most recent meetings I have been seeing in the West, there are huge gaps in the data and it takes more time and money to fill in the gaps. Being as blunt as I am, the utilities will not give the data that they need until the regulatory agencies ask for it. So the states and the Feds need to work together and ask the utilities for making sure they get the data they need. The utilities will do it. They need to be told. It's that regulatory certainty that investors need; utilities need it too. So I think if that was given to them and push them a little bit more to give that data that didn't have gaps in it to the planners and groups that need it, it would help change and you could have a better picture of what is going on.

CHRIS KELLEY: Bryce.

BRYCE FREEMAN: I guess I'll just have a little commercial here for WECC, Jim and the staff. As I mentioned in my remarks, I have been involved in the stakeholder process at WECC for a number of years. And what they have done in my mind, is nothing short of miraculous as far as creating data sets and data tools and bringing some sense of comprehension to what is otherwise very confusing issues in the West. Now having said that, I think there is a limit to the talent and the time and resources that WECC has and I think there is still a lot of work to be done to look at things on a truly West-wide basis, in the West. So, I would encourage that we continue to work on that. A lot of those initiatives are underway. We are looking at a common dataset that will facilitate not only production costs modeling but power flow modeling, so we can look at both based on the same dataset. That is pretty important. I think there is just a lot of things that we need to integrate in the West to provide modeling results that are truly robust that account not only for power flow and reliability, but the economic implications of policy decisions in the West and not just the production costs, but the capital costs of the various policy choices that we are looking at in the West. We haven't really gotten to the point where those are too well integrated, so we need to keep working on that. But we'll need time and

money to do that and DOE has been very helpful. Larry and a lot of other people at DOE are very interested in what goes on in the West and so I would hope that DOE can continue to support us and help us while we try to figure out what happens if we push that red button.

CHRIS KELLEY: Thank you. Other comments on tools or data? No? So, I feel like I'm cheating you out a little bit of this last panel, so I want to give you a chance to maybe address the topic of the last panel as well which is, security, whether cyber or physical and the importance of that. And I recognize I can't ask you any specific questions about it, but I guess I'd like to know if you want to talk a little bit about how important you feel it is here in the West and specifically in generation and transmission, where you think it applies and maybe not talking about what is being done about it, but how important it is to you and your organization. Anyone care to take that on?

DOUG HUNTER: Obviously it's very serious problem after the Ukraine black energy situation. But I was very -- I use it as an example because there was a lot of public information was associated with that. I was very impressed the way the utilities came together. As a CEO, I was requested to be on a phone call in 30 minutes and that was utilities across the nation. I don't know how many thousands of people were on that phone call in 30 minutes. I was very impressed with that. Obviously we already have systems in place and they wanted to go through and we were working with the situation as we come back. A lot of being done. Obviously people are going to do things to the system, but if I could just harken back to my point, this is what I like about distributed resources and moving them down and spreading them around so we can have this type of local power system, if there is a grid-wide that says comes down, we have resiliencies in the communities to take care of themselves to some level like Main Street and hospitals and things of that nature to still operate. So it is very important we are spending a lot of money on it in the utility business and it is paramount to reliability. So I bring back to the American group and continue to -- as much as the regulation is burdensome and boring to all get-out to read. It seems very important.

JIM ROBB: I'm sure it’s designed that way, Doug. So I don't think it is impossible to underestimate the importance of security and I think it is particularly key here in the West because of the nature of the system again with some very large sub stations and very critical

transmission paths. We are in the process of implementing physical security standards as directed by FERC a year and a half ago and that becomes operable this summer. And it's focused on identifying really the key assets across the interconnection. Not everyone, because putting in the kinds of security features you need would be economically prohibitive across every asset, so it is really focused on the critical few and I expect in the West we probably have 20-30, not hundreds, that will be covered by that standard. On the cyber side, I think the cyber side is very, very hard. And it is proven to be very, very hard. I think it is a real challenge here in the West because of the large number of small, rural, entities that we have to deal with. Certainly a large utility like Southern California Edison or others will have great IT departments and great security folks. But you're not going to see that same ability to invest in that kind of capability across the smaller entities. You want somebody that gets access to the system -- they get access to the system. One of the other things that is really important in this whole security area, it was highlighted for me through the grid exercise that NERC conducts every two years where they simulate basically a series of simultaneous physical and cyber-attacks on the system. That was in the table top, executive table top last November, I guess. And one of the things that struck me is how many people in the world of security have a partial role but not a comprehensive role? And, it's very easy to see the system melting down with the attack on a few key areas. I think one of the things that I encourage DOE, NERC, FERC, the White House, National Security Agency, Home Land Security, et cetera, is to really take the report that NERC put out with the summary of findings and recommendations and really take to heart some of the recommendations around clarifying roles and responsibilities across all the many constituents in the area because in the event of a real meltdown, it would be a colossal mess. And nobody wants to have that moment. So I really suggest that some work on clarifying that role, responsibilities, both in Washington and then across the various regional entities that have reliability and security responsibilities. That that is clear and clarified well in advance and is taking place.

CHRIS KELLEY: Thank you. Bryce?

BRYCE FREEMAN: I guess I would just comment that of course customers want safe and secure service, but I'm not sure they want it at any cost and at the end of the day, I don't think I have to remind this group, it will be customers that will pay for any physical hardening of the

network and cybersecurity technologies that are in place to keep the bad people out. And I just wanted to comment on something that Doug said, I'm not sanguine about the ability of distributed generation to really be an asset with regard to security and reliability, because in order for me to make that leap in logic, you have to assume that everybody has some sort of self-generation capacity. In many cases, if there is a disturbance on the grid, distributed generation will separate. So you have your self-generation that you can use at your house or business, but it's not pulling on to the grid to help other customers in the event of a disturbance on the grid. So, I'm a little bit confused about how all that will work in the future.

CHRIS KELLEY: Thank you. Julia.

JULIA SOUDER PROCHNIK: Before I left DCI, I worked at NERC and got to be involved in debate this cybersecurity standard and it's still really engrained in me about how critical it is and how important that security is to the viability of the grid. At the same time, as I mentioned earlier, there is a fine line where we need to make sure that we protect the system, but we also need to make sure we share the data to make sure we are building the next best system. We need to really work with all the agencies about how do we define that data. We need to make sure we are giving access; we need to make sure that data is shared with the right people so that we can really build the grid of the future. So I would just add that caveat.

CHRIS KELLEY: Thank you. Other comments on security? No? I think we have time for maybe two more questions and then again, just referencing another panel here. So your focus has been on generation and transmission. The next panel coming up will be on distribution. I'm just curious to know, when I hear about all of these new points of generation being placed on the grid that presumably occurring at the distribution level. To what extent, and maybe this is more of a question for the operators and utilities here. What extent is that changing the way you have to do business from interconnecting the transmission operations with distribution out of operations? Is it a non-issue or there are a lot of changes that need to be made?

DOUG HUNTER: Well, if you take energy and balance as an example in the market here we are in the Pacific Corp footprint for the most part and it was a big change out in capital, to metering your back room and schedules and logs and your points. But, it is an evolving concept. This is the way the generation is coming about. I don't think we are going to stop it

and I don't think the California model is the proper model. Just to let it happen. It goes against what Julia is saying in terms of planning. Get all the generating sources out there because part of the concept here, to answer Bryce's point, is that it's a much more involved discussion but what we have to start to deal with here is in the distributed set is not at the house it's at the substation. That substation has to know all the generating sources out there. That could be thermal, that could be fuel cell, it could be Nano-based, it could be a wattly. It could be a solar PV and how does that integrate in? So you can disconnect from the system into a micro grid is the concept. And those micro grids can still have enough generation to keep themselves available. And you can see this in very secure areas. At the Idaho National Laboratories, one of the things we are looking at doing around our reactors up there is to provide what we call critical infrastructure security zone. So these reactors are so safe, we can bring in businesses right next door to it. We sit on 33 acres of land. We can have computer companies. We can have refineries. We can have all sorts of critical infrastructure right up against us so that when the grid goes down, to the bad people out there, we can stay as an island. You can see that going around. It's a changing market. It's a changing paradigm that we are seeing out there and I don't think we are being imaginative enough to take advantage of the technology that is on the table right now today that is not going to cost us a lot of money to reinvent and getting technologies aligned and I think we'll have a more reliable, safer and cost stabilized system.

CHRIS KELLEY: Jim?

JIM ROBB: So I'm going to curl Mike Florio's hair and any FERC Commissioners who happen to be listening. I think one of the one of the realities of the situation is that the role of transmission, O Power system and distribution and load management is blurry, and will continue to blur. That will bring a bunch of regulatory issues over who has jurisdiction over what, but I think from an operating perspective, we have to be jurisdictional blind and really kind of manage the physical system we have got and there is no question that we are going to see more and more resources being deployed behind the meter. Now we of think behind the meter resources not as a generating resource, but as a deduction from load. However, it is volatile, because the cloud eventually does come over L.A. and those panels all trip off. So it needs to be thought of in concert and I think we are learning. As I said, we have 12% of wind and solar in the Western Interconnection right now and that number may double over the

course of the next 10 or so years. So this is going to become more and more of an issue and we are probably at the epicenter of really trying to figure out how to make that work. One thing that is really important to think about, California has had a great track record in implementing solar and wind programs. Won't talk about the economics, but bringing those resources on. What they found is they can't manage them themselves. The way CalISO keeps the system in balance is that they have a concept now called over-generation and whoever heard of that before? But there are times in spring when loads are low, but the sun is shining. But they generate more power than they know what to do with. And that was the origin of the energy and balance market and it's the fact that California has straws into the rest of the interconnection that really enables them to work the way they have been able to work. The question that I chew on and that the planners here at WECC chew on, is what happens when the entire interconnection looks like California does now? Because we don't have straws any place else. We have to manage it all within an integrated system. It's not to say we shouldn't do it, it just means we need to be ahead of the curve and understand what other kinds of technologies and so forth do we need to have in place to deal with that. Like I said, it's the theme that I have been raising here. It is very, very different than what we managed in the past, not bad, but different. And we need to adapt to all of our tools to the new realities of the generation mix and the load mix we will be doing with.

CHRIS KELLEY: Thanks, Jim. Ron did you have any comments?

RON DARNELL: I'm not an engineer. I have to recover the costs that these guys pose on us. And I guess that is the one thing I would say is, I believe we have got phenomenal engineering capability in this country. The one thing that we need to do a really good job of and I think having public meetings like this is extremely helpful. This transformation is not going to be inexpensive. It's not necessarily going to result in a lower cost supply of electricity. And that is something that is not often talked about. That is my two cents. I tell you, New Mexico, as far as what we are doing, all of our utility scale - solar farms, are interconnected at distribution. At some point we will cease to have enough of those sites available.

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

BRYCE FREEMAN: I'll give a two-word answer: Rate design. That is really the area that is getting the most attention these days with regard to renewable integration, particularly solar integration, is how do you accommodate those folks that choose to have generation behind the meter and at the same time, not prevent but limit the extent you can, the cost imposed on customers who choose not to and everywhere I go, that really is the big elephant in the room with regard to that. Thank you.

CHRIS KELLEY: So I think we have time left for one final round of comments, so you have got the QER task force here in front of you. We talked a lot about a lot of different things relative to generation and transmission. Why don't we say a couple of minutes a piece? Just a final closing comment from everybody. We'll start here at the end with Jim.

JIM ROBB: Thanks very much and I really appreciate the opportunity to share some views here. I think there are some very common themes across the various panelists. The one thing I would say we didn't talk as much on as I really wish we had, that I want to keep very focused on your agenda as you think about fuel choices going forward, is the harmonization of natural gas policy with electric policy. You are all familiar with the Aliso Canyon situation, I have addressed it in some of my comments, but I think it is very easy to define the electric system, starting at the bar through the transmission wires to the customer and I really think we need to expand our thinking to include the fuel infrastructure behind that. Because both the shift to weather dependent fuels, whether it's wind and solar. We have a large component of hydro here in the West. And then natural gas also has weather issues associated with it. So, the weather dependency of the fuel mix and infrastructure underlying the natural gas system are the two areas we didn't spend as much time on here relative to what I see is the importance of being going forward over the next 10-20 years. That would be my charge to the Task Force.

CHRIS KELLEY: Thank you. Ron?

RON DARNELL: Continue on my cost bandwagon here. I would urge that there is a really close examination as to how to fairly allocate costs. States like New Mexico have a very small population relative to what the state is capable of producing but it is not going to be able to politically deal with increases for improvements that don't necessarily improve the lives of New Mexicans. And since Bryce brought it up, I'll throw in my two cents on rate design, which

I feel more comfortable talking about, but we have to get away from recovering fixed costs on a volumetric basis as well as subsidizing pricing schemes like net metering that are unsustainable and we need to elevate the conversation and have a real discussion about what is fair. And lastly, I'll say just a plug for energy efficiency, the cheapest, cleanest, kilowatt hour is not generated.

CHRIS KELLEY: Thank you. Doug.

DOUG HUNTER: I just think like to thank the DOE for what they are doing, and continue to do it. The Department of Energy under the Secretary Moniz has been extremely helpful in this period of time on a lot of forefronts. I deal with them across-the-board on a lot of different technologies and without The Department of Energy and even this data collection and all things we are talking about; we wouldn't have that. I would just give this comment. It's very hard for the common person to digest what is coming out. I mean, I'm a big follower of EIA. I get the notices constantly and they are huge and there is a lot of data and a lot of fun to get into and play on that thing. But I can tell that your kids in 12th grade don't care. We need to find a way of one more step out to get it done in the community and make it very digestible for all of our customers to see it.

CHRIS KELLEY: Julia.

JULIA SOUDER PROCHNIK: It's amazing, I was going to say something very similar to Doug. Our worlds can work together. I agree. I think DOE is doing a fantastic job with the QER in the inner agencies coordination. That is critical. I mean there is so much negative aspects going on and to see so much positive outcomes out of this and the coordination is important. I think the communication of getting this out to the audience and to the community is critical. Really sharing these recommendations to help educate the culture shift that is going on. And I just wanted to highlight a couple of things that DOE funding has been tremendous. And really helping push so many components of the West and the East with the data and with planning and with all of these reports with information. I think it would be great to continue to have that so you get all that diversity at the table. You get the stakeholder involvement and those innovative, creative ideas together. And also again just wanted to highlight that caveat I addressed earlier about making sure when you have the data it doesn't have the gaps that you

respect the security concerns, but at the same time make sure you're not building a steel wall around you so you can't really implement the things you want to promote. Thank you.

CHRIS KELLEY: Bryce, final comments?

BRYCE FREEMAN: Thank you. I guess I would just say that I have been around this Western Interconnection resource advocacy and planning process for a lot of years. We made a lot of strides. And frankly, I think heroically raised the profile of these issues in the last 15 years. But I don't know. It's all well and good to talk about the glittering generalities of how we want the system to look in the future and we want it to be cleaner, greener and more resilient. That all sounds well, but as I talked before about how I think the system operates anyway, the physics do matter. The physics on the system do matter. And at some point, you have to bring it down from the generalities of what you want the system to look like and we haven't agreed about that so far. So, we need to get some agreement among all of the different stakeholders about what we want the system to look like and then we need to design a system that is affordable for customers, that is reliable for customers, is resilient and secure and safe. And that is affordable. And in that system, you have to pay attention to the details. Part of the details are the physics. We are going to have a lot of challenges in the future if we do some of the things that are being talked about. We could have multiple intraday path low reversals in the West. We never had that before. It will be hard to plan for that unless we know exactly what we are doing. I would just, admonish that we take as much time as necessary, to make as much effort as we need to, to get the answers we need before we shoot. We need to aim first.

CHRIS KELLEY: Thank you. With that, I think your duties are complete. Please join me in thanking our distinguished guests.

[Applause]

Panel 2

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

CHRIS KELLEY: At this point, we are going to turn to our next panel for the day, which is a focus on distribution as I said, and end use. As we transition, I just want to remind folks if you haven't had a chance to sign up, if you want to provide public comments at the end, please do so at the entrance and if you wish to do that online, provide your comments at www.energy.gov/QER. We'll break for one minute as we transition then get started.

CHRIS KELLEY: So we are just missing a couple of panelists. We know one will be showing up a bit late. But if you are on this panel and you are in the room, please join us up front.

CHRIS KELLEY: I think just to keep things moving, we'll go ahead and reconvene. We'll so that in a minute if folks want to take their seats, we'll go ahead and get started.

CHRIS KELLEY: We'll get started now. And make best use of our time. Our second panel here for today, is focused on electricity distribution and end use. How do we manage challenges and opportunities? So I'm joined up here by Paul Radakovich, Vice President Transmission Distribution Operations for Rocky Mountain Power. Leonard Gold, the General Manager for Gila River, Community Utility Authority. Colin Jack, Chief Operating Officer and Engineering Manager for Dixie Power. Roger Woodworth, the Vice President of Avista Corporation and President of Avista Development. Mark Case, principal and President for ETC Group and hopefully joining us a bit later, will be Laura Nelson, Director for the Utah Office of Energy Development.

So folks if you were here for the last panel you know the routine. I will run through it really quick. We are going to have everyone present, you have 5-7 minutes. You do have these colored lights up front. When the red one turns on, it means five minutes is up, you still have another couple of minutes if you want to use it. Do we have anybody with slides that is presenting here today? So we should be able to get this loaded as soon as you get started. We'll

run through all the presentations and then come back to me for a few questions. Sound good? Start us off, Paul.

PAUL RADAKOVICH: Good morning. I'm Paul Radakovich, Vice President and Transmission Distribution Operations for Rocky Mountain Power. I'd like to thank everyone involved for the opportunity to be here today. Rocky Mountain Power is a division of Pacific Corp. provides safe, reliable and affordable electric service to approximately 1.1 million customers in Utah, Wyoming and Southeast Idaho. Our industry and the services we provide our customers are changing rapidly to keep pace with the transition to cleaner sources of energy and with many customers, desiring greater choice, flexibility and control of their electric usage and for some, their generation. For the past century or more, the power grid has served society well by providing safe, reliable and affordable energy that improves our quality and life and serves as an engine for economic prosperity. Energy companies like Rocky Mountain Power are fully engaged and ready to work with all stakeholders to ensure the grid continues to provide this essential service to our customers and communities.

First I want to comment on some of the good work that is underway to make the power grid smarter while remaining, safe and reliable and affordable for all customers. We are currently revamping our planning tools and processes to accurately model load, energy efficiency, distributed generation, demand control and response characteristics. The power grid is rapidly becoming more digital, enabling ever more data to be utilized to study and predict conditions that allow the optimal configuration and operation of the physical assets. We are investing in proven technologies including smart meters, communications enabled devices, distribution automation, and protection and control equipment to handle two-way power flow. We now evaluate distributed energy resources, typically solar, storage batteries or a combination of the two, along with traditional asset and upgrades like larger transformers or conductors to find the least cost adequate solution to serve our growing and changing customer requirements.

Our planning engineers are also performing proactive studies to understand the distribution grids hosting capacity for distributed energy resources. This entails modeling increasing levels of DER, typically local generation, to find the locational breaking points in terms of steady state voltage or voltage fluctuation and grid protection. Best practice solutions are then applied

to understand the Smart Grid investments that will be required as additional distributed energy resources are integrated on to the network. Our work to date is informed in investment decisions and no regret proven technologies and shows there is time for thorough analysis and planning for future deployment of increasing levels of DER. Talk about the data aspects of this and really the information technology requirements for evolution to a smarter power grid could be the most important change component to be considered. This has the potential to be the largest information technology project ever undertaken with tremendous qualities of data that must be transmitted, analyzed and stored. Integrating new and existing information technology systems will be critical to realize the full value of investments for our customers. Important decisions regarding what is possible and what is affordable and prudent, requires careful analysis in light of rapidly changing technologies. This is an area where policy makers can play an important role by providing open architecture standards for grid and grid edge information technologies. Just a quick breakdown of the high level opportunities and challenges in this area and foresee opportunities. Certainly this provides customers with that additional flexibility and control of their electrical uses and generation. There are operating efficiencies to be had with automated meter reading, remote meter connects and disconnects, power grid optimization using real time data and improved outage response and prioritization of grid upgrades.

On the challenge side, we talked about data management. What to store and how long to store it. Integration with legacy information technology systems. Open architecture versus proprietary systems. Vendor compatibility and longevity. And cybersecurity in terms of end use is really about protecting customer data.

I'll just conclude to say the evolution of a smarter power grid is well underway. The speed with which this evolution will occur, will largely depends on the evolution of energy companies state regulation, important fact-based discussions and analysis to required determine the value of grid technologies. For instance, local net meter generation versus local generation with data visible to the grid operator, versus local generation coupled with energy storage that is controllable by the grid operator, will have dramatically different value propositions. Appropriate pricing must be established absent speculative externalities to recoup the energy company’s fixed costs and to credit customers, local generation production at wholesale rates.

Proper pricing will incentivize new renewable energy construction without imposing inappropriate subsidization thereby providing fair prices for all customers. Thank you.

CHRIS KELLEY: Thank you. Leonard?

LEONARD GOLD: Thank you. And on behalf of the Gila River Indian Utility Community, we want to thank you for inviting us to participate in this session. So, just to give a perspective, GRICUA is located within the Gila River Indian community, which is approximately 372,000 acres. There are four utilities located within the community. GRICUA is in this diagram here. The blue, yellow and red area is where GRICUA cover and overlaps another utility as well. So we utilize the infrastructure of another utility as well as our own to serve our customers and we have 2700 customers. So we are on the other end of the spectrum from a million down to 27. But we have the same obligations and responsibilities to provide safe, reliable and cost effective power for our community members.

So, the perspective that I bring to you today is we are a tribal utility. We serve only within the community. We are also part of the sovereign nation, so that changes or effects the regulation jurisdictional aspects. We are not regulated by the state. We do have FERC oversight. We have limited or restricted customer base and we have limited or negligible influence in the transmission and power markets. What we need to do is certainly while large utilities get the attention when it comes to policy, we can't underestimate the needs of the smaller utilities and the rural utilities, which is the kind of utility that we are. I put together a slide which covers our thoughts on issues, challenges and opportunities. Being a rural service area, the challenges for us are we have long radial circuits, we have lower customer density. We have about seven customers per mile. And the ability for circuit fuel ties, if you will, to enhance and promote Smart Grid activities, is a real challenge because of the cost of having those long radial lines. So the opportunities are the technology. Like everyone said, you heard from other panelists talking about costs. We have the same thing. We have to keep our rates low and stable and it's hard to do when you have a limited customer base. We look at purchase power representing 60-70% of our budget, so we have to be out in the market looking at choices and we have to look at the investment in technology and what we can do for that. So the opportunities for us are use of staffing and technology and the resource management and resource purchases. On

the technology side, smart meters are certainly a challenge and the web and wireless access and applications for customers.

The mix of our customers is both traditional Native-American as well as the younger people who embrace technology and we did a customer survey several years ago and the use of the Internet was less than 50% and predominantly because the demographics, the people that were answering the survey, were the older generational people who don't necessarily embrace that. But we have, as a utility, we have been using cellular metering to do remote connect and disconnect and capture interval data on a 24-hour basis since 2006. So the challenge to us is certainly to be able to maintain that and to expand that. The cost of changes in technology is significant for us. The technology we are using our cellular meters was 2G. That is sun-setting in December of this year, which means we have to go through a whole new cellular type system and the cost of those meters is going to be close to a million dollars. But the opportunities are for us to provide better service to our customer, provide customer portals where they can get more real time information, more data, to open up and explore prepayment with them, which will allow them to better manage their utility bills and their consumption. On reliability, we have to do the same thing as any other utility. We look at outage analysis and preventive maintenance and do all those services, infrared testing and we go out and develop a mapping system that allows us to show where outages are and utilize and integrating our cellular real time meters to try and even be more effective and pinpointing where outages are and what it takes to restore those outages.

On the renewable side, we integrate energy storage. We don't have that many renewable energy projects right now. The biggest thing is we can't afford and do not offer customers subsidization of renewables. We also do not do net metering. We do revised sell on the projects we have, which is three, and actually Utility Authority was the first renewable project. We built a new building and we had to develop an interconnection policy and that's where the board went with the buy/sell which as you have heard from other people, effects the cost. On the power side, real time, low following scheduling is not something we can accomplish, so we have to use third parties and we just participate with other utilities in that services. And the

same thing with transmission, we're transmission dependent and therefore we have to participate and rely on others for those services.

And with that, I will conclude and just say I want to thank everyone again for allowing us to participate in this.

CHRIS KELLEY: Thank you. Colin.

COLIN JACK: Can I borrow the remote? Thank you. Good morning, my name is Colin Jack, I'm a licensed professional Electrical Engineer. I'm the Chief Operating Officer of Dixie Power in St. George, Utah so I put up a map of our service territory. We are a non-profit electric co-op that serves 18,000 members scattered across 2000 square miles in Southwest Utah and Northwest Arizona. There are several rural electric cooperatives in the state of Utah, including our neighbor to the east which serves an area of 16,000 square miles. So, compared to large cities like Salt Lake and Provo, we have relatively long lines and low consumer density. Therefore, a higher cost and lower revenue per customer. Even so, I'll compare our power system performance against any other system in the world. We enjoy some of the lowest retail rates in the country, have an outstanding safety record with EMOD of 0.68 and enjoy 99.99% reliability year-over-year. And having worked 10 of my 30 years overseas, I can make my comparisons worldwide with confidence. I have worked in 26 different countries and have touristed in another 26. So I looked at power lines in 52 different countries around the world. In my 30-year career as a power engineer, I have seen and deployed a lot of technological innovations and I have been directly involved as we migrated from electromechanical devices to solid state digital and then microprocessor control. I have seen materials evolve from wood to steel and to composite fiber resin and from porcelain to polymer. Currently we have meters that read themselves and send the reading back over the power lines to the office and we have the capability to remotely disconnect and reconnect. We supervise and operate our power stations from the office over fiber optic lines that we run with our transmission lines. We do our engineering on computers now instead of on the drafting table and with a hand calculator like we did back when I started.

All of these innovations and our power industry, contribute to Dixie's success and providing low cost but reliable service to our members, many of whom, because we live in the Sun Belt,

are retirees who live on fixed incomes. Rural cooperatives serve economically sensitive communities and rural households spend a greater percentage of their household income on utilities than do their urban counterparts. Even so, even small rate increases have a greater economic toll on rural communities. The power delivery industry in which I operate, sees its fair share of challenges. When I first started in this industry, our greatest opponent was Mother Nature, who was very adept at turning off the lights with lightning and with wind, but now 30 years later, Mother Nature still plays a major role, but often takes a backseat to misguided governmental policies that can have the same result. We deal with Federal Land Management procedures that effectively block all new power lines and even upgrades and maintenance that are required to keep up with our growing population and aging facilities and are almost impossible to accomplish and certainly impossible to complete in a timely and cost effective manner.

I showed you here our map of our area. Here is a quick map of the whole state with the six co-ops outlined in stripes. You can see some of the tribal areas that we work around. Here are some of the Forest Service that overlaps our area and here is the Bureau of Land Management area that we have to work across. If you add all that up, you see that we live on little tiny islands of private land in a huge sea of public property. So, in this area, the Federal agencies designate large areas as road less and therefore impassable, even though there have been roads in those areas for hundreds of years. They designate endangered species making whole areas off limits to power lines, even though our activities that we need to do to maintain ourselves system don't in any way threaten those species habitats. The Federal Government also taken clean affordable coal fired power off the menu, even though there is no presently available viable alternative to provide plentiful, reliable power. Our previous panel addressed that to some degree.

State governments are not a lot more helpful to us providing reliable and affordable energy to our members. Net metering requirements mean that co-op must take energy from solar home system owners that is generated off peak and give it back to them on peak as if those two things were of equal value. And also since the majority of the utilities fixed cost are blended into the energy rates, as members with solar systems purchased less energy, the fixed cost gets shifted to their neighbors, who can't afford expensive solar panels. And even though I have

been warned not to talk about solar power, I have been told it would be like standing in front of a runaway train. We do it anyway. And I know something about it because at Dixie Power we have a couple of solar plants ourselves and I have done thousands of them with grass huts all over the world. So there are three reasons co-op members get interested in solar power. One is to save money and they don't. And two is to reduce CO2 emissions and they don't. And three, to be prepared for power outage, and they don't even do that. So I would be happy to expound on any of these points in the question-and-answer session. Thank you.

CHRIS KELLEY: Thank you. I can almost guarantee there will be questions. Roger.

ROGER WOODWORTH: I wanted to hear him keep going. It's great to be here. It's great to be here, I appreciate the invitation. If you like to learn more about Avista Corp., I encourage you to go to AvistaCorp.com and you can learn all kinds of things about our company.

A quick few highlights; we operate in five states and serve customers in four of those states. Hydro facilities in the fifth one. Those states are Oregon, Idaho, Alaska -- I missed one. Washington. Where is Commissioner Jones and then Montana. So, a couple of other interesting facts about our company. We're the company that started Itron. So you might be familiar with that enterprise or another one you might have heard of is Ecova, which specializes in build management information systems and currently under the ownership of NG, we sold that a couple years ago. It should give you a hint of the kind of company we are. We tend to be more innovative across a field of things and those two companies illustrates an important transition that you heard about a bit from Paul as well as from Colin already, that innovation in our industry is not stagnant. Is it doesn't stand still. It is on the move all the time. And even though we think of utilities as being very stayed, the fact is we are not. And the idea that somehow the utilities are apart from a system as opposed to a part of the system, where the new technology is coming is a misplaced notion.

For those reasons, I wanted to not talk as much about the specific policy challenges or technology challenges, which are also opening all kinds of opportunities. Instead I'd like to encourage the solution as DOE works on this quadrennial review to look more to design principles to help bridge the challenges and the opportunities that we face given the new technologies and given some of the conflicting policies we currently have. And I'll offer three

design principles that I think can be useful in this regard. The first is the importance of setting context, the second will be the importance of aligning efforts particularly around policies and resources allocations and then finally leverage and integration of our assets.

The first on context. As I'm sure you have been hearing in this conference will for the next couple of days, there is a ton of focus around the things and components that make our systems work. And for the delivery of energy. This is all important but I promise you that most people don't think of those things in those components. They think of the hot in the shower and cold in the beer and light at a flip of a switch. That's true whether your house is small or you live in the White House. If you think about energy and electricity specifically in context, going back 100 plus years, electricity and I think Paul mentioned this, we are a part of the fabric of the economy of this nation. We must not lose sight of that fact. It began with the relieving the burdens of work. Powered productivity and then beyond that, where do we go next? It enables entertainment and starting with radio and these days where you can get anything on something as small as this. And it also enables or connects consumers in ways we never previously conceived. This idea of electricity being the most empowering invention of all-time, no it's not the Internet. Because without power you can't have the Internet. It's the most powerful of all-time. So how do we hold on to that aspirational view of what is that this system, what electricity does he for us? That is design principle number one. Let's hold on to that, let’s imagine at the very beginning not about the things we are going to do, but why we do them. Imagine what, if we said is a design principle, I will suggest these as starting points. Whatever we do, let's preserve a reliable, safe and affordable system. Whatever we do, let's diversify to improve options on our system for its resilience and whatever we do, let's make sure that we are good stewards of the resources that we deploy. And finally whatever we do, let's make sure we empower people to achieve great things.

Those kinds of things change our sense of what it is we are trying to accomplish and help inform the kinds of choices we should make. Second, alignment. Alignment around the efforts we put in. As you can imagine, electricity was once a novelty both to the market as well as to consumers, as well as to technology. And utilities were the entrepreneurs driving it. I just got off a plane and I'm still a little dry from that. A magical thing happened when as a nation, we -- and this doesn't happen overnight. But as a nation, we align policies that enable the expansion

of this electricity delivery system to serve people everywhere in our country. It's a ubiquitous system. It's amazing of what it can deliver. When you think about this, as Paul mentioned before, this idea that fabric of the economy, we were at the root – electricity is at the root of powering the most productive economy on earth. But we could lose that if we are not careful. So let's be careful and let's make sure that we are aligning resources as best we can and for this I want to share a quick metaphor about tug-of-war. You see kids play it and one kid is hanging on the rope pulling down and another grabbed on both hands and pulling all their might and some other kids has their hand on it standing on the sideline because he can't figure out how to fit in? That's a snapshot of misalignment. That is a snapshot of how our industry and all the people that have a stake in it behave today. My hope for this process is that we can strike a different kind of balance and a different kind of alignment that puts us all on the same rope, pulling in the same direction at the same time. That is powerful alignment and will help our country achieve something that otherwise won't be achievable as quickly as easily as cheaply than if we worked together towards common purpose.

The last item I'd like to share is this notion of leverage. It’s the idea of seeing utilities as allies, not as something to be held a part in a role. As I mention ubiquitous infrastructure is a huge leg up on anything this nation chooses to do in terms of leveraging the digitalization, the new technologies and options they create. Yes, safe, reliable and affordable but as an industry, we are about to invest over the next decade plus or so about a trillion dollars, to do what? To keep it safe, affordable and reliable? Or is there something more we could do if we were mindful about the possibilities of what technology enables and we were mindful about the current mismatch we have in policies that create friction and limit our ability to make things happen. Our capacity to leverage these assets by thinking of the new technologies as a part of, not as a part from the system, is very, very potent tool at our disposal. But only if we choose to exercise it as a people. I think this process and I hope for it is that this process will lead to grander thinking not just about the things and the components, which are really important. We have to debate through those and get to them. But let's start with a higher order of purpose that sets the framework, that improves the context with which we make our decisions, that helps everybody get on the same rope in a way that is potent and more self-fulfilling to their own interest but also for the greater good. If we don't do that as a people, we are relegating ourselves to greater

friction, wasted resources, a legacy that is not as great as what our forefathers brought to us. I think that is our obligation and I hope this process will lead us there.

CHRIS KELLEY: Thank you. Mark?

MARK CASE: Thank you and I'm a little nervous to be here. It's interesting, I was a last minute addition to this panel and even though I am not as prepared as I should be, but that's okay, it never stopped me from talking in the past. It's interesting, we've heard about the duck curve, everybody knows what the duck curve is and this is humorous because I'm often an odd duck in gatherings like this. I'm not part of the grid. I'm not part of the utility. I'm not part of the utility system. I'm not a regulator. I'm an engineer. I have an engineering business and we deliver energy efficiency to our customers. I work with our customers. I work with medical manufacturing facilities, hospitals, I work with schools, universities, states, government facilities. I'm always working on the customer side of the meter. And yet I love participating in these things because I know that what happens on that other side of the meter, that supply side of the meter, has a big impact on my customers. It has a big impact on my business. And it's interesting because we are in a new era now where the reverse is also true. What happens on the customer side of the meter is having a larger and larger impact on the other side. We'll talk more about this in a minute but, that's who I am. I come at this from a very different perspective. But I also think it is important to put my heart on my sleeve when I have discussions like this about what my motivations are. I started in energy efficiency more than 35 years ago. I came of age during the original oil crisis. My father, a mechanical engineer, we talked about efficiency at the dinner table. About getting more out with less. And it's shaped who I am. That's a piece of it. The other piece of it is I'm an avid outdoorsman and avid recreationalist and I love the outdoors and grew up in Utah, I love Utah. And I am really worried about what we as a human species are doing to that environment. I think we really are threatening future generations with the way we are acting now. I want to do something to change that. I want to be very upfront and let people understand that that is where I'm coming from. I'm a businessman. I'm a capitalist and I make money at this, but you know what? The things I do and the things we do impact my children and their children and I worry that they are not on the right path. We are not on a sustainable path. So that's where I come from. I want

to just get that out there. Part of that comes from being in a place where sometimes it's uncomfortable to say that kind of thing.

But, all that said, I'm an optimist. I have seen what happened over the last 30 years. I predict as well as anybody what is going to happen in the next 30 years. My prediction will be wrong, right? Everybody's is. But over the last 35 years, it's just continually blows me away at the untapped potential to reduce the amount of energy that we use. We talked about - a lot of people already talked about the cold beer, hot showers, I love that line. I take it to heart because my customers, they could care less about electricity. They don't want electricity. They don't want energy. Discussions like this about transmission and distribution and coal fired power plants and the whole bit goes over their head. They want cold beer. They want hot showers. They wanted the things that electricity enables. My experience has shown that we can deliver those things to them with significantly less energy than what they are currently using. I mean significantly. We are not talking two or three or 5% reductions. We are talking 20 and 30% reductions. If you go look at -- they do a survey of demand side management and resource potential studies across the country. There is some controversy about how rigorous and how good are they and how optimistic or pessimistic they may be. But there is a theme out there, and there is a tremendous amount of demand-side potential. Again, on the order of 30%, 40% in a lot of times. I have to confess to being frustrated when I see this. This has been my entire life. I keep expecting it to disappear. I keep expecting to work myself out of a job. It hasn't happened. I'm finally comfortable with the reality that it is not going to happen. I'm going to be in business, there will be customers out, there are going to be economically viable and efficiency opportunities for people out there forever probably. Technology just changes -- LED lights. Anyway. And I don't think that that potential is given the attention that it deserves. Discussions like this and venues like this. This is one of the reasons I put myself out there to be this kind of odd duck in groups like this is because I can go into 99 out of 100 buildings in the city right now and I can identify 10% energy reduction with the return internal rate of return of 20-40%. The same thing 30 years ago. It's still there. We haven't captured it. We have gone a long way. We have done amazing things. The energy efficiency industry, demand side management, tremendous growth. It's gone a long way from the time I cut my teeth. Anybody here remember the institutional conservation program? Those with gray hair in the room,

maybe someone remembers. One of the DOE's original programs to roll out energy efficiency to schools and hospitals. That's where I cut my teeth.

I have seen a big change in what we do to deliver that energy efficiency. The big change is there is much less focus on capital investment. Much less focus on buying a new boiler or new chiller or buying new pumps, this kind of thing. 70% of our work right now is in data. It's in intelligence. It's driven by the Internet of Things. It's driven by machine-to-machine communications. It's driven by network technology and driven by software technology. I'm a software shop now. And these same technologies are what is connecting my customers to the grid. There has been lots of discussion about distributed energy resources. Generation on the customer's side of the meter, demand response. Load shedding. All of these things, these technologies are becoming pervasive and as has been pointed out many times here, it's being adapted but very slowly. That red light means I'm done, doesn't it? I don't have anything prepared. I apologize.

I would like to throw out just a couple of things that my experience tells me. Regulation. I believe regulation is a sign of failure in the market. I believe regulation is also a sign of mistrust in the market. As you were talking about alignment earlier, I think and coming from a state that has lots of reasons for distrusting lots of other people, I think working on trust and communication among the various groups, bring them into play, that is what will create better regulation. Venues like this help to support that. Having a conversation helps to support that.

CHRIS KELLEY: Thank you, Mark. So Laura, you joined us a little bit late. Let me introduce Laura Nelson, Director of Utah Office of Energy Development. Laura we are in our opening remarks right now. You have you 5-7 minutes.

LAURA NELSON: Thank you very much. And I do apologize for the being a bit late this morning. Scheduling snafu, I suppose. But I want to say I really do appreciate the opportunity to be here and I also want to express appreciation to DOE for picking up - taking a very comprehensive look at our electricity sector as part of that Quadrennial Energy Review process. I completely agree with Mark that it is important to have the conversation and the dialogue. There are many changes occurring today, whether they are policy changes, whether

they are socioeconomic preferences, or market pressures. And what we are seeing is a time where we really have to continue to be innovative in our approaches around energy.

And with that, I'll just segue into giving a brief introduction to the Governor's Office of Energy Development here in Utah, which is a bit of a novel office. We were formed as a result of the Governor's 10-year Strategic Energy Plan, which he began developing in partnership with a vast group of stakeholders in the state to find out what Utah's energy plan and future should look like and they said, we need an office that is really dedicated to Utah's energy future and so that is really what the Governor's Office of Energy Development is. It's an office dedicated to Utah's energy future and our mission is to advance Utah's energy economy and that includes across all energy resources. And I would be remiss to say that it also includes advancing non-energy minerals as well because those in fact play an important role in much of our energy future.

So, we are unique, maybe not a duck. Maybe a goose. I don't know. But we are a little different too because we are not industry and we are not regulators and we are not policymakers. We are policy implementers, policy advisors, so we look to provide information that we can inform policy and also direct policy to develop Utah's vast array of energy resources. We also engage in planning. So subsequent to the release of the Governor's 10-year Strategic Energy Plan in 2011, updated in 2012, we developed the state's energy efficiency and conservation plan that came out in 2014. So planning is a key part of our function and we also work to engage directly with all stakeholders and with industry to promote energy development in the state and we have a set of incentives that are provided by our office across the energy space to support diversity of our energy portfolio, which we think is important for having a robust energy future and maintaining affordability and reliability, so we utilize incentives and we help to build partnerships across different energy sectors, whether it is bringing combined heat and power opportunities, for example, to our industrial customers or educating about industrial energy efficiencies. Or if it is looking for new advanced coal technologies. We look to bring various partners together so we can move projects forward which we think will drive innovation, deliver new technologies and make for a more robust efficient and sustainable energy future

for the state of Utah. So, how about if I wrap up a few minutes early and then I can give you some minutes back.

CHRIS KELLEY: Thank you. So with this, we will go ahead and turn to the questions. So let's dive right in and I'll open this up to whoever would like to take it first. So, this really is on the subject of just the uniqueness of rural customers and rural electric cooperatives and tribal utilities. So, we had some folks here starting with Josh's comments on RUS and then heard from some of our panelists about the unique nature of these types of entities. So I sense affordability is the key for your customers. And possibly that it could be a number one concern to them. Is that an accurate statement? And I guess I would juxtapose that against some of the other comments about other things being more important from some of the other panelists. So the question is, how do your customers feel about affordability and do they see or you see the changes that are occurring as impacting that? I'll open that up to whoever will take that up.

COLIN JACK: At Dixie Power, we take a telephone survey of our customers every second year and in fact, I should have mentioned that in my opening five minutes. We have an American consumer satisfaction index level of 89 out of 100 which is one of the highest utilities in the country. But, they get a 20-minute question when they answer the phone if they choose stay online and ask a series of questions about what is most important to them and what value do they perceive out of their cooperative and what are their concerns. And universally, and I should have printed it out, but it's a book, but I could have brought it with me. Universally the top concern, number one concern of our members is affordability. And that is the thing that they are looking for. Now they always appreciatory reliable electricity. Nobody likes it when the lights don't come on when the move the switch. After 10 years camping out in the bush of rural Africa and South America, I've had enough cold showers to last me a lifetime and it really hurts my feeling when I get one at home. Thankfully it doesn't happen very often, but cost, I think is absolutely the number one concern of our members.

CHRIS KELLEY: Thank you. Other comments? Is that true?

LEONARD GOLD: So the tribal utility, cost is definitely at the forefront and with the limited customer base and the economic level of a lot of our customers, they can barely afford to make their payments on a monthly basis. So we have to come up with creative ways to allow them to

keep their payments low and so technology is key for us in terms of being efficient in what we do. And like I say, we had remote meter technologies since 2006. And that allowed us to reduce the cost of both connects and disconnects. Such that instead of where a lot of utilities may be charging 250-300 dollars for a connect reconnect charge, ours is just 25 dollars and we will waive that a lot of times. So cost is definitely there. But what is also interesting is the change that is taking place in terms of reliability. When I first started working with community and you get a cloudy day and before we got involved and started making improvements to the system, at the system, a cloudy day, a little bit of wind, a lot of customers would be out of power and could be out of power for days and that was part of the reason why the community formed the utility authority in the first place. We changed that. And with that, of course comes that suddenly there is a little tolerance for being out of service. So cost but now there is less tolerance because of technology. Everyone has computers. Everyone has their cell phone. Everyone has that technology and they want it. So, we have an outage and we get first calls coming in five minutes later, getting calls, why isn't my power back on? So those are the two challenges we have, but they both are driven from the cost perspective.

ROGER WOODWORTH: Can't quote me on the statistics but here is a general idea of trends we have seen in our company and I heard it from other utilities. This is not just a rural issue. I want to emphasize. It could be an urban issue just as easily. If we went back 30 years ago, I'm going use the phrase energy burden, so this would be like the household obligation. How much has to go to energy versus other discretionary choices or choices that you have to live your life. Don't quote me on the specifics, but in round numbers, the number of customers on average that struggle to pay their bill at some point over the course of the year is about 1 in 7 and it wasn't like they were destitute and stuck forever. But at any given point in time, maybe 1 in 7 were kind of struggling. If you fast forward about 15 years, it was 1 in 6 and today it's like 1 in 5. So, how far is it okay for that to go? And the answer should be not very far. Because this is a statistic that reveals our humanity. How much burden do we put on people to achieve overarching goals that are good for society but punishing to some percentage? And we have to be mindful of that balance and it's a competing forces analysis. We have to have both. And the question is how do we achieve both in a way that honors the opportunity we have to society as a whole and at the same time is respectful of this very, very real need in our society?

CHRIS KELLEY: Thank you. Other comments on affordability issue?

PAUL RADAKOVICH: I'll mention Rocky Mountain Power, if you look at our service territory, we are a knit together patchwork of REAs and co-ops and purchase over time. We have the density in the Wasatch front, but then tons of rural service territory as well. And I'd say there are two universal concerns or interests of all customers and they are affordability and reliability. What we are seeing coming on now is increasing numbers of people that want to do business of all sorts over mobile devices. Manage their bill, manage their accounts, there is a growing number certainly interested in some form of generation or distributive energy resource on their site. So it is electric vehicles we are seeing increased uptake, certainly rooftop solar. But I just mention affordability and reliability every customer. Thank you.

LAURA NELSON: Maybe just from a state perspective. I want to say that affordability is part of our mission really as well and part of our state energy policy and the motivation behind the Governor's 10-year Strategic Plan and the energy efficiency and conservation plan. And people may not recognize this, but Utah's population is set to double by 2060, by 2050, we will be 2 1/2 million people stronger than we are today. We are about 3 million people today. And we recognize if we want to be able to achieve that mandate, that we absolutely have to be as efficient as possible in the utilization of our energy resources, especially as they relate to our electricity use. We are very motivated to work with our utility partners. We work with both quest star and Rocky Mountain Power to advance energy efficiency programs and I believe that currently, Rocky Mountain Power is meeting about 84% of its load growth through energy efficiency and we think that is important for promoting environmental stability. It is also important for protecting affordability. So, from a state's perspective, our policy really is to look at how we can be as efficient as possible in our energy use because we think that that’s critical to affordability.

CHRIS KELLEY: Any other comments on affordability.

COLIN JACK: Can I make one more comment? Just spurred several thoughts. As we talked about different rates and costs, and consumer affordability, it's important to know that we have customers every month that end up having to get their power disconnected because they have been delinquent for several months and they are being disconnected for power bills of 50

dollars they can't pay. So, for us to cavalierly say we could -- everybody be willing to pay 50 bucks a month for something, they are not. And I was a little distressed to hear Germany held up with such a shining example of the way to run a power grid, when their rates are 5-6 times what our rates are. If my customers had to pay 25-30 cents a kilowatt hour versus the 5-6 they play now, I wouldn't have 18,000 customers. And willingness to pay surveys that I see bantered around, are notoriously inaccurate. Anybody will say, I'm willing to pay extra for this benefit. But then ask them to write a check for it. And that is different. Just we had some discussion on previous panels about solar power. Back in 2008, Dixie was in inundated with requests for solar power. So we ran out and built a solar farm and offered it at half the market price because I was getting multiple calls every day. And out of the 250 KW units that we built, we had 25 subscribed. Not 10,000. So, willingness to pay is usually 99% inaccurate when they make those surveys.

CHRIS KELLEY: Thank you. So Colin let's stick with you. You did take a shot at solar during your opening remarks. I just -- and you talked about affordability of solar just now, but you made a comment about questioning CO2 reductions associated with solar. Can you expand on that a little bit?

COLIN JACK: Sure. I get to talk about all three or just CO2?

CHRIS KELLEY: Cover all three, but in fairness to all the other panelists, give others a chance to talk as well.

COLIN JACK: So on CO2, and I can circle back later in we have time. On the CO2, whenever you have any alternative energy, the intermittent energy of any size, and we talked about in the previous panel about how sometimes the sun goes behind clouds or the wind stops generating so they become unreliable in a moment. Then you have to back that up with simple cycle gas generation. And to what people are trying to reduce when they talk about we have to do away with coal. We are not talking about ash in the air. We are talking about CO2. The whole clean power plant that has been named clean power has nothing to do with clean. It only has to do with CO2, and as we do this cap and trade on CO2 and we are reducing coal to put in solar, but solar has to be backed up or wind backed up one for one with a simple cycle gas generator. The simple cycle gas has the same CO2 emission per kilowatt hour that coal has, versus a

combined cycle which can't react immediately. So, as you build all this wind and solar, and you build simple cycle gas generation to back it up, your net reduction in CO2 net is zero. I don't know if everybody followed the math but it was pretty quick and fast.

CHRIS KELLEY: We are transcribing. So we can follow-up later. Thank you. So thank you for those comments. Other comments on solar maybe a different perspective? So I was hoping Laura you might have some comments on Utah's stance on solar.

LAURA NELSON: So I mentioned in my opening remarks that we really believe in energy diversity. While at the same time we don't believe in achieving that through mandates. And so, we have not opted for a policy where we dictate that a certain percentage of our electric generating resources be from particular resources in this case, renewable resources or solar. We are realizing what I would call a solar boom right now, whether you look at the distributed generation, portion of the solar, or the utility scale solar, and we think we have achieved that through a carrot approach, as we would call it, by providing incentives for development and those developments do have to meet the cost rates that are set by our Public Service Commission. So, we have not seen, I think, skyrocketing rates that have occurred in other places where they have adopted certain standards, renewable portfolio standards through mandates which we think creates artificial price signals. So I think to Colin's point it is very important when we look at diversifying our portfolio, that we seek to achieve it in the most affordable way possible, because there are some people who simply can't make those higher cost decisions. So, we believe that an approach that looks to diversify through incentives or positive policy rather than mandates, is the best approach to bringing those new resources on and then it will be more in line with what is happening in the market.

CHRIS KELLEY: Thank you. Other comments on solar? Nobody wants to step into this one, huh? You want to take it Roger or no?

ROGER WOODWORTH: Yeah, and I'll focus on a little different angle of this and it does have to do with what Laura talked about with incentive. I love the approach you just described. It's more market-driven. A lot of the incentives today are focused on residential homeowners, roof top. And yet we know that the math is very clear, that that's the most expensive approach to deploying solar and yet that is what we incent. So when we talk about trying to reduce

friction in the system for our country, we have a challenge and an opportunity here to rethink the incentive structure. Where can I get the most solar at the least cost in the fastest way? And it's not incenting residential, it would be incenting some utility scale. But that's not how we do it. That's a missed opportunity that leaves conflict and friction on the table and deploys resources in a way that aren't otherwise available to deploy to a higher order of purpose. These kinds of examples of misalignment are what I was trying to refer to earlier, that you can solve through design principles by making the commitment on the front end of what the outcome looks like before you're faced with a choice to help frame the decision. Here is another way of thinking of the same thing: Even if we choose to stay with incenting residential solar, take two circuits equal in all respects except one is under loaded and one is overloaded. Today the incentive structure is blind to where the solar goes. So and one, it helps the system. And the other one it makes the system less efficient. It's more costly. But we incent them identically. Our system used to be really simple to regulate, but today it is very complex and all these things have to be taken into account if you want to achieve the optimum outcome to reduce the cost, speed up time, assure the best outcomes over all. But they require a wholesale rethinking of the way we allocate resources we have available to run our energy system. I hope that is what the Quadrennial Energy Review is designed to help us as a nation. QER. Thank you very much. We, can achieve greater things if we put our minds to it and have that alignment. The solar example is a good model to look at to see and to tease out some of these kinds of principles.

CHRIS KELLEY: Leonard.

LEONARD GOLD: Talking about incentives and from a tribal perspective, Native-American communities can't take advantage of all of these solar incentives because they don't pay taxes. So, you have this incentive out there to do certain things, Native-Americans would like to take advantage of it, tribe utilities would like to. And the only way to do that is to come up with these complex arrangements with those entities that have taxable appetites for the investment tax credit et cetera. And it's typically a one-sided arrangement because they want to earn return on their investment. So it has to be some policy consideration for how to, if you you're going to have incentives, there maybe has to be two different views of it and one being from the Native-American perspective, as a tribe utility, we'd like to do a utility scale solar project, but we can't

do that because of the cost structure and the way that these complex agreements have to be done where you have to do it for so many years and then you flip it and everyone has a partner. It's way too complicated and needs to be simplified.

CHRIS KELLEY: Thank you. So let's turn to a subject we heard a little bit about on the last panel, the generation transmission panel, and that is the importance of communications, outreach, education of the customers. And I heard some interesting comments here on our panelists that maybe customers don't really care about how the electricity gets to them. So that could be a little bit at odds with what we heard in the transmission side. So arguably you have a closer connection to the customer on the distribution side. To what extent do you think it is important to do this outreach and communications to end customers to educate them about the changes that are happening in industry and the things that will affect them?

PAUL RADAKOVICH: First I think that is always important no matter what kind of business and when you're providing a service to people is to have an open dialogue with them. And for instance, with an all of the above strategy where energy efficiency is such an important part of the way this business is going to go forward, letting people know what programs you have, what options they have. Critical. I think to the success of those programs, saves huge dollars on the back end of an IRP and the options that we need to have them at. All the way through issues driving rate cases and trying to get accurate information out because there certainly is going to be special internets that line up decisively against all kinds of things. So just trying to get back spaced information out is critical. Probably more so than ever as we have this digital future in front of the power grid and how that could evolve or will evolve is very important.

CHRIS KELLEY: Thank you. Anyone else? Colin?

COLIN JACK: Dixie Power, we have only got 18,000 customers and not 5 million or whatever. But we work real hard to stay in communication with our customers and engage them when things become important for them to know about. We hold an annual meeting where all members are invited to join us for dinner and for a lecture on the power situation. We have Facebook pages and we have kite festival where we have people come. But, engaging them and things in recent years when the Senate was considering a cap and trade bill, we got thousands and thousands of postcards from our members to send to the Senate when the EPA

was getting ready to issue the same cap and trade but under a different name. Across the country, we had two million members send in e-mails to the EPA. And 15,000 or so from our own membership base. It is important to keep your members informed and we work real hard at that and I feel like we succeed in engaging them.

ROGER WOODWORTH: Yes, to what Paul said again and let me build on it a little bit and Colin mentioned this. You used the word “engagement”. That's the difference I would encourage us to think about. Customer education is what utilities used to do. We'll tell the customers what they need to know when they need to know it. It's not a very potent way to sustain a relationship. But engagement. And the fact is, and this is true of all of us in the room and everyone we serve in any capacity not everyone shares the same interest in the same way. So one customer might be keenly interested in what we do environmentally and other about efficiency and someone else air quality and someone else about energy pricing and they are all varied. The most important things utilities do these days and it's imperative really to just to open up channels for communication and by, that I don't mean education, I mean dialogue. The chance for people to learn what they want to learn when they want to learn it and a pathway back to talk to somebody in the utility that can help them understand or receive that and fold that into how we think. So, Facebook, tweeting, social media, all these things are in our portfolio today. We are doing things today -- people can opt in to various things they are interested and points of contact that are more directly communicating through the web and individual names that people can call. And Mark mentioned earlier, the idea of customers on the other side of the meter are suddenly influential or becoming more influential of what happens on the other side of the meter. So this idea of two-way dialogue isn't just about information or understanding policies or options, it's about the possibility of actually changing the interaction of equipment on the system. You say what is the big deal of having a thermostat that dials down. If you have several million of them under management, suddenly it makes a big difference. Small things add up and consumers, our customers, people who are friends and neighbors have a chance to be part of that system. Will everybody want to do that? Absolutely not; but will some people want to? Yes. Will there be other people to help others who don't want to mess with it but still want to participate year round? Yes. So the question for us as a nation is how do we make these things possible so customers can engage to the degree they want, in a way to help the system get stronger and not weaken it. Not make it costlier but better

for everyone. I think that is the challenge of the QER and the chance that we have here to start to define a different set of outcomes that we want above and beyond just the things that we talk about.

CHRIS KELLEY: Thank you. Roger.

LAURA NELSON: So, again just from the state's perspective. Absolutely the energy education is key. And so, our office is charged with education and outreach and informing people about opportunities, possibilities, but I think we find that it is difficult to get people engaged if they don't really fully understand the electric system for example, and how it works. So, we have developed an energy premier. It's how energy works. It's available on our website energy.Utah.gov and I think that really conversing with people and explaining how the system works is critical because that is how they then can get engaged in different parts of how they use energy when they understand the production and transmission and distribution of electricity. They are more informed and they are they can make better decision. With that said, I think that you can only talk to so many people in a day and in a week and a year and if you don't have opportunities, to Roger's point to truly get them engaged, then I think you are going to miss the chance to find those innovations and drive the types of outcomes we want in our energy space and our electricity space. So another program that we have undertaken this year is putting together in partnership with a number of state agencies, a fulsome energy curriculum that would go through fourth grade, eighth grade and then a high school component of it and ultimately also a University component of it because I think that one of the things that we are missing is a comprehensive energy education where people actually understand that all these resources are coming together to give us the robust energy economy we have today.

CHRIS KELLEY: Thank you. Any other comments? Okay. So I think we have time for our last round here. So again, you have the QER Task Force before you. So if you could summarize maybe any final points you have or if you like to bring up a new point, you're welcome to do that. So why don't we say two minutes a piece and since we are already down with you Laura, we'll start at your end.

LAURA NELSON: Okay. I guess what my final point would be just that, and I think it has been said on this panel, that energy, the electric system is really the foundation of our modern

society. And we live in a world where about 25% of the population doesn't have access or has limited access to electricity. And I think that we as a nation can set an example about how we efficiently and responsibly develop energy resources by not picking winners and losers but by looking at a comprehensive robust energy portfolio that meets our needs, allows in some cases for export opportunities, for both resources and technologies because I think that that is going to improve not only our equally of life but the quality of life that can be delivered globally.

CHRIS KELLEY: Thank you. Mark.

MARK CASE: I'd like to reemphasize what I was saying before. Think about what the impact on the people in this room, the people that run and manage and operate the grid and all that stuff, think about what the different future might be with the 30% reduction of energy and power requested from that grid. It's just huge. It's just huge. So I just urge everybody to think about that potential because it is there. It's out there. And it is economic. Not so easy to get. I'm not saying that. A lot of challenges to getting it. Which brings me to the next one. Right now, energy efficiency is largely driven by utilities and it's been grated and gone a long along way. But there are a lot of problems with utility engagement and it’s been great, it’s gone a long, long way. There are a lot of problems with utility being engaged and controlling and managing demand side management programs. Regulatory issues. A lot of cross incentive issues. There are a lot of, hey, I want you to help me reduce the demand for your product by 15-20%. What? There are some traditional business models out there that just really don't work with utility delivering demand side resources. They'll still do it and need to be doing it but there is say lot we can do to achieve that efficiency by applying resources maybe a little bit differently.

CHRIS KELLEY: Thank you. Roger.

ROGER WOODWORTH: I'll just recap. I wanted to jump on that but I'll -- we can do that later. Three points of design principles for design. Start with the why. Let's under the QER, let's get DOE to get the overarching objective goal of a higher order of purpose clear so that it makes it easier to put every other decision in context. Let's be very deliberate about examining and critically reviewing our current policies and our incentive structures so that we can in fact align our efforts to maximum impact. If we don't do that then we are leaving friction to continue. And then the third one, leverage what we have into what can be. I want to weigh in

one additional point here that is illustrative of this potential. As part of that trillion dollars, our industry will spend in our nation over the next decade plus, it will involve the smartening of the grid and in order to smarten the grid, with the digital information technologies you heard about today, it requires a communication infrastructure that overlays it. Is that just for utilities? Electric utilities? Or does it have utilization, usefulness beyond the electric utility? Could it be leveraged into something else that for a lack of a better terminology we'll layer smart cities. The same technologies that are pervading our industry, pervade the health industry, that pervaded water industry, the national gas industry, they pervade how you find parking in some cities today. And they all depend on different communication infrastructure. What if we only built one and what would our nation look like then in terms of its economic performance? This is a small example but it's elucidative of where utilities as allies can lead the way and be part of a solution as opposed to a part from it. And I would encourage that as a concluding remark, because at the end of the day, the progress our nation makes and the success we achieve in part is totally dependent on this electricity system and we should do everything in our power to make it the best we can be collectively, not just for discrete interest but for the most common denominator we can achieve. That should be at the top of the list for how the QER expresses what our nation should do, must do in order to continue to be successful.

CHRIS KELLEY: Thank you. Colin.

COLIN JACK: So, from our perspective, as an electricity distribution provider, I have listed our top three concerns. First, would be intrusion into our power supply market, picking losers and winners rather than allowing the free market to determine technology selection. First we were mandated to use coal back in the late ‘70s. And now we are shutting down coal before the costs are fully recovered. The energy industry is a capital intensive industry; costs for building resources and infrastructure are necessarily amortized across long periods of time not unlike a home mortgage. These long term financing arrangements rely upon long term regulatory stability. Utilities can't abandon projects and project financing mid-life in favor of alternative resources without creating significant rate shock for their rate payers. So to prevent economically harming rate payers, regulations must be consistent and predictable. So that was my first one. Second, mandating expensive alternative energy projects which don't meet power supply or economic benefits of our members. And then third, is the Federal lands blockading

new power lines or even access to existing power lines since we live and work on small islands in a sea of Federal lands. I showed our state's map at the beginning of my remarks. And you can see why we need help and when we have bureaucrats who choose to blockade us, they have a really effective tool. Thank you.

CHRIS KELLEY: Thank you. Leonard.

LEONARD GOLD: A couple of things. One of them and Roger mentioned about conservation and energy efficiency and also Mark did. And I think we have seen that in terms of housing that has been built within the community and the lack of them being built energy efficient. So I think there needs to be an upfront. You need to build homes energy efficient, you need to build buildings that are energy efficient for the long term. Going back and doing retro fits is nice but it's costly and most of our community members can't afford to retro fit their homes. That's one thing. The other thing is technology is great for us in terms of doing a lot to be able to somewhat know what customer wants to control a little bit of demand. But the real issue that we also have is we have a physical system. Requires people to be out there and to touch those wires and you can't change that technology unless you're beaming it somewhere. As long as you have wires and poles and transformers and et cetera, people have to work and they have to be out there doing that and that becomes - the technology becomes challenging. You get people -- so improves our workforce but also has a cost. And the final thing that we think about and we talked about it is what is going to be the game changer on the distribution side? And we really think it is going to be storage, battery storage. And battery storage comes along and you couple that with the renewable resources, we are probably going to be like what happened with the cellular market. I'm of the old generation, I have a land line. My son can't understand why I have a land line. He keeps telling me you only get a call from marketers. I think we see that in terms of people leaving the grid and if they leave in vast quantities because they are able to be able to sustain themselves with the technology, what does that leave for the infrastructure we have sitting out there? So we have to look at a lot of these things as we head in that direction. It's an opportunity, but it also creates a challenge of infrastructure that may not be able to be amortized over its life.

CHRIS KELLEY: Thank you. Paul?

PAUL RADAKOVICH: I'll end with another thank you for the opportunity to be part of this QER public input process. And to say energy companies like ours, and maybe I'll speak for ours, we are just really excited, I think, about the changes that are occurring and our role in informing the future of power grid and how this is all going to work for an engineer, myself; incredibly exciting opportunities ahead. With that, I'll say as we go forward, the best path for successful outcomes for our customers will be through cooperation and collaboration with all the stakeholders. We'll get a lot better result than fighting over issues and it will really take some solid regulation and some facts based treatment of the value of various aspects of DER to get this right. And lastly, I'll just close to say, we have been studying these kind of possible scenarios for the future. And one of the good news items at least for our network and there are others maybe in different parts of the country, but we have time. The wolf is not at our door. We do have time to think this through, stick with proven technologies, and ensure that we are delivering services that our customers really want and are ready to pay for. And potentially let some technologies develop further as we talked about storage and other things, some potential game changers. No reason to jump deep at this point as some of those things take shape. So I'll conclude there.

CHRIS KELLEY: Thank you. Please join me in thanking our panel.

[Applause]

So at this point we are scheduled for a lunch break. We will get started again at 1:30 but I'll point out that our hosts at WECC have some of these brochures at the entrance, if you're looking for a good place to eat, apparently there are a few places in the neighborhood, so they have a map with all the locations. So, again just a reminder if you do want to provide comments at the end of this session, please do sign up at the front of the room and for those who are online, you can submit your comments to www.energy.gov/QER. And we'll get started here at 1:30 p.m. local time. Thank you.

[Break]

Panel 3

Cyber- and Physical Security and Resilience

CHRIS KELLEY: We have got our panel assembled. Let's get started with this afternoon's agenda. So, our third and final panel is on the subject of cyber and physical security and resilience. Joining me at the front are Mark Gabriel, Administrator and Chief Executive Officer of the Western Area Power Administrator, WAPA. Michael Ball, the Director for Corporate Security and Risk at PacifiCorp. Mike Moon, Vice President of Compliance Western Electric Coordinating Council, WECC, our hosts. Tim Roxey, Vice President and Chief E-ISAC Operations Officer, North American Electric Reliability Corporation, NERC, and finally Phil Jones, Commissioner, Washington Utilities and Transportation Commission.

So, gentleman, just as we had set up with the last few panels, what we'll do is give you a chance to provide your opening remarks. You'll have 5-7 minutes each. We have some colored lights set up at the front on this white table. When the light turns red, I'll point it out to you right up here. When the light turns red that -- green means go and red means you're at the 5-minute point and then you'll have two minutes to wrap things up. We'll go right down the line and give everybody a chance to provide opening remarks and then it will come back to me again for questions. So I'd like to remind everybody that the views expressed by the panelists are their own views and not the views of the administration including the U.S. Department of Energy and the U.S. Department of Agriculture. And with that, why don't we go ahead and get started with Mark.

MARK GABRIEL: Thank you very much very much. I'm impressed to see so many people came back after lunch. I'm Mark Gabriel and I have the honor of running the Western Area Power Administration. I'll give you the 30-second commercial. We are one of four power marketing administrations that are part of the Department of Energy. We operate across 15 states, a million and a half square miles, 177,000 structures, 320 substations and 500 some odd con sites. And we operate 24/7, 365. So providing power across that vast footprint is both a privilege and also sometimes a challenge, especially because of the need for the high levels of

reliability that we have and the issues of cyber security, physical security and resilience to the grid are near and dear to our hearts.

One of the things in listening to the panels this morning and I reflect on all the time, is as an industry we have a couple of choices. Many may not remember, but back when you studied Roman or Greek methodology there was the God Janus looked forward and backwards. As an industry we have to take the opportunity to not just look backwards, which is to repair and replace and rebuild, but to try to figure out how we take advantage of the new technologies out there and think in a different way. It's not simply a case of more guards, more guns and more fencing, although that is obviously critical as we look at how we invest in infrastructure. We have got to figure out what is the right investment and how do we move this game ahead. Bottom line is, in today's market, the critical nature of our information and the critical operations of the grid have become one. This is being made even more complex when we look at all the distributed energy resources being added. When we look at the way markets move the industry. And in fact, I'm convinced certainly for Western, our information technologies and our operating technologies have merged. There are those who would say your supervisory, control and data acquisition systems are separate from your business system and that may be the case on the surface. But I would argue that that world is now the same. We operate with the same type of communications and software; we have the threats that exist on the physical system as we do on the cyber system. In fact, what we have seen in an increasing level is cyber being used as a strategic weapon. And I stay awake at nights worrying about the merger of unfortunate issues where we have a physical shooter, let's say and a cyber-attack at the same time. So, we have to really figure out what are we going to do? What tools can we deploy? How can we be forward thinking and looking as opposed to simply saying, I'm going put up more guards and guns and fencing? That's really the challenge for all of us.

And I also want to point out that we tend to think about grid resilience as the lights being on. I would offer that in today’s environment that's no longer enough. We have to think about security, quality, reliability and availability. And all those pieces really have to link together. Our systems are changing, the loads are changing and the thought of a digital load versus a motor load means we have to operate the system differently. It's incumbent upon us to try to take advantage as an industry to really look forward and say how can we have breakthrough

thinking about this? Now of course there are tradeoffs, who is going to pay for this? Western is fortunate that we tend to be the lowest cost provider in all the markets that we serve and we do that very intentionally. When I look at the tools we had to deploy, we have very active asset management for example, and how does our asset management allow us to look at our cyber and our physical situations? How can we make sure that we have the real-time access to information not just on our system, but on Mike's system, on everybody's system? And I think we have to figure that out and that is one of the big challenges that we have in the industry. We have got to educate folks as to what we are doing today and we have to educate them in the need to invest for technologies into the future.

Now, we have to figure things out like who is going to pay for this great stuff? Now one last pitch I'll give here because I see my yellow light on, that is for the concept of the strategic transformer reserve. Because one of the things that we know in this industry is the inability to get large power transformers in time and of the same level of quality that we need it. It's a very large issue. Fortunately, it was called out in the first QER. We have some action in Congress on it. We need preparedness. We need to be sure that we are ready for the future, not just by looking at the past, but trying to figure out what do we need out into the future? We've got to deal with bad guys who have an asymmetrical advantage to us as an industry. The only way we do that is looking forward and making sure we are planning both cyber and physical security together in a unified fashion.

CHRIS KELLEY: Thank you. Michael.

MICHAEL BALL: I'm Michael Ball and here to represent Pacific Corp. and also Berkshire Hathaway Energy, which is Pacific ICorp.'s -- part of the family. Also represented here is Rocky Mountain Power, and all part of the Berkshire Hathaway family. I want to thank the Department of Energy for the opportunity to be here today. And also just the opportunity to sit on the panel with these very well respected guests as well.

So, one of the things just about Berkshire Hathaway as a whole, is we are a series of family, locally-owned businesses across 11 states and three countries. We have 84 billion in assets in that base and we also serve 11.6 million electric and gas customers. We also have 16 billion dollars' worth of investment in renewable energy area and I think the key thing that I think is

stepping back, we have a big responsibility in that area of our business. It creates surface area for risk. And I think that translates into how we are -- what we are here today to talk about.

Cybersecurity threats globally are a fundamental risk to us and they are growing constantly. In our space, in the energy space, that threat has been known and we have had an awakening, so to speak. And it was exemplified even just in December of 2015 with the attacks in the Ukraine. Weaponization from a cyber perspective to cause disruption. That's pretty concerning. We all have been worried about it and seen it realized. It's again a wake-up call for us. Our adversaries are many. They are nation states, they are cyber criminals, activists, even individuals are highly skilled. We must worry about them all. And that is certainly as a practitioner in cybersecurity, that keeps me up a lot. So I think the thing is, how do we reflect on that? This new age of cybersecurity? One of the things I think is important is that we realize that it is no longer a game of keeping the bad guys out. We are no longer just trying to keep the bad guys out. Now it's about detection and response and resiliency. We are working hard as an industry to drive forward to be able to obviously we want to minimize the likelihood but we realize that bad guys get in. The question is, do we catch them? And is our architecture enough that it actually minimizes their ability to execute anything that can cause damage and how quickly can we respond? So I think that is fundamentally an important part of it. We have seen this come through in some of the mandatory and voluntary standards we see in our industry. Certainly, compliance requirements like NERC, that polarized the electric sector to focus on how can we protect our assets? One of the things that I think we have to be very careful of, is that mandatory standards are also minimum. I think that is really important and we can't fall into the trap that says, if I'm compliant, I'm secure. So I think that doesn't mean we are not more secure. But we have to think more broadly than that. And how do we achieve that? Well, part of it I argue, we can't lose site of the basic principles of security. We need to apply good security hygiene and our individual businesses. It is important because each of our utilities are energy businesses are a node on a series of networks that make up the critical infrastructure of this nation. And by protecting each of those elements, we are more resilient as a nation. Our adversaries are advancing and so must our skills and our capabilities. And we have to also transcend beyond our silos, that is one of the other important things that I think we have seen occur.

Because it’s no longer just about protecting our assets. What about our suppliers? Adversaries are getting into our environments not because they can get through our defenses, but they can get through a trusted partner's defense. We must think broader than that. In addition to that, when we think about getting out of our silos, we also need to think about things such as our partners. We need to think about what information can we share with our partners? I think that is an important part of working within our industry and I think we are uniquely positioned to do so and we have done great work.

Some of the things that our industry groups provide great venues to bring us together to talk about good practices and share information. We have national, state and local public sector agencies that also bring us together. And the other thing that I think is important and this is part of our evolution, is our intelligence community and our information sharing about real legitimate threats. This is really important because we get information that is distilled from intelligence sources that are provided to us that we can rapidly respond to, but we are looking for more. It needs to be more timely and needs to be more actionable. It needs to be more embedded in the way we do our business so we can execute that in real-time.

So these are barriers that still stand before us, but I would argue that we are better today than we were yesterday. And we need to keep moving forward in that. The other thing is just as an industry, that public-private sector relationship as a series of utilities or energy business we have a lot of stakeholders. The stakeholders are our customers, the communities we serve, the states that we operate in regionally. We are responsible as a region or as a participant in the nation's critical infrastructure. And I think the question is as we challenge the severity and the magnitude of the type of attacks we can see, the things that we see represented in things like grid X and these exercises that are very catastrophic, how do we have all of those pieces work together more harmoniously? That is our challenge. So that is one of the things we can do. And I think I will just close up quickly, we just are seeing the advancements of our public-private sector relationships exemplified through things like the electricity subsector coordinating council. I think this is a really an important part of our advancement as a nation representing our industry. I have a colleague on my left who is an executive sponsor there. As well as our own CEO. And in this space we are trying to drive change and advancement and the we need to participate in these things. So a number of programs are a part of that. It's an opportunity for

us to continue to advance our capabilities. But we are far from done. And I think the more extreme and the more scenarios we explore and exercises and drills and challenging our thinking, it challenges the way we do business today, is about how we learn from that and advance before we realize it in reality.

So with that, I'll try to wrap it up. That is how I would characterize it. We are better today than we were yesterday. And we need to continue that and have a sense of urgency in the work we do to advance ourselves and we do that not alone, not in our silos. It is with our partnerships and it is with our peers and relationships and information sharing and that partnership at a national level, as we try to explore how it is we are going to overcome some of these most advanced adversaries.

CHRIS KELLEY: Thank you Michael. Mike?

MIKE MOON: Thanks very much. A couple of notes, our mission at WECC is to assure the reliability of the bulk power system in the Western Interconnect. Not guarantee and not ensure. We have to collaborate work with industry. We oversee 350 entities registered for reliability to bulk power system and generation and transmission. Sort of three overarching notes. The standards really provide unique opportunities and challenges in terms of how we move forward as a regulator. A couple of other notes: From my previous career we used to say, the bad guys are bad, not stupid. And we have to keep that in mind when we look at how we do regulation when we are dealing with determined adversaries. And finally, nothing is worse than an ill-informed regulator. You all need to share information and we need information so we can do our job well.

Some of the themes that I picked up on from the two previous panels, cyber and physical security is hard, data sharing is critical, electrical sector is highly complex and involves many other partners, vendors, organizations that we need to deal with. And that regulators need to collaborate with each other, industry and other interested parties. Some of the key points I'd like to make is, we can learn a great deal from other regulators and the challenges they had. Regulators provide reasonable assurance, not guarantees about compliance. Something to understand about compliance, that has been mentioned, that doesn't guarantee reliability and security either. It's a minimum level. We have to understand risk. As a regulator, for our

industry, for ourselves and those we regulate. We can collaborate with industry. WECC has several tools beyond compliance and enforcement that we can use to influence the industry. We need to drive fear out of the current environment with regards to compliance and I'll get to that. And then finally, we have to be a fair and just regulator and we don't want your money. And I'll get to that very succinctly.

First of all, regulators provide reasonable assurance. Not guarantees. We can't look at everything all the time, otherwise we would have a 70,000-person organization and it would be burdensome. We work within a civil construct. Not a criminal construct, and that is a very important distinction in terms of how we deal with our entities. There is a lot of issues in that statement. In terms of that self-regulatory construct, this industry is very, very open, over 80% of the violations identified are identified by the industry, by the entities. That is really tremendous in terms of their commitment to being reliable and secure, identifying their own deviations and problems. And obviously the purpose of regulation isn't enforcement. It's about getting entities back into compliance. That is a critical component.

In terms of understanding risk, I look at a lot of other regulatory models, constructs, events. On April 20, 2010, the McCondo well blew out; otherwise known as the dynamically positioned drilling vessel Deepwater Horizon. This is a case study in failed regulation. Eleven men died, 83 days past, the oil is spewing 4,000 – 5,000 feet below the surface of the Gulf of Mexico. Significant environmental damage. Bottom line here, when you read that final report, both the regulator and the industry failed to assess risk. Had nothing to do with standards. It was about assessing risk and dealing with it and we made strides with FERC and ERO over the last few years in that arena.

In terms of collaborating, like I said, bad guys are bad, not stupid. There are determined adversaries that are trying to impact our systems and folks are working hard. We have to consider human performance in what we do. We have to advocate for a just culture. We want people to admit mistakes. We want people to come forward when they find problems and not to be scared. And this requires a lot more disclosure by the industry. At WECC, there are several tools we have to influence the industry. Melanie Fly, who leads our reliability assessment forms analysis also has in addition to those two, situational awareness of that

analysis and there is so much information that can be shared and under her leadership, a lot is happening there.

When we talk about compliance, we have to drive that fear out. As a regulatory body, we are fairly young, 7, 8 years, started what many would say as very heavy-handed. Everything is a Federal case and everything is a fine. We have come a long way there. We have to have a clear distinction between what is a deviation because of human performance, because of lapses in management that occur, not by any intentional fault, and by those things that are clearly malicious if you will. If something bad happens, you don't need to worry about WECC, you need to worry about the Department of Justice and a massive mine explosion is an example of that. We can be a smarter regulator.

One of the things we have to keep in mind is the rapidly changing technology is a challenge for regulators. Because technology will always far outpace the ability of a regulator to make new standards. And if those standards are too prescriptive, it may lock them into things that really cause a lot of problem at how they comply, because we do want more than the minimum. Finally, we need to be a fair and just regulator. We don't want your money. We have to consider all the facts and circumstances and give you due credit for cooperation. We'd rather you invest in your own systems to go above and beyond mitigating the violation. At a technical conference on the state of the electrical reliability organization in 2014, two FERC Commissioners basically made the statement that we are not in the business of generating revenue. And with that I'll turn it back to the Moderator and look forward to discussion. Thanks.

CHRIS KELLEY: Thank you. Tim?

TIM ROXEY: On behalf of the North American Electric Reliability Corporation, I'm thankful to be able to participate in this first of the second initial QERs. And I look forward to offering some remarks on their behalf. Cybersecurity is a constant and evolving threat. It is something that you really can't even come to grips with entirely in its totality. NERC continues to lead a multifaceted approach through enhancing cybersecurity through mandatory standards, improved information sharing through the electricity information sharing and analysis center and exercises to increase learning about threats and vulnerabilities. NERC has worked closely

with our private and public sector partners including the Departments of Energy, Department of Homeland Security, our Federal Energy Regulatory Commission friends, as well as many others around the world. NERC a private non-profit corporation founded in 1968 to develop voluntary operating and planning standards for users, owners and operators of the North American bulk power system. FERC, we are young - FERC certified NERC as the electricity reliability organization at ERO in 2006. In 2007, one year later, FERC approved the initial set of reliability standards. These reliability standards became mandatory in the United States in 2007. The first set of cybersecurity standards were approved by NERC's Board in 2009. NERC's area of responsibilities spans the Continental United States, Canada and northern portions of Baja, Mexico in an area which serves 334 million people. The E-ISAC also supports Alaska, Hawaii and other territories. So larger than just the NERC footprint. The North American BPS is among the nation's most critical infrastructures, as we heard on multiple panels. And the BPS is also one of the largest most complex systems ever created. It is robust and highly reliable. Nevertheless, conventional and nonconventional factors do present risks to the BPS. Therefore, assuring liability, mitigating risks and preparing for recovery and restoration of the BPS service is a vital concern. Cyber Security is a constant involving threat requiring diverse defense strategies. NERC continues to facilitate the implementation of critical infrastructure protection version 5 now, and work continues on implementing the first physical security standards, CIP 14. The first to requirement that became enforceable last year in October. Standards are but one piece of a comprehensive approach. The threat of cyber and physical attack on a grid by nation states terrorist groups and others criminal actors, are bad, they are not stupid, as you say. That's very true. Is at an all-time high and challenges will continue. NERC's E-ISAC is an essential information sharing hub which provides situational awareness, incident management, coordination and communication capabilities within the electric sector. These efforts are complimented by research and technology developed by DOE's national laboratories and this work significantly helped to promote computer to computer monitoring and information exchange. The E-ISAC is the leading source for voluntary information sharing for many in the electric sector, it gathers information from electricity industry participants across North America and shares that information with other electric industry participants and key governmental industries and entities. Governmental entities also provide the E-ISAC with information regarding risks,

threats and warnings. The E-ISAC uses a variety of tools and programs and activities to enhance security, such a secure web portal, alerts, exercises and training and education. The E-ISAC portal allows it to reach thousands of industry members and hundreds of organizations across the sector. This portal is the mechanism for industry and government contact E-ISAC staff with questions, concerns and security related information in a secure manner. The ESCC, Electricity Subsector Coordinating Council, a CEO led senior policy level body, has called for the E-ISAC to be the central source of information sharing between the electricity sub sector and the government. This support for the E-ISAC's role in information sharing has led to increased awareness and improved communications on its operations and performance initiatives. Along with standards and information sharing, NERC's grid security conference and grid X, a continent-wide exercise for participants across North America provides important forums for education and training on key security issues and provides input for lessons learned. More than 4,400 individuals from 364 industries, law enforcement and government organizations across North America participated in this past grid X. A key component of NERC's ongoing effort in the enhanced security posture of the North American grid, before and after an event happens. To ensure reliability and security of North American grid, we must remain focused on trends and changing risk landscapes. Physical security threats, among other events; an April 2013 attack against a California substation, raised concerns about physical attacks. It is important to note that the attack did not result in the power outage. In fact, no customers lost service. NERC's physical security standard zip014 requires users, owners and operators of the bulk power system facilities to conduct a risk assessment and identify critical facilities.

Cybersecurity threats since 2007, NERC has updated its standards to reflect the changing cybersecurity landscape. The fifth version is going into force now. Effective July 1 - it has been changed. Cyber-attacks on three distribution utilities in Ukraine -- I can get into this later if there are questions on it. 2013 has garnered significant attention, that was three distribution level company's outages were manually initiated by remote adversaries, 225,000 customers were plunged into darkness. Lasted for about six hours. More later in the Q&A.

We also work in International communities. The International ERO model supports and facilitates North America to include Canada and the pieces of Mexico. And I'll hold off for questions.

CHRIS KELLEY: Thank you. And finally Phil.

PHIL JONES: Thank you. And thanks to DOE for putting this together today. It's always good to come down to Salt Lake City and participate in an event like this.

I think I'll start by just reinforcing what Melanie put up on the slide deck, the quote from admiral Mike Rogers. Let's just read that again. He said, “There should not be any doubt in our minds that there are groups out there that have the capability to shut down, forestall our ability to operate our basic infrastructure, whether it is generating power or moving water or fuel.” So that is the challenge that we have. And I think the previous four speakers have talked about a very dynamic threat environment out there. It is very dynamics. It's complex. The Malware that is being offered on the Internet is getting cheaper, better, all the time. The ability to look at physical attacks on some of our most important critical infrastructure is getting better. The bad guys consist of various groups. We can get into that in Q&A. So I think it is really important for The Department of Energy and the QER to point that out. Chapter 2 in the QER sets forth a good framework and talks about four things: Reliability, that's what Mike does traditionally at WECC. But we are beyond that, safety, safety of your workers, safety in constructing infrastructure. Security and then resilience. And as past President of NARUC-- I made cybersecurity my theme. Three years ago, I have giving talks and engaging a lot of people on that and just let me offer a few general comments and a few specific ones. I think we are making progress as Michael Ball said. Utilities are making strides. There is a lack of consistent application across all utilities. In the West, we have issues with wildfires. I see the Commissioner Florio in the audience from California. We all remember the San Diego gas and electric in southern California. The most terrible forest fires. I had terrible forest fires in central Washington last year. I would posit that with more extreme weather, we will have more variability in temperatures and weather and we will see more wildfires in the West. So, let's start planning for that. It's not just all cyber.

As Michael Ball said, or somebody else, and I think Admiral Rogers hints at this, the bad guys are pretty darn good and getting better. They are already in the systems. Some of the systems we have. So over the past 2-3 years, the focus should be on getting them out of the system, neutralizing them and resiliency. So I'm going to talk a little bit more about resiliency today because we need to build resilient systems and Commissioners like me, have to be open to the possibility of putting perhaps more assets into the system that aren't immediately used and useful or prudent by our normal standards but it's things we need to look at. We in the State of Washington and our staff have been looking at the issue for several years. So, what are some of the key issues for the utilities? That I think are important? Board involvement is one. We need to get the corporate Directors and the board involvement of the IOUs more involved in this. And for the PUDs and your elected Commissioners, need to get more involved. Second, employee education is really critical. If you look at the attacks in the Ukraine or there was a simulated attack in Hamish County PUD, in my state done by the National Guard. Here is how they got in - phishing. We offer 100 dollar or 200-dollar certificate for a little thing. It's amazing how many people still click on that. So the utilities need to continue their efforts to train people on this but it is not easy. It's human nature to want goodies and want good things and click on something.

Supply chain is third. Supply chain management. Really difficult. We are making progress. FERC has a technical workshop but we need to do better on supply chain management. Fourth, big verses small as Jim Robb mentioned this morning. We have a lot of small utilities in the Western Interconnection. Many are consumer-owned. These guys cannot afford to hire a highly-paid and believe me, people are getting paid more and more in cybersecurity these days. It's a hot profession. So they cannot afford to hire a full-time security person, so what do you do as a state Commissioner or a U.S. Federal Government official or WECC? I mean, is cyber hygiene a common good? Is keeping the lights on a common good? Well, how do we help these small utilities? Who pays for it? What is the governance model? These are not easy issues.

And the last thing I'm going say, I'm going reinforce what Jim said this morning for DOE. Take the lessons learned from the grid X 3 exercise that NERC wrote. I sat in on those. I sat in on two black sky exercises in the period of two months. I became very depressed. It's not fun

sitting through exercises where millions of peopling are migrating from the major cities, there are major public health outbreaks. We can't get large-scale transformers in. It's not fun. But, it's good to go through these exercises and shame on us if we don't take those lessons and take some of those lessons learned. Not just you and the Federal Government. We at the state agencies. The state of Washington and California, sometimes we have too many state agencies trying to do the same thing and we need to coordinate better. We need to get our Governors involved and our National Guard involved. So these are complex issues. I think we are making progress but we still have a lot to do.

CHRIS KELLEY: Thank you. So, we'll now turn to the questions. So let's start off with something that I heard you underscore Phil, just now, but Michael brought it up as well, and that's the concept of the supply chain and security in the supply chain. And this just a question for everybody and Michael and Phil you can expand on this if you like. But you mentioned protecting or the need for suppliers to ensure security that is built into systems from the outset. And this supply chain assurance to ensure that all systems and components that go on all on the grid are secure. Is your sense that the vendors are taking this seriously? Are they providing you with quality secure products? Anyone want to address that.

PHIL JONES: Sure. I'll start. I'll say a few things. We have a lot of software companies in my state, Microsoft in particular. I visited their cybercrime center several times and talked with their people. There are a lot of concerns about going to the cloud. Microsoft, Amazon, everybody is pushing utilities to the cloud. I don't want to talk about those issues but I think Microsoft, some of the software vendors have good, common basic standards. So what we do at the Washington State Commission, is our staff reviews the cybersecurity plans of all the utilities every year and we look at contract language in the RFPs and we look at things like is cybersecurity being considered, et cetera?

My final thought on this and I'd like to hear from my co-panelists, I think technology is changing so rapidly and FERC did a great job on a technical workshop on this and I don't know where FERC is going to end up on this, but I don't think mandatory prescriptive standards are the way to go right now just because technology is moving so quickly.

CHRIS KELLEY: Thank you. Michael?

MICHAEL BALL: So just to expand on the topic a little bit. One of the things that I think we are going to struggle with for some time is supply chain risk. Because if you look at the manufacturing chain, the components that are required through many different sources, the integrity of those systems are in question. So I think we are going to be taking measured steps improve that. What we can do today though, there is a very good document funded by the Department of Energy that is procurement guide for industrial control systems just if you look at it, it actually does a really good job of outlining the entire acquisition chain when you are bringing it into the control system. So meaning that you want to set very clear expectations upfront when you go with your vendors. You want to make sure have you good design criteria. Make sure that you have good testing criteria. Ultimately what you want to do is when you bring these assets into play in the organization, you want to have assurances to the greatest extent you can, that these security integrity of the systems is intact.

Then the next question is, how do you maintain that? So contractually you really you want to make sure that we are building in the appropriate level contractual terms but what about if there is breaches of the third party? What if there is integrity issues we need to be aware of? Can we build those into our contracts? Build that expectation with the vendors upfront? What we expect in those relationships. I think they are waking up. I think some of the vendors are really taking it seriously. Some have a long way to go.

CHRIS KELLEY: Thank you. Mark?

MARK GABRIEL: One of the things that we face, what I will call real world vendor challenges, and that is when you look at where equipment is manufactured or the chips that are in the equipment that is manufactured, is very hard to trace the lineage back to make sure that a given chip in a piece of hardware has not somehow been dealt with. I mentioned transformers and I don't want to sound like a one-note singer here but for example right now we are forced by law to buy the least expensive transformer that fits our spec. The chance of that being manufactured in the United States is less than 1 in 10, let's say. And even the manufacturers in the United States are connected to other countries and I don't want to sound like a jingoistic here, but when we are talking about supply chain sanctity, it's very challenging when we are

ordering transformers from China, forgetting the logistics and time and all the other issues, but I'm not sure that we understand yet what are the long term implications of having hardware manufactured in other countries, which may or may not meet our standards either technically or certainly from the cyber perspective.

CHRIS KELLEY: Thank you. Mike?

MIKE MOON: From a regulatory point of view, I tend to agree with the Commissioner Jones. We have got to be very careful because our mandate is reliability and security both power system and we have to be careful not to get into business practices, commercial endeavors; if you look at contract and procurement, those are whole fields of expertise and competency that take years and to have to oversee something like that, it's not something I believe the Federal Government or even us through the ERO could do any time soon in an effective way. Information sharing collaboration reaching higher levels. I do know several of the large relay manufacturers, component manufacturers, do take this seriously. Are working hard on their part of it. Thanks.

CHRIS KELLEY: Thank you.

TIM ROXEY: I want to point out something that we didn't talk about yet but it's pretty obvious to me. That software if you write a software specification requirements document to go buy something in the supply chain, if the software that is implementing that thing is beyond 20-50,000 lines of code, then it is technically impossible with our current level of understanding and relationships of this type, for you to do a 100% verification validation of that code. Most code sits in the 10-15-20 million line per thing range, operating systems can be very, very large. So, the guidance that was given, the Department of Energy's industrial control system procurement guideline language is very, very good. Homeland Security has a counterpart document to that. National Labs, if you're suspicious about something, ask through one of your National Labs contacts to actually have it tested at a National Lab. They will run a fantastic array of tests against it to try to shake it down to see if they can break it and they pretty much have broken just about everything so far.

CHRIS KELLEY: So, I heard a fair amount on the role of government here in this space but I just want to expand to that a little bit. So given that some of the threats mentioned in your opening remarks are presented by foreign states for instance, is there a national security imperative to support and regulate cybersecurity for grids and do you see an increased role for Federal Government as a result? It could be a can of worms here.

MICHAEL BALL: I'll bite. So I don't know if it will answer directly, but I think what we are really -- there is a role at a national level. If we look at grid X and look at the complexities of a national level crisis, how do we manage this? I think it was brought up earlier in a very poignant point. The fact, who will we structure ourselves to deal with something like that and set priorities? I think if you deal with a national event, as a utility or individual utility, my mission is to restore the services to our customers as effectively and efficiently as possible. Is that the same mission if we are dealing with a national level? Is that -- how do those dynamics works and who is responsible to help us manage through that? So we have to explore that. I don't think the answer is clear. I think we see indicators of efforts to start to look at this but if we have a very significant event at a national level, there is clearly going to be a role at the national agencies at play. We need to understand what that is.

CHRIS KELLEY: Thank you. Other comments?

PHIL JONES: Sure. Phil Jones again. I'll say something here. I believe in state's rights and I believe that local is sometimes better than going through the grid X3 exercise, the most severe part of the exercise, believe me, by the end of that day with the bulk electric system down, a lot of the restoration of power was happening at the state and local level. So the role of the RTOs and the bulk electric system was useless, frankly. So, my point to you is, it's not Federal or state. It's a partnership and it's really difficult to get right because there is so many potential actors. I like Mark Gabriel's idea on the strategic petroleum reserve type thing for transformers for large-scale transformers. I think that is something that Congress should take up and review. I think that is really important, but that would only be really critical in a very severe attack that probably has a nation state behind it. So you have to look at the nature of the attack; is it activist? A nuisance type thing? Can it be handled at a relatively low to medium level? Or is it going to be a very severe level? The problem is, as many of us who have been through table

top exercises, is the game of attribution, whether it is Malware or even physical attack. And getting that attribution right quickly with information that is actionable within 24 hours, is very difficult. So, the longer it goes on, the more national security implications it might have, because it cascades into other grids and so your question is kind of a simple one, it sounds simple, but the implementation and response to it is quite nuanced.

CHRIS KELLEY: Tim, did you have a comment?

TIM ROXEY: If you can imagine a try angle, the base of the triangle is literally the regulatory environment, whether it is a NIST guideline or a move in the government or NERC6 or a different WECC from Europe, a set of standards. They are all standards and good practices and guidelines. The slab above that, those are all baseline risk controls by the way, and I think government has a beautiful responsibility and obligation to really get those as well as they possibly can. I think we do a really good job at that. And we change them as things change. The slab above that is the information sharing and analytic function which is also a joint partnership between government and private sector. Private sector actually does understand how this grid works on a millisecond basis very, very, very well. The vendor community does as well. Government understands big muscle movements. So when you get to the third layer of that little four-layer triangle, that's where the government steps in. You saw that in grid X3. When do you choose to execute posse comitatus? How does the Stafford Act help a private company? Not so much. It does help the state. So maybe we need a posse comitatus for the private sector to be defended and maybe a different kind of a Stafford Act for something that can actually come down to the local to help them. Lots and lots of public/private partnerships. The electricity subsector coordinating council, fantastic, Senior Executive, 30 CEOs very, very high level policy discussions. When an issue comes up through the regulations, we have done everything we can, something still going wrong, we are drying all the surge controls. Now we get to the governmental controls and above that it's the multi-guilt governmental controls. So the information sharing among the friendly five eyes, variety of other avenues in which information is shared, making sure you take with you your subject matter experts that will tell you what will happen when you do that. That is critical. So partnerships are very, very key and there is definitely a part to play on both sides of that to improve those going forward.

CHRIS KELLEY: Thank you. Mark?

MARK GABRIEL: I'm not sure we need any more rules or regulations from a governmental perspective, but the one area that I have seen up close and personal in the three years that I have been in this job, is the vast intelligence gathering resources that can be applied to the industry. My biggest challenge every day however, is what I consider to be the weak link of information sharing. We are dealing with a commodity that moves at the speed of light and getting information that moves at the speed of weeks. Weeks and weeks to get quality data that is actionable right now. And again I get to see both sides because we are obviously involved with all the industry information sharing. That is so ponderously slow as to be useless. And it's no offense to Tim and all the folks who work hard. Because they have a very valuable role, but if I see a place where our government can really interlink with the private sector and all of us in the industry is getting us information that we can act on right away. I can find out when North Korea launches a missile in 12 minutes. It's all public no, so we can talk about it. 12 minutes later I had an e-mail that gave me all the details. A year ago when they had the disaster where in West Virginia where the oil tanker fell over, I had a map and photographs and everything, in 16 minutes. When a neighboring utility has a break-in at their substation, it takes two weeks to a month for me to get the following e-mail. Shots were fired somewhere at a substation, somewhere in the southwest. Does not help me. It's like telling me increasing darkness towards evening. So if there is one place that we can really lean into, it's to lean on the government and get the industry to link better to get us information that is real time. Because it is a safety issue. It's a reliability issue and a resilience issue.

CHRIS KELLEY: Thank you. Mike.

MIKE MOON: I definitely agree the government has a role to play in facilitating information sharing and also supporting innovation to stay ahead of the bad guys. Regulation by its very nature is reactive. It's simply a reactive construct. Rules and regulations. If you look at CIP 14 that Tim mentioned, one attack, one event should not be the cause of a major new rule or regulation, in my opinion. If you look at this analytically with information and you do that analysis, and then you bounce it against the cost effectiveness, we have got to be smarter and we have to be ahead and not be reactive. Thanks.

CHRIS KELLEY: Thank you. So now I'd like to turn to the subject of the cost for all of this. So, we heard on the earlier panels, struggles around rate cases and building in cost. There is obviously a cost associated with ensuring security. In your opinion, based on your backgrounds, who should bear that cost? Something that needs to be just built into rate structures? Something that should be addressed at different levels? Phil it looks like you're ready to answer.

PHIL JONES: For some reason everybody turns to the regulator.

CHRIS KELLEY: You waved your hand.

PHIL JONES: I'll go first. First of all, let me say at the outset, if we define this as a national security problem, very severe threat as Tim said, we are going up the chain and we think a nation state is involved, I would pause it again that we should consider taxpayer-funded assets like a strategic transformer reserve. We should put that on the table and have a good healthy debate about it. Why should the electric rate payers, whether they be co-ops or IOUs, bear all that burden? Regarding IOUs because I know them the best, that's what I regulate. I think there are 3-4 states that have some sort of a rider mechanism already for resiliency investments. I think that is in the QER. I think it's New Hampshire, Connecticut and a few states like that. So that is good. In my state we haven't seen any big requests by the three utilities including Michaels's that I regulate. We haven't had big requests for redundant IT and server buildings. If the IT system were infected, we haven't had any big requests for large power transformers. So, again, we review that informally. We haven't come up with mandatory rules, but I think we are fairly comfortable with that. And then the last thing I would say is that after Hurricane Sandy, those states in the Mid-Atlantic area in New Jersey and New York and Connecticut, all of them if you look at what they funded, and again that's not a cyber-attack, that was a physical -- that was a natural disaster. Billions of dollars. Hundreds of millions and billions of dollars have been spent and put into rate base. You can other rate base this and earn a return on it and a return off or you can have a tracker or some sort of deferred accounting mechanism where you get a return of the expense without an equity return on it. So there are various ways, there are a lot of tools in the toolbox that commissions do. What I'm urging all of my colleagues to do is have workshops, come up with a policy statement and general guidance for the utilities so

when they file, there is a reasonable assurance that the Commissions have some basic principles on this.

CHRIS KELLEY: Michael?

MICHAEL BALL: Maybe to build off of what Phil was talking about is I think there are very certain circumstances where there could be very large costs, security-based investments. But I have to say that by-and-large, most of our security-based investments are embedded in the technologies we deploy. If we are doing the right job, when a project comes up to deploy, whether a new control system or whether a new set of assets, we need to embed the security design and principle in the project itself. So that is where those costs tend to be. Link those costs to those assets. So that is how we are able -- this is the way we do our business. And therefore we are not in a position where we are going to ask for a specific. So I think that is important. Just our costs should be -- by-and-large security costs should be embedded in your investments cycle.

CHRIS KELLEY: Mark?

MARK GABRIEL: We have taken a very specific approach. I mentioned we have 320 substations. We go through somewhere between 65-75 per year and do an analysis on what needs to happen on the physical side. Some of this is what I call the dumb, easy stuff. And I'll give you one that is right out of our report. We have keys for substation that is did not say, “do not duplicate”. I'm serious. Now that sounds silly, but there is certain good hygiene that you do whether it is on the cyber side or physical side. We then look forward to make sure that the design criteria on both physical and cyber takes into account the new challenges. So, it's a lot cheaper when we are putting up a substation or redeveloping a substation to put in no cut, no climb fencing as opposed to ripping down the old fencing and adding it again in an existing project. Some of these things I think are just good business as Michael said. Creating secure enclaves for the SCADA system is one approach we have taken. From a cost perspective, it would be no different than my five regions each doing their own cyber work around the SCADA system. I'd argue we will do this cheaper because the way we are taking a look at this. And another piece which is really critical and that's training. Good cyber hygiene, good physical security hygiene requires training. And just as somebody said, 100 dollars to get you

phishing attack, we see this all the time. All the free zip drives that are given out at the trade shows that our folks go to. Things that are very simple but -- so I think a component that is relatively in expenses are around training and design and doing the dumb, easy stuff.

CHRIS KELLEY: Thank you. Mike?

MIKE MOON: A couple of points. In terms of cost, I'll let lots of other folks figure that out, but I would tell you regulatory-wise, the more prescriptive and control based your standards, typically the more focused that an entity's management practice has to be, unties their hands as opposed to being innovative. The standards that we have now are very controls based and very prescriptive. If you're a bad guy and you want to plan an attack, the first place you look is what do they have to do? Let me find the gaps and seams. So can we think of a way to do regulation that allows levels of flexibility in innovation to stay ahead of that threat? And that is hard to do because as we talked about human performance, the phishing attacks, the education of your workforce, how do you regulate that? And so I think that is critical. We have got too think about how we allow some flexibility for entities to use their own business practices, management practices, stay ahead of the ball game and meet some performance standards as opposed to real prescriptive standards that the bad guy can figure out real quick.

CHRIS KELLEY: Thank you. Can we turn to give Tim a chance before we go back to you?

TIM ROXEY: I'm good.

PHIL JONES: Tim is not a cost guy. If I could just follow-up with two things that were triggered here. First, we have really been pushing our regulated utilities to ban all flash drives, and removable media from their business practices. And I think all three of ours have. So, but it is a tough culture change in these companies because everybody has gotten used to removable media. The other thing I'll say is some of the more advanced utilities that I regulate are going to two-factor authentication for log-ins and passwords not only just remotely, but even in the company. We could go on and on about how even two factor authentication passwords probably five years from now will be outdated, but today I think it's a good security practice.

CHRIS KELLEY: Thank you. We spent a lot of time talking about cybersecurity. I heard a few folks mention resilience at large. I want to just sort of broaden it up a little bit and talk about that. So, is your sense that enough is being done for overall resilience regardless of the threat factor? Can you expand on how overall resilience is factored into new projects or operations? Or regulations that you have purview over? A general question about resilience. Anyone care to take it? Mark.

MARK GABRIEL: We, like a lot of utilities, are faced with critical infrastructure. We have 320 substations, fortunately only around 6 or 8 of them are in the top category, but my sense is that pretty soon Tim will be telling us it is the next 15-20. Just kidding a little bit there. And so, what we have to understand for the resiliency, you have got several options. You can build an additional substation, let's say, or put in more equipment so you take the substation down from the criticality that it faces. So that is really important. The second thing really comes down to what I think the industry does very, very well, which are industry partnerships. We know darn well how to reroute power and how to manage the system to make it more resilient. And I guess the third component and this is going to be a hard one for everybody and with all the new technologies coming on to the system, is there a way to manage it much in the way we think about the cloud for all of our devices? I see iPads in the audience. We have laptops, we have cell phones. We have a whole array of tools that we access this mysterious thing called the internet and over time, we have to going out how do we turn the grid into a more flexible tool so that it increases its resilience and if we take out one node we are not crippling the entire system. That the will require a lot of cooperation across the industry. We do it pretty well today. But we'll have to kick it into high gear out in the future.

CHRIS KELLEY: Thank you. Michael. Did you have anything?

MICHAEL BALL: Sure. When we talk about resilience, stepping back, stepping back from the cybersecurity topic, I think it means many things. And the way I would characterize in our industry, it's really about making sure that obviously we try to protect our assets. We want to minimize the likelihood of something happening to disrupt that service. But just as important is how do we respond? How do we detect when we have something that we need to react to and how quickly and efficiently do we do that? The tighter those things are together, the more

effective we are in having a resilient system. And I think that is important as it builds into our crisis management plan. So, whether it be a physical event or cyber event, and I think our industry is well poised in this. We have crisis management plans at the company level and how we integrate that. To me, it is resilience is a story of how quickly can we respond back to normalcy? And I think we have a lot of good things in play and obviously more to do as we explore more complex scenarios. I think we have a good blueprint. Thank you.

CHRIS KELLEY: Thank you. Who wants to go? Tim?

TIM ROXEY: So another drawing. It's a straight line left and right with the boom in the middle. Some statistics before I talk about resiliency is the left-hand side is where you protect and prevent. Do you everything you possibly can. We talked about it. There is training opportunities. There is opportunities for the Federal taxpayer like Phil was talking about picking up some of the costs associated with that side. The detect, this is the part that we are terrible at as humans. We are terrible, terrible, terrible at this. And we are also terrible at this technologically speaking and respond and mitigate. Responding and mitigation are the strong suit of the bulk power system. We are extremely good at putting our systems back together. Don't always get it back to the same normal. We have introduced a concept through the grid X series of new normal. But we get it back as close as we possibly can, as quickly as we possibly can and I don't think anyone would deny that. Now for the detect. On an information technology side of our house, the statistics are not very good. Usually it's something like 200 plus days before the person got into your system, before you detected it and usually it was when they did something silly like knock over a box or do something very noisy. That is just the way it is. So why aren't you in your emergency response plan now? Why aren't you dealing with mitigation and response, knowing that if you looked hard you might find something? Well, it's a whole spectrum. We do exercises as part of the CIP requirements, that baseline foundational risk controls. Grid X is a wonderful exercise to give us unity of message and unity of action. That allows senior Federal officials, senior private sector officials, grid operator folk, people who are asset owner operators, to come in and actually unify their message, unify their action and have a much better response and mitigation. So it is a whole

spectrum across -- and all of these, whether a standard or a mitigation struggle, all of these are part of the resiliency tool bag.

CHRIS KELLEY: Thank you. Phil?

PHIL JONES: We have to do cost benefit analysis at the State Commission in order to put these assets and these costs in the race. And the costs benefit analysis, especially for a black sky or a high consequence, low probability type of event or even for resiliency is difficult. And frankly, our metrics are poor. And DOE has tried with what is called the interruptible cost of -- what is it called? Well ice. The ice calculator. The ice calculator just doesn't cut it for an outage more than four or five days. It's gonna be hard, but it's like this whole cyber security thing, it's hard to project into the future about these high consequence events, but we need to come up with a better way. Maybe the National Labs could help us. Maybe NAROK and DOE coming together could work on a new metric or a series of metrics whereby State Commissions and state policymakers could come to grips with how much resilience do we want to put? How much do we want to pay the rate payers to build resilience into the system for a one in 500 or 1 in 1,000 or 1 in 250-year event?

CHRIS KELLEY: Thank you. Mike?

MIKE MOON: I'd like to bring back two points I made. One is: How do you protect the industry when they share information? When they are learning? All these things you can learn from. That is really critical. One of the biggest programs that could really go even further than it is, the event analysis program and ERO. The more we identify the little things, the near misses, again if we use the Federal Aviation Administration, the aviation safety reporting system, ASRS, where just a multitude of data is used to identify little problems before they become big. That allows the FAA to have reached unparalleled levels in commercial airline safety, because they are always learning from even the littlest things. Something as simple as that type of near miss database. Again that is about keeping ahead. The ability of a bad guy and our ability to react is only limited by imagination. And so, the more we can learn from every single little event and give industry credit when they share that information, will go a long way to help them there.

CHRIS KELLEY: Thank you. So with that, I'll turn to our final comments so just as with the other panels, I'll give you all a chance to sum up your points. If you like to add any new points, you have got a couple of minutes apiece and we'll start right here with Mark.

MARK GABRIEL: Great. Thank you. I just have four quick points. One is I want to edit Mike Moon's comment. Data sharing is hard. And I think that is something that we have to get over as an industry and certainly the timeliness of that data sharing right now seems at least from our perspective, to be pretty impossible. The second thing around both good hygiene and what I call the spirit of compliance. The folks who work with me at Western know they hear me talk about that all the time. We cannot regulate our way into a more cyber or a better cyber position, we can't regulate our way into a better physical security position. We can use those as the minimum standards and figure out what is the spirit of how we are going to operate out into the future? The third piece which I think is important is, at Western, they hear me talk about that all the time. We cannot regulate our way into a more cyber, a better cyber position and we can’t regulate our way into a better physical security position. We can use those as the minimum standards and figure out what is the spirit of how we are going to operate out into the future. The third piece, which I think is important, is at Western and certainly across the entire industry, we have to stay focused and have a robust activity in this era of change and that is really challenging. We have to work with our customers and the end customers to educate folks because we want to keep the cost low, but at the same time we don't want to leave the door open for challenges. And my last point is really important and I think that we have to look forward. We cannot solve this problem by looking backwards and saying gee, the attack in whatever country happened with some piece of software. We have to understand that the robustness of our system is going to be built by future. So that means we need new technologies and new tools and we have to figure out what is the challenge for the future as opposed to trying to fight the war from last time. It's not going to help us as an industry.

CHRIS KELLEY: Thank you. Michael.

MICHAEL BALL: So just to sum up. We covered a lot of topics today. But I think we just certainly scratched the surface. When we look at very complex and advanced scenarios which are the ones that scare us the most, it is easy to get paralyzed by the issues that are around that.

I think the only thing we can do is to take meaningful step forwards. We covered a couple of key topics that will help us in doing that. One is working beyond our silos. The ability to work with our peers and with the industry. To share information, to enable ourselves to be more rapidly responsive in an actionable way to issues that face us. So I think that will be the important. So thinking beyond the silos. Strengthen the public-private sector relationships. I think the things we are seeing through things like activities that ESCC, working at a national level and looking at policy issues and driving our industry forward is going to be a central part of that at the very top levels of our organization. So, look forward to being a partner in that and participating in advance.

CHRIS KELLEY: Thank you. Mike.

MIKE MOON: We can and we should and we have to collaborate across all the forums, regulator, regulated, various vendors. That's critical. When we look at the regulatory construct, I tell a lot of executives, you have a responsibility to demonstrate compliance. We have an obligation to determine reasonable assurance. And we have to keep in mind mistakes happen. Things happen. Material fails. People make mistakes. And we have to treat people accordingly in terms of that philosophy. A civil system versus a criminal. If it's a criminal system, you don't have to worry about us, maybe DOJ. Together, we really got to understand the risks, the threats and vulnerabilities and we have to be proactive about how we move forward and it gets back to information sharing and giving the industry credit when the they do that and protecting them instead of going after them.

CHRIS KELLEY: Thank you. Tim?

TIM ROXEY: So the part that I didn't get to because of the red light, NERC's efforts provide a strong approach to cyber and physical security and resiliency however, our standards remain the foundation upon which a strategic approach to address these threats begins not ends. Going forward, there will be a continuing need to rapidly expand automated monitoring, assessment and mitigation, support for coordination among the North American grid on security matters is key. Barriers to information sharing caused by excessive classification of information must be removed. Recent legislation providing emergency authority to DOE was an important addition to the security framework. DOE's continued participation and support for the work of NERC,

E-ISAC and ESCC in securing matters, is needed to further expand and enhance sector and cross sector coordination. Thank you very much for the opportunity to speak.

CHRIS KELLEY: Thank you. Finally, Phil?

PHIL JONES: I'll reinforce some of the comments of my co-panelists, but as I said earlier, I think is just as much a people challenge as a SCADA or IT challenge. So working with the boards, the corporate officers as well as all of the employees of the utilities is of critical importance. States and Federal authorities need to work with the utilities, I would agree with Mike Moon. This is more of a collaborative effort than a confrontational rate, recovery type, where we are often at odds with our utilities. This is truly collaborative. But we need to figure out our swim lanes. Sometimes we have too many people trying to swim in the same lane, whether state or Federal and each branch of government needs to do its best to figure that out. And lastly, I said it earlier, grid X3 was a very good exercise. I cannot commend you enough Tim, for that exercise. It's done every three years. Every two years. So every two years, we should not do the exercise, go home and forget about lessons learned. So I think if maybe DOE could help fund some activities with states, National Guard, Governors, along with the Federal agencies and utilities, that would be a great help.

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

[Applause]

Public Comment Period

As they move away from the podium we turn to the last part of our meeting. The public comments period. We will have members of the QER Task Force join me up here on stage to receive some comments. So if you haven't already signed up, once again, I just want to remind folks, please do sign up at the entrance if you would like to provide comments. Once again, those that are watching via the live stream, you can submit your comments at www.energy.gov/QER. So I'm joined up here by Larry **Mansueti**, Matt McGovern, John

Richards and Karen Wayland, who you met earlier today. So Karen is going to give a few remarks before we start.

KAREN WAYLAND: I want to reiterate what I said before, which is that we had some very interesting panel discussions here, but the public comment is as important to us as these sort of sit on the dais, and have your name on a card. We have a number of ways that the public can provide input to us and this open mic session is one of them. Also as Chris mentioned, upload your comments to us at energy.gov/QER. There is a web-based form. Click on it and type in comments or upload reports, data, other documents. And we encourage you to do that. Do that as often as you like. The public comment period ends on July 1. So, I hope that we have -- I think we have one person signed up for when they came in this morning but if there are other people who would like to make comments today, reactions, recommendations insights, we will welcome them. I'm going to turn it back to Chris to run that comment period.

CHRIS KELLEY: So for those providing comments, we have a couple of microphones positioned in the room here. You will have five minutes to provide your comments and the colored lights just like the panelists, you'll be able to see that up front here when the red light comes on, that means your five minutes are up. So, the only person we have signed up right now is John from the Idaho Governor's office. John, did I not – you can announce your name and correct my mispronunciation.

JOHN CHATBURN: That's fine. I'm John Chatburn with the Idaho Governor's Office of Energy Resources. And I just wanted to stress, I guess, the transmission side of what the discussions were today. We can do any number of things when it comes to planning for the transmission system. But in particular here in the West, because of the, some would say over abundance of Federally managed land, if we aren't able to get transmission lines sighted and constructed across Federal lands, all the planning we do ends up in documents or sits on shelves. I would strongly encourage that the Federal agencies get-together and attempt to look for places within the regulations that can be streamlined. Occasionally, from time to time people talk about wanting to redo some of the acts. I don't know that that is feasible at all. But, let's look for things in the regulations that slow us down, that are redundant, where we can do a more timely job on the siding of transmission lines. And I'll give you two examples: We have

two high-priority, Presidential priority. Our RT team transmission line project that go into or through Idaho. In both cases, we have Federal agencies to one extent or another that have the potential to, we are going to hope that they don't, on the one hand, we have Federal agency that their draft DIS has totally ignored the most scientific and environmentally responsible route for the transmission line, in favor of being in compliance with a recently released one-size fits all guidance document. On the other hand, we have an agency that it appears that might be somewhat reluctant to participate with the sighting of the line even though it has been determined that there are no operational constraints for that agency with the landing site in both cases. The two routes, three routes actually, but the routes, are strongly supported by the states, by the local jurisdictions, by the local citizens, and by the local NGOs and by the state NGOs. There has been some opposition from some national NGOs. And when Washington, D.C. listens to national NGOs rather than looking at the science and listening to the folks on the ground including their own on the ground Federal agency employees, we have got problems. And if somehow you all can bring the administration at large together so we can address these problems and move forward, it would be greatly appreciated. Thank you.

CHRIS KELLEY: Thank you. So John was the only person that signed up. Do we have anyone else who would like to provide public comments? Going once, going twice. Okay. With that, this concludes our meeting. Thank you all for attending. Our next meeting is scheduled for Des Moines, Iowa on May 6. Thank you.

[Applause]