Quadrennial Energy Review
Second Installment
Electricity: Generation to End Use
Stakeholder Meeting #7
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Opening Remarks

>> CHRIS KELLEY: Good morning. I'd like to welcome you to the 7th Public Meeting for the second installment of the Quadrennial Energy Review, focused specifically on the electricity system from generation to end use. Welcome to those of you here in Atlanta on this beautiful Georgia day, at the lovely Georgia Tech Research Institute. I'd also like to welcome those of you who are joining us via the live stream on the web. My name is Chris Kelley with Energetics. We're an energy consulting firm supporting the DOE on this QER effort. I have the distinct honor of being today's facilitator. We'll be hearing from a number of speakers today, but before we get started I'd like to refer to a few housekeeping notes.

First, the QER Task Force welcomes comments from the public. If you wish to make a comment and have not yet signed up at the front of the room please do so now or at any of the brakes that we have here today. And for those who are joining via the live streaming you may commit comments via the web form that can be found at the website. So as I said we have an outstanding set of speakers here today, their comments and presentations can be found after today's session at the same website.

Before we get started. I'd like to read a short statement about the purpose of today's meeting. Pursuant to the Federal advisory can Committee act the purpose of today's meeting is to ask for your individual input or your organization's input regarding electricity from generation to end use and provide a forum to exchange information. To that end it would be most helpful to us for you to provide these recommendations, and information based on your personal experience, your individual advice, information or facts regarding this topic. The object of the session is not to obtain any group position or consensus, rather, the U.S. Department of Energy is seeking as many recommendations as possible from all individuals at this meeting. So with that, allow me to introduce Dr. Karen Wayland. She is the Deputy Director for state, local and travel cooperation at DoE's Office of Energy policy and systems analysis, Dr. Whalen will introduce our next speakers.

>> DR. KAREN WAYLAND: Thank you, Chris, and thank you to Georgia Tech for this wonderful room and for hosting us and thank you for the city of Atlanta for giving us the weather and the welcome here.

You will hear from a number of speakers, including the secretary who will explain in much greater detail why we're all here today, but just a little context. If you're here, you're aware of the very dramatically shifting energy landscape in this country. And as a backdrop, the President directed the administration to do the first ever Quadrennial Energy Review. It's a White House-led effort because there are at least 22 agencies that have some equities in energy. And so this is a department of energy meeting, but we represent the entire administration here.

The stakeholder engagement part of the Quadrennial Energy Review or QER as we call it is a critical part of this process, and that's why we're here since the beginning of this process in January, 2014, this will be our 21st stakeholder meeting around the country. So we're very serious about the input that we're going to get from you today.
So with that, I'd like to turn the podium over to Stephanie Benfield from the Mayor's Office to welcome us.

>> STEPHANIE BENFIELD: Good morning, everyone, on behalf of the Mayor I would like to welcome everyone, especially Secretary Moniz to Atlanta. And thank you all for having this important I vent here.

As some of you know, Atlanta was named last year and we've held onto that title as the number one city in the country for square-footage committed to the better buildings challenge. We also were recently named number four in the country for ENERGY STAR buildings and we were just named an early adopter of spark, which is Department of Energy's solar program.
So we really are doing great things here in Atlanta thanks to the Mayor's leadership and thanks to the incredible support that we get from the Department of Energy. So, thank you, Secretary Moniz, and the others with the Department of Energy. We're very grateful for our partnership with the Department of Energy. And on behalf of the Mayor who sends his sincere regrets for not being here, thank you so much for being here and welcome to Atlanta.

>> DR. KAREN WAYLAND: Thank you, Stephanie. And please give our regards to the Mayor.

Next I'd like to introduce Dr. Tim Lieuwen, the Executive Director of Georgia Tech's Strategic Energy Institute. He is the professor and Davis S. Lewis Junior Chair in the School of Aerospace Engineering. He has also the leads executive position at Turbine Logic, a firm specializing in data analytics which I think we'll actually hear about later today and he's the author of a textbook, as well as a number of other highly regarded publications. So were it that, Dr. Lieuwen.

>> TIM LIEUWEN: Good morning, everyone, it's a real privilege and pleasure for me to welcome all of you to Atlanta and to Georgia Tech on behalf of the 22,000 students here and the over thousand faculty.

As Karen mentioned, my role at Georgia Tech is to serve as the Director of our energy Institute and so in that role I essentially act as the system integrated with the over thousand researchers which consist of faculty and research Fellows and students who are actively working on energy problems across the whole value chain of energy. And actually in that role it's a very special privilege for me to be here with the Secretary of Energy, Dr. Moniz. As many of you know hey formerly the executive Director of the energy Institute at MIT. And I want to say thank you, sir, for your leadership and showing how the great University system in the United States can really contribute to critical energy challenges, as well as thank you for your services to the Department of Energy, as the secretary.

Just want to say a couple things about Georgia Tech, I think many of you will know it, but we are one of the largest Science and Technology focused universities in the United States. In fact, the largest College of Engineering in the United States is at Georgia Tech. We graduate more Georges than anyone else. And one of the unique -- uniquenesses of Georgia Tech is the combination of breadth and depth and quality. For example, our School of Industrial and Systems Engineering is not only the largest school like that in the United States but also consistently ranked the number one school. And that goes across many of our departments which are the top 1 or 2 or 3 both in size as well as in ranking.

And so we're very committed to innovation, so it's -- we're glad to be part of these meetings, innovation across our whole mission space, innovation in education. For example, we have a very highly regarded online Master's Degree in computer science which is really driving a lot of conversations.

We obviously in the R&D space, but then also we're very commit the to innovation in how to do public/private partnerships both with our industrial partners with the Federal Government, were it the state government, with the city of Atlanta. Of and there's a lot of things going on at Georgia Tech, a lot of active experimenting and just one thing that I would highlight to you is tech square which was just recently highlighted in the Harvard Business Review as a national model for how universities can seed innovation districts in this case consisting of a vibrant community consisting of graduate students and faculty and start-ups and large Corporate Innovation Centers.

Lastly just wanted to say something about again what a privilege it is for us to be able to have the opportunity to host this QER, simply because from my perspective Georgia Tech's energy priorities very, very nicely align with the priorities of the QER.

In fact, in many of our areas where we bring distinctive strengths to bear. Just to highlight a few, the area of renewables, particularly photoable. We are working and have national leadership. Natural gas and advanced gas turbines, significant activities in grid modernization with our electricity systems groups, cybersecurity. So again just want to welcome all of you to Georgia Tech and looking forward to being part of this meeting.

(Applause.)

>> DR. KAREN WAYLAND: Thank you, Tim. As I mentioned in the QER is an interagency effort and there are at least 22 agencies that have some sort of equity in energy across the Federal space, but there are only a few that actually have some deep, deep equities, the Department of Energy obviously is one, Department of Interior, Environmental Protection Agency and you might wonder why is there a panelist from the U.S. Department of the Agriculture.

They also have a very deep and I think Georgia may be aware of the deep relationship that the USDA has had with the electricity sector for many, many years, starting from the early 1900s. So with that I'd like to introduce Josh Cohen who is the Deputy Administrator for the U.S. Rural

Utilities Service. Josh was appointed the Deputy Administrator in October, 2015 and before he was at the USDA he served at a number of roles in state and local government, including at the Mayor of Annapolis. So with that I'm going to turn the podium to Josh.

>> JOSH COHEN: Good morning, everyone. Okay. All right.

(Pause.)

>> JOSH COHEN: All right. I think we're all set. First of all, thank you to Secretary Moniz and to the QER team for including USDA in this important review of our energy system, not just a review of where we are but where we're going forward as a nation.

On behalf of our secretary Tom Vilsack and the Undersecretary for Rural Development, it is a pleasure to be here representing the U.S. Rural Utilities Service. So to Karen's first point. Why is USDA even here, and she's -- as she pointed out, since the early 1900s, USDA has had an equity in the electric system. And many of you are familiar with some of the acronyms I'm about to say. But if you go back to rural America, before the New Deal, when the country was getting electrified in urban areas rural America was largely being completely left behind for reasons that are pretty straightforward. Low population density meant low return on investment. There were few large institutional users, the same way that there are in urban areas, and the cost was simply prohibitive, especially if you're talking about a population that was a good deal agricultural and struggling through the Great Depression.

So in 1935, as part of the New Deal FDR created the REA, Rural Electrification Administration. Congress enacted it into law the following year. And so this year we're celebrating the 80th anniversary of the REA. And what REA is, and it's now called rural utility service, essentially what we are is a big lender, we provide loans and grants. Thousands of loans and grants for a variety of purposes but I mean fundamentally we are a financing arm of the U.S. Department of agriculture. Some people have various stereotypes of lenders, especially if you're talking about government lenders and I'd like to tell the story that former Speaker of the House tip O'Neil used to tell when he went to bankers' conventions.

So he story he told about your stereotypical banker was that there's this young couple, recently married. They want to get a starter house, you know, start this next chapter of their lives, so they meet with their local banker, they're very nervous, he says, please, have a seat in front of his desk. Starts grilling them about their credit history, grilling them about their finances, grilling them about what their future plans are. And making it by all accounts incredibly uncomfortable for this nice young couple.

And at the end of his grilling he says: I have one more question, and if you answer this correctly, I'll give you this loan.

So, I lost an eye is what the banker says. So one of my eyes is a glass eye and one's real, if you can tell me which eye is the glass eye, you get the loan.

So, the wife, without missing a beat, says: Your left eye is the glass eye. And the banker says that's exactly right. How did you know that? And she says it's because the only one that had any warmth to it.

(Laughter.)

>> JOSH COHEN: So he liked telling that to bankers' conventions. But that is not how we see ourselves at RUS. We see ourselves as very much a partner with our borrowers, and I'm going to talk a little bit about what we do. As you can see on the slide, we finance all aspects of the rural energy, and rural is the operative word, everything from generation to end-user.
We support our borrowers, many of whom are small electric cooperatives. We support them with technical assistance and engineering review. We finance fossil fuels, we finance energy efficiency, the 2008 farm bill give us that authority and we finance a number of renewables.

Our main financing options are loans, we also do guaranteed loans, as well as we have a small portfolio of high energy cost grants which are direct the grants for communities that have incredibly high fuel costs.

Who do we lend to? Pretty much most organizations that are involved in the energy system, both nonprofits and for profits. You can see cooperatives at the top. Like I said, they are historically our biggest borrowers, our biggest partners.

And at the bottom, you'll notice that we finance where the service area is typically 20,000 or less. There are exceptions to that, but that's the key. And the reason that's in there is because even today, not in the Great Depression anymore, thank goodness, but there are still challenges for rural America to get conventional credit and financing.

Our loan terms are incredibly favorable. They can go up to 35 years. The FFB, the Federal financing bank rate is treasury plus 1/8, which is good right now.

And we offer different options. You can either set the rate at the time you get it and just forget it until the end of the loan or you can roll over the interest rates at up to 90-day windows, as short as 90-day windows and keep rolling them over if you want to play the market that way and if you feel like the rates are starting to creep up and you want to lock it in, you can lock it in at any time at the end of your 90 days or 6 months or however long you've been rolling it over for. So this slide is from earlier this month. If you look at the bottom, the FFB quarterly rates, treasury plus 1/8 you can see, it's incredibly favorable.

And so a lot of folks may not think of the U.S. Department of agriculture as a financing resource, as a solution for energy efficiency, for distribution, for whatever it is that your energy need may be, but if you're in rural America, you should absolutely be thinking of us, because we may be able to provide a good solution for you.

So today, we move forward 80 years or 81 years after the REA was established.

When we think of rural America or when RUS talks about it, it comprises 75% of the land area, but 40 million residents. So proportionally about 12, 15% of the population. Most of the rural electricity in America, the distribution system is owned by member-owned rural electric cooperatives. There's over 900 of them in the country. Collectively the rural electric cooperatives own 42% of distribution lines throughout this country.

So even if you don't live in a rural area you may very well be receiving your electricity over a rural electric owned distribution line.

Rural America covers 13% of the nation's meters, delivers 11% of total kilowatt hours and even though most of the rural electric cooperatives are distribution Co-Ops, there's about 40 transmission and generation Co-Ops that generate about 5% of the total electricity in the U.S.

So over the past 80 years RUS has financed $120 billion. More than 40% of the U.S. electric infrastructure today is financed by an organization that either is an RUS borrower, was an RUS borrow error received funds through an intermediary lender that we also loaned to.

Currently in fiscal '16 we have $46 billion in loans out there, almost 600 borrowers, we pride ourselves on our amazing delinquency rate. And we have $6 billion in financing authority that Congress has authorized this year.

All right. So I talked about where we -- where we've been over the past 80 years. I'm going to just briefly mention some of our forward-looking focus.

One of the areas that we focus is on security and resiliency just like DoE, just like anyone in the energy sector. And one of the benefits of having RUS financing over all these years that all of our loans that we financed have required the infrastructure to be built to Federal standards. And in fact, and many of you who are in energy know this, even if you're not a -- an RUS borrower other lenders still require infrastructure to be built to the RUS standard.

So our standards today are expanding to address the challenges of climate change. President Obama has directed his whole cabinet to make sure that whatever our equities are that we're building resiliency, whether it's biofires or risk of flooding, cybersecurity. So, looking forward, that is more and more part of what we're doing and what we're requiring for our borrowers.

I mentioned the 2008 farm bill gave us authority to finance energy efficiency. Our main program is equipped energy and conservation and loan program. It is a program where we lend to utilities. The utilities can do the work or they can relend it up to 1.5% to the end-users and the rate payers repay it through on build financing, it can be from demand side management to LED lighting to weatherization. Improving energy efficiency reduces energy demand for all of us and the loan rate is part of our basic electric infrastructure loan. It's treasury 1/8. Also we have something not in the slide deck, working through our clearance in DC to get published in the Federal Register. It's called RESPA, Rural Savings Energy Program. We hope to get the notice

out within a couple weeks. Similar goals, as equip. Several differences, one you do not need to be a utility to take advantage of RESPA and two if you think treasury plus 1/8 is too expensive for you, RESPA is a 0% loan. But we're still, would go through clearance, like I said, within a couple weeks, we still hope to get that out.

Example of our loan, Vermont Energy Investment Corporation. It was a $46 million loan that there you can see last -- earlier this year Secretary Vilsack at the podium with Senator Leahy beside him. It's a partner where we loan $46 million to Vermont Energy Investment Corporation.

We also do wind. You can see our utility scale projects, we can loan from 20 to $200 million typically. We also do smaller scale community projects.

A few examples, one is in North Dakota. Had a few loans to base and electric, this one was 2013. Prairie winds, more than 150 turbines and a loan which guaranteed the projects costs. This is a community wind energy facility. There's three turbines and it services almost 2,000 Co-Op members. You can see the loan cross and the direct grant.

RUS is one of three agencies within the rural development umbrella at USDA. We have the Rural Housing Service and Rural Business and Cooperative Service. Just briefly RBS has several programs that have equity in energy.

We call them by their numbers, 9003, the binary refine resistance program. Just last December Secretary Vilsack announced the award right here in Georgia to ensign Georgia binary refinery. And that's an example of a program that takes existing woody biomass which is in agricultural and rural communities there's an excess of, and that project will convert 440 dried tons of that into 20 million gallons of renewable fuel oil the of so one aspect where RPS has equity in the energy system. The 9,007 are program finances typical more energy. This is just last fiscal year alone. The program had almost 2,000 obligations and over 240 monthly dollars in loans and grants. And on the next slide you can see that the vast majority of it was to finance solar, $90 million of solar. And collectively in 2015, the program financed over a billion kilowatt hours of energy that was either generated or saved through their programs.

So that is a quick overview of USDA's rural development and how we fit into the energy space. Again, thank you very much for having us here, and I'll be on the panel.

(Applause.)

>> DR. KAREN WAYLAND: Thank you. Hey, it's a particularly appropriate that we have RUS here with us today, these meetings that we're doing are largely similar around the country with a panel on transmission and bulk power and end use and the third is sort of topic specific. So here today it is on finance so again it's very appropriate to hear about the RUS financing options.

Now it's my distinct pleasure to introduce the 13th Secretary of Energy, Dr. Moniz. He came to the Department for the third time or second time in 2013. And he, before that served as several roles during the Clinton administration, first partly as the Under Secretary of Energy, where he was responsible for science and energy programs at DoE. And also serving in the White House in the Office of Science and Technology policy.

He has been a professor at MIT for many, many years, and was a founding Director of the MIT Energy Initiative. During that time when he was out of Washington, he served on a number of boards often connected to Washington. One of them was the President's council of advisors on Science and Technology and that PCAST group put out several reports that recommended that the administration tackle a Quadrennial Energy Review. So he recommended that we do it and then he came to the department and told us that we would be doing it. So -- and we've had a really wonderful time learning about energy infrastructure together. So with that, I would like to introduce Dr. Ernest Moniz, Secretary of Energy.

(Applause.)

>> ERNEST MONIZ: Well, thank you, Karen, that reference to this being not my first time in DOE was like raising a question, you should have known better, but, actually, it's been terrific to be back there and it's good to be here at Georgia Tech again. Lots of connections, lots of connections here.

One of -- where is Sam Nunn? Isn't he here someplace? There he is, it's great to see you again, our great friend, great friend of everybody here probably, Sam Nunn. With whom I've had the pleasure to work on many national security issues, as you know, he's been a real stalwart on advancing our country's security certainly over the last quarter of a century particularly on nuclear issues with the demise of the Soviet Union, but also in energy, and in fact, Sam was on my Advisory Committee for the MIT Energy Initiative, which gave him every chance to be a continuing shameless advocate for Georgia Tech. And I think Tim Lieuwen's statistics kind of reveal who's feeding him numbers in this -- in this comparative ranking of engineering schools in the United States. I won't mention -- I won't mention others at this time.

But also here at Georgia Tech I should mention unfortunately I think he's traveling but Rafael Bras. The Provost and another old friend and a member of my Secretary of Energy Advisory Board. So we get lots of advice from Georgia Tech and we appreciate it a lot.

I also want to thank Josh Cohen from USDA for taking part here. The -- also, actually, the -- appreciate all of you being here. Appreciate certainly the panelists. I do want to note my very good friend Mike Langford here who will be on the panel later on. He's President of the Utility Workers of America within the AFL-CIO. We do a lot of work with labor but I really wanted to single out Mike for the point of view of obviously very, very strong focus on jobs and while that's not the main discussion here, I just want to say that the jobs issue, A, is very important, B if we take the Paris agreement, putting aside the point of it, climate change. When you have every country in the world committing to a low carbon future what that means is that the

already rapidly developing clean energy technology and energy infrastructure market is just going to grow that more aggressively, globally, and we are talking literally trials of dollars of opportunity. So whether it's rebuilding our energy infrastructure here for low carbon future, or taking advantage, hopefully, of a incredibly rapidly growing global market, it's something that we have to keep our eyes on, and we do, and again, I'm sure Mike will bring that perspective to the panel.

I also want to thank the Southern States Energy Board and Jim Powell who's there. Very important, very important regional board and working closely with the Federal Government, which is his job. And -- but also enormously helpful in putting this -- this together.

And finally, I do want to, because this is the last of the regional meetings for QER 1.2, which means the last of these regional meetings in this administration, we hope there will be another round in the next administration, but certainly, a number of people in the energy policy and systems analysis office at DoE have really worked really hard for these meetings and the earlier meetings in the QER, and Dr. Wayland has been the Point-Person for all of this outreach activity. But John Richards, Matt McGovern and especially Larry who are here have really put heart and soul into organizing these, and we appreciate it a lot.

I might just finally add, as a way of introduction that today is a big day in Atlanta for DOE. Not only the QER meeting here, but earlier today, we kicked off another meeting with over 900 participants, led by our Office of Small and Disadvantaged Business Utilization.

And so this is all about bringing small business into DoE activities, and it's pretty remarkable. I won't go into the details, but we actually, in our prime contracts and our -- and essentially, and the first tier awards from our management and operating contractors, operating our big laboratories, et cetera, we -- we -- we send -- last year we sent $10.8 billion of procurement activities to all businesses. So this is another really important part of the jobs -- the job story, and today we'll be having that meeting, also, in Atlanta.

So, let me -- let me turn to the first a little history in terms of the first version of the QER. The first installment of the QER I should say, again, quadrennial four-year process but we are putting out our major pieces as we march in time. The first piece was just over a year ago. Karen alluded to it.

That was a comprehensive look at energy infrastructure. Transmitting, storing, delivering energy, wires and pipes, of course, but -- but also things like inland waterways, for example, which are often not talked about in the same -- in the same discussion, but are enormous parts of the commodity transportation system of the United States, and other kinds of -- kinds of infrastructure.

A report I had 63 recommendations for executive and legislative action. I think it's of relevance today to say that the report has had tremendous impact.

The many state and national energy organizations have talked about how the QER has helped shape the discussion. But in addition, on Capitol Hill, 14 of the QER recommendations have already come into law. Things like the FAST Act, the Transportation Bill, and Bipartisan Budget Act explicitly referenced, I would even -- could even talk about the dramatic reading of the QER by a Senator on the floor of the Senate last year.

The QER directly went into shaping that legislation. One example of it is, as an example, in the -- in the legislation of last December, is that $2 billion was authorized as mandatory spending for modernizing the strategic petroleum reserve. That was an example of one of the recommendations where it was noted that the SPR petroleum reserve was in desperate need of modernization after its construction a long, long time ago.

And in addition, because of the change in America's energy system with the increased oil and gas production in different geographies of the country, the way that the infrastructure was working, you had things like reversal of pipeline flows, et cetera. All of this led through analysis to a conclusion that we also lack the ability now from the petroleum reserve in an emergency to be able to put sufficient oil on to the water. So, both modernization and increasing maritime access was put forward in the recommendation, and $2 billion, as recommended in the QER was there.

So I say all of this from the point of view of the importance of the input that we will be getting, hopefully, today, from those here, and those on the web today, and -- but also in the days and weeks ahead, because clearly the opportunities for it will -- will continue of the and we believe that the second installment of the Quadrennial Energy Review will, like the first, built upon analysis, built upon bringing together the many agencies in the government that have stakes in the topic at hand, will provide the basis for sound, bipartisan discussion, sound Executive Branch, Legislative Branch discussion; sound assistance to state regulatory and policy developments. And so, again, the impact is large. It will be large. The input is very -- is very important.

Just in mentioning the -- idea of multiple agencies, I should say that the overall effort is chaired by the Domestic Policy Council and the Office of Science and Technology policy with the Department of Energy having the lead role in terms of providing the analytical support, and also the mechanics of things like these stakeholder meetings in which colleagues from other departments join us.

So, again, it's really -- the main message there again is: This matters. It actually has had material impact. The first version will have more material impact. We're still working on many of the other recommendations and we believe, again, this one, this version will as well. Now, so come to this version.

One of the clear conclusions in QER 1.1, the infrastructure study, was that among all of those infrastructures, certainly arguably, the infrastructure of infrastructures is electricity. Virtually nothing else tends to work if the electricity isn't on.

In fact, in Hurricane Sandy, that became quite evident in things like there was transportation fuel. There was gasoline available, but you couldn't pump it when you had the power system out for weeks, just as one -- one same pill example. But you're going to go on outside the energy sphere as well to information technology and the like.
So the second -- second installment, I think, as you know, is really now focus on electricity end-to-end. So, from generation to the transmission and storage and distribution to the end use is also part of the -- of the consideration.

Now, clearly, technology plays a role, and the department has made in these last year's major investments in some technologies, both -- on all parts of the system.
Again, from generation through operation of a stable, reliable, modern grid to the -- to the end use side. But what I do want to emphasize is that in looking at the electricity system as a whole, it's a lot more than that.

And there will be, in the QER, clearly analyses relevant to the dramatic changes that are taking place in the industry, really challenging many of the traditional lines of thinking, many of the traditional business models.

The -- for example in the business models for utilities, I mean, everything from the need for managing long distance variable resources to the the emergence of kind of quietly, but the emergence of grid scale storage. That is becoming more and more prominent. To the deployment of distributed resources and things like net metering, for example.

These are really challenging the traditional business model. And so these kinds of discussions, how markets function, financing options, which will be discussed today, these are all part of this -- of this important discussion. Another aspect of that, and in many ways underpinning the need for new business models and new regulatory models, is this question of valuation of services.

Things are changing. And how do you -- I mentioned storage. How do you value storage? How do you put that into the rates? And many, many more factors come into that. Reliability, for example. Security. Traditionally have not been included in that. And that's the kind of analysis that we want to carry out, and that can only benefit in being guided by the input from -- from our stake -- stake-holders.

So, clearly, climate is another of the big issues that we must grapple with in planning a system for the future. And I want to just conclude, in fact, in saying a little bit more about that. Certainly, in tells of reliable infrastructure, the expectation for, if anything continued increase in the -- in the risks for more extreme weather, for example, is certainly part of the discussion.

But what I want to say in terms of climate change and today's discussion, is, for one thing, I have never seen a credible scenario for dealing with energy over the long-term, let's call it mid-century, beyond, without two common characteristics.

One is you can't get there from here without a strong demand-side response.

We certainly need to work on the demand side, on energy efficiency across-the-board. But the second one is again, in any credible scenario that I've ever seen, as one goes to deeper and deeper decarbonization, in some sense, the lead horse is the electricity sector.
We have more options there. And -- and the talk in terms of, you know, cost for marginal ton avoided, it's always much lower in the electricity sector than say in transportation sector, for example.

So really, again, this electricity discussion and how one thinks about the evolution literally on a -- on a half century time scale and more is really critical for thinking ahead to the electricity sector, with all possible supply sources, and maybe with different architectures, but as -- as critical to decarbonization.

And make no mistake about it, Paris, the Paris agreement was a major first step. But I emphasize both words, major and first. So it was major, because we did have essentially all the countries in the world, first of all, acknowledging the need to address climate, but secondly, adopting targets in -- typically in the 2025 to 2030 time scale.

We all know that those targets, in and of themselves, will not get us to the point we believe we need to be, let's say by mid-century, which is why the agreement also had in it a provision for five-year reviews, implicitly at least acknowledging that we are going to need increasing ambition with time.

And that's a very important feature. And it also impacts the kinds of decisions that we need to make and to shape in the next years as we -- as, after all, utilities, for example, talk about making a significant investments that have long lifetime.
So really, right now we've got to be thinking not just about the first step of the next 10 to 15 years, but about the succeeding steps and what it means to make the kinds of investments that this sector requires.

The last point I want to make is that we believe there is a strong regional component to how we address these issues. And that's why we are having regional meetings, to get the perspectives in different -- in different parts of the country. The reason is, the -- the underlying reason is certainly in the context of climate change, we feel strongly that there is no -- you know, there is no single magic low carbon solution. The low carbon solutions will look different in different countries. It will look different in different regions of our country. For a variety of reasons. It may be natural resource reasons, it may be different regulatory structures.

On the latter, for example, nuclear power would be an obvious example of the very different trajectories right now for existing and new nuclear plants in different parts of the country, really because of different regulatory structures playing a -- playing a critical, critical role.

So we believe the regional perspective is very important. And indeed, in our response to climate, one of our response to say climate, something called Mission Innovation, that's with a capital M and a capital I, which was announced by President Obama and 19 other leaders on the first day of the Paris meeting as a commitment to innovation, technology innovation in this case, I say in this case, because we also need policy innovation and business model innovation, but technology innovation, as really one of the key tools for that increasing ambition that we will need going forward.

Because fundamentally it will underpin continued cost reduction of these technologies. In our proposal, in the President's proposal to the Congress for the fiscal year 2017 budget, the proposed -- he proposed a significant increase. The good news is that there's been very strong bipartisan support. The bad news is the numbers game isn't so positive this year, but -- but an important point is, in that budget, we also proposed something new in terms of executing the innovation program; and that is, to establish regional innovation partnerships.
Without going into a lot of detail the main point is that one way or another in different regions, which have different needs, which have different opportunities, which have different resources, natural resources, Human Resources, institutional resources, Georgia Tech would be one of those resources, for example, that -- that each of those regions, through some nonprofit entity, would actually manage part of this portfolio, aimed at this clean technology transformation. And, again, we think that is good policy, because those portfolios will take on different characters in different parts of the country, and we believe in which the overall -- the overall program.

So that's another -- another, again, important feature. I might say in terms of -- in terms of regional, we're here in Atlanta today, obviously looking at the Southeast Region, but I just want to note, to credit really Atlanta for a lot of what it's been doing. Of we heard a little bit about the solar from Stephanie earlier, but, also, something like the Atlanta Better Buildings Challenge to reduce energy and water consumption by 20%. At least 20% over more than 40 million square feet of buildings is -- has gone great. And its efforts like those that has Atlanta ranked number four on EPA's list of 2016 ENERGY STAR top cities.

So that's just one example. We congratulate the Mayor and others in Atlanta for that leadership, but it's an example about what's happening in different cities, and states and regions in our country. And we want to capture that. So that is the context in which I at least see these regional meetings occurring, this meeting today. And we'll certainly be looking for feedback from this, but emphasizing that what we hear today is important, but what we hear in follow-up is important, as well, as you think about the discussions today and think about what else might be very helpful to us as we shape what we think will be a very important, integrated, analytic system view of the full electricity system as we must see it evolve in these next years and decades.

So, thank you, and I think, Chris, I turn it back to you, and ...

(Applause.)

>> CHRIS KELLEY: So, our panel has offered to take some questions. Anyone have any questions for any of our panelists here this morning?

(Pause.)

>> CHRIS KELLEY: All right. You may have covered everything, Mr. Secretary.

(Pause.)

>> CHRIS KELLEY: Okay. Well, with that, why don't we move on with our agenda. Please join me once again in thanking our panel.

(Applause.)

>> CHRIS KELLEY: So we're going to transition now to our first speaker panel of the day that is focused on bulk power generation and transmission. How can we plan, build, and operate the appropriate amount for future needs. As we transition here we'll get you all set up at the front. Just a reminder, if you're here in the audience and you'd like to provide comments at the very end of the meeting, we will be taking those public comments. I'd ask that just that you sign up at the entry to this room.

And once again, for those who are joining via the live stream, please submit your comments at the website. So we'll get started here in just a moment.

(Pause.)

Panel 1

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

>> CHRIS KELLEY: Okay. So we may be joined by one more panelist here, but we're going to go ahead and get started just to keep on our time slot and make the best use of your time so I'm joined here on the first panel. So I have a distinguished set of panelists here with me. Stacy Dochoda. Brian Thumm. Doug Esamann, Executive Vice-President and Vice-President, Midwest and Florida Regions Duke Energy Corporation and Mike Langford.

And Mike is -- let me get your title here right, Mike, the National President Utility Workers of America, AFL-CIO.

And Lisa is joining us, so, Lisa Johnson is the Chief Executive Officer and General Manager for Seminole Electric Cooperative, Incorporated.

So panelists, just a reminder of our plan here, I'll go right down the list, starting with Stacy, and give you 5 to 7 minutes to provide your opening remarks, you'll just go through everybody, all the panelists and it will come back to me and we'll have a chance to answer some questions, we have some colored lights here at the front of the room, when it turns read, five more minutes, two minutes, and I'm sure I won't have to bring out the hook. Why don't we get started with Stacy.

>> STACY DOCHODA: Thank you, Chris.

Good morning, everyone. On behalf of the council I appreciate the opportunity to participate on this panel. I'm the FRCC President and CEO. The FRCC promotes and assures the reliability of the bulk electric system in peninsular Florida, by being the reliability, planning coordinator and the state capacity emergency coordinated. FRCC's structure allows a reliability focus on all of the bulk electric system oversight needs for Florida at one organization.

FRCC has a long history of coordinated operations aimed at furthering reliable operations, dating back to the 1950s. At that time Florida Utilities came together to enhance the transmission interconnection capabilities, the benefit and the sharing of operating reserves.

FRCC currently has 20 members, its work is a product of the combination of our member Committees and our staff. The big geography of the region has required close coordination of member utilities for many years. The peninsular nature of Florida results in the region being interconnected with the Eastern interconnection through only one interface composed of 11 transmission circuits.

In addition, the interdependence of the systems where some utilities rely on transmission services provided by other entities has required Florida utilities to maintain close coordination and communication at the regional level. Looking at resource adequacy into the future, FRCC's projected summer peak demand for 2020 is 49,900 megawatts and that includes 3,200 of demand response. The capacity in 2020 is expected to be more than 58,000 megawatts and that provides us with a projected 24% reserve margin in 2020.

Looking at our capacity mix, FRCC is currently 64% natural gas. 17% coal, 12% oil, 6% nuclear) and 1% renewables, although the fuel mix is predominantly natural gas, Florida has no native gas production and currently relies on two Interstate natural gas pipelines for more than 90% of the supply transported into the region.

These two pipelines have the ability to deliver 4.4 million cubic feet per day. More than 80% of the gas supply from these pipelines is dedicated to serving electric needs in Florida.

In regard to future requirements, these natural gas pipelines are almost fully subscribed. However, Florida's natural gas needs are expected to increase in the coming years to meet the high demand, the gas transportation infrastructure serving the State is expected in 2017.

A third major pipeline continues to move through the permitting process, having received Federal energy regulatory Commission certificates earlier this year. These projects include Sabal Trail, Sabal Trail Central Florida Hub and the Florida Southeast Connection Pipeline Projects. These projects will provide over an additional one Bcf per day of capacity and access to new supply source.

Returning to resource planning in FRCC each utility is responsible for its individual resource planning and is under the jurisdiction of the Florida Public Service Commission.
These individual planning processes consider fuel diversity, energy conservation, renewables, load forecast, demand response and other factors during the development of their resource plans.

Each year the individual resource plans called ten-year site plans are consolidated by FRCC, they're analyzed for resource adequacy and transmission reliability and presented to the Florida Public Service Commission.

For transmission planning each transmission planner in FRCC evaluates the needs of their individual systems and develops long range plans to address those needs. FRCC planning consolidates those individual plans and ensures that the composite regional plan is reliable.

As the order 1,000 Form FRCC evaluates the rolled-up plan and a system analysis to evaluate whether there are other regional projects that could displays projects within the initial roll-out plan.

Looking at load forecast in our region the projected annual average growth rate for customers over the ten-year planning horizon is 1.5%. The current average growth rate for energy is .8% per year and that compares to forecast of 1% last year. The impacts of conservation and energy efficiency, including the impact of energy efficiency building codes and appliance standards continues to contribute to the declines in per customer consumption as reflected in the current forecast.

To conclude, even with the modest load growth, we must have plans in place to meet the expected additional demand. FRCC's yearly analyses provide a region wide view into projected resource adequacy and transmission reliability. Thank you.

>> CHRIS KELLEY: Thank you, Stacy. Brian.

>> BRIAN THUMM: Thank you for the opportunity to participate on today's panel discussion, I'm honored to provide our perspectives and our role ensuring a reliable bulk electric system as we navigate through the challenges of an evolving industry.

Shortly after the blackout of 2003 former Secretary of Energy, Secretary Bill Richardson, was quoted as saying we are a super power with a third world electricity grid. In preparation for today's panel discussion I read the stakeholder briefing that says the United States has one of the most reliable, affordable and increasingly electric systems. A long way we've come in a short 13 years. Why the former may be characterized as hyperbole and the latter potentially as hubris, it may be worth noting that the United States continues to evolve to meet new challenges. A changing resource mix puts pressure on coordinated planning efforts. That changing resource mix is largely characterized by Variable Energy Resources like wind and solar which puts pressure on things like frequency response, generation ramp rates, bulk electric systems often suffers from parallel flow issues, forecast shortcomings and a multitude of other challenges that manifest in both the planning and operating horizon, but the bulk electric system continues to evolve in a way that would address those challenges head on. The role of our entity is to make sure that it remains reliable from infrastructure to real time operations, because in the end our goal is the same as the registered entities it interacts with, reliability excellence.

SERC is a nonprofit corporation in North Carolina, our mission is to promote and improve the reliability of the electrical system in our boundaries, we cover all or part of 16 states and is 52 of which have dispatched energy markets. They oversee the implementation of the reliance. They maintain an analysis program with events analysis. Ongoing anally analysis ensures dependable delivery of the energy needs throughout its footprint. This panel seeks to inform on the planning operating and building of bulk electric system assets, SERC plays a role in two of them, planning and operating, the role in operations is collaborative. They facilitate an exchange of ideas through training conferences that we sponsor, our role in planning is also collaborative amongst its members, they help ensure the system is effectively studied and the limitations are clearly identified. Through its stakeholder Committees they are a central coordinator for analysis and entity forms necessary to develop planning solutions and reliability assessments in the region. In the coming decade, we will see excess of gas-fired generation, decrease of generation, increase of nuclear and other like wind and solar. Since the power system is tightly integrated a region wide planning approach remains necessary to provide an adequate reliability check. Coordinated planning efforts help provide assurances that while individual utilities are determining the appropriate amount of generation to add to the system, they are able to add value by taking a big picture view of overall system reliability.

Dangers to the power system to accommodate are assessed and vetted through regional and inter regional processes. Our role is to provide an independent assessment of the changes in resource mix and other reliability implications such as transmission system impacts.

The actual plan and related decisions rest with the asset owners who are required to plan their systems in accordance with the negotiating planning standards. $17.7 billion of investment is anticipated in the footprint over the next decade. We are working to ensure this represents not the right amount of transmission investment to accommodate the changing resource mix but also that it's an application of transmission investment in the right places as well. Given the

changing resource mix it's crucial to maintain essentially reliability services. The influx of wind and solar resources demand response programs, battery storage and other non-traditional resources threaten system inertia across the interaction. There's a growing concern about behind the meter generation resources, changing the characteristics of how the grid is planned and operated. Ensuring that frequency response, ramping and voltage can be maintained for all operating conditions must remain vital to planning processes. Regionally they can provide a perspective due to its ability to collect data from a wide range of industry stake-holders and analyze the data in an impartial fashion. Through the monitoring program they are able to capture data related to the overall risk of the system. Through its group they capture operational data and provides trend analysis for the overall assessment.

In either case they share the data with the register reasonable doubt entities to enable them to make educated information about the system. They advance data analysis because of the ability to spot trends, make corrections for weather patterns in geographic regions and inform entities about specific areas they can potentially enhance their planning and operating practices. They stand ready to assist the industry through compliance, reliability and outreach efforts to ensure the transition to the future state in a thoughtful and reliable manner. I appreciate the opportunity to participate, and I look forward to answering questions.

>> CHRIS KELLEY: Thank you, Brian. Doug?

>> MIKE LANGFORD: I'm Mike Langford. I also would like to thank the Department of Energy for the opportunity to come here and speak.

One of the things I'd like to just partly just tell I was little bit about the professional women and men who make up -- they are the ones that operate, maintain all your generation from -- safely from nuclear power plants, to coal, to gas, to renewables, to all aspects of generation. They also work in all aspects of transmission and distribution systems.

So a lot of the facts and figures that you hear up here today from the other panelists plays a key role as we move forward because you have to, look, I mean, look at the color of my hair here, it's a little on the gray side. Right? And a majority of the workers in our industry is starting to reach that maturity themselves.

Speaking in our nuclear side alone about 40% of our workers actually retire this year. And the knowledge that it takes to become fully proficient at these types of jobs is anywhere from 4 to 5 years. So you can see you just don't walk in off the street. These are highly skilled jobs, highly paid professionals that are really are your first responders in times of need.

If you think about man-made disasters or natural disasters, who's there on the front lines cutting the power, cutting the water, cutting the gas, restoring, rebuilding, regardless of what kind of thing it is. Men and women of the utility workers.
So we have to put a human infrastructure aspect to everything as we move forward here. It is a solution, we have created a trust because we believe that it's continuous learning, that we have

to be in a continuous learning mode to meet the future needs of the skills that are needed. What does that future utility work need to look like? Call Center, substation, power plant operators, everything in between, are highly skilled jobs, these are middle-class jobs, people that can buy automobiles, buy cars and pay their taxes, hey, what a novel concept. Huh? Think about it. I mean, these are good jobs and we should really put a Foss and a number and a priority. Because looking through the transcripts of the last six meetings here there are very few words mentioned about jobs, training, and skills.

And I'm glad to be here to be able to try to put that face to it, because as we move forward, a lot of these stats that you're going to hear up here, we repeat just educating people in this country about the need to repair America. And when we say repair America, we're talking gas, electric and water infrastructure.

Folks, if we want to reduce that carbon imprint, that footprint, just by repairing our leaky water pipes in this country, we'll save on a lot of energy.

So, therefore, there won't be a need to generate so much. And as we bring in renewables we need to make sure that they are good jobs, not -- right now, it's not utility scale so-to-speak. So we really need, if we're going to get serious with the renewables, we really need to focus on how do we make these utility scale. And I'm a firm believer that some markets need to be regulated. And here I talk about national security. I talk about do we really want to put the emphasis on renewable energies, a regulated market could make these things happen.
You know, we're all guilty in this room of probably spending anywhere from 150 to $250 a month for a thousand TV channels we really watch 5 or 6 of. Right? Think about it. But when it comes to clean energy, water, and safe and reliable natural gas, don't ask me to pay another dollar now. You know, because that's just too much. Right?

Think about it.

We have to really market and figure out a way to pay for these things in a regular market. It is one of the ways to go, I'm talking things that some folks may not like to hear, but some things are just too important to leave to chaps.
And the folks that I represent, they are in a unique position. They not only work in this industry, but they're consumers, they live in the communities, they repair the communities. So they have a wealth of knowledge on what's needed to be done.
So just tapping the resources, as we move forward, it's an exciting time. Things are changing. Reliability, you know, Brian brought up our infrastructure, and third world country. Our electric system is rated at a D plus. Think about that.

If any of your kids came home with a D plus I don't think any of you would be too happy in the room. Would you?

When you thing about what is needed to repair our electric system in this country, literally, trials of dollars and we have to finance that and we have to figure out ways to do it. But in the meantime it will create literally hundreds of thousands of new jobs.

So, therefore, I say let's look at all these opportunities and consider them as opportunities and move forward, and I'm anxious to hear the rest of the panel members, and, you know, have an opportunity to answer any type of questions that you may have.

Thank you.

>> CHRIS KELLEY: Thank you, Mike. Now, Doug.

>> DOUG ESAMANN: First, I have a few PowerPoints, should I drive that or do you? All right. Thank you.
So I'm Doug Esamann. I'm an Executive Vice-President of Duke Energy. I have responsibility for our regulate utilities in Indiana, Ohio, Florida and Kentucky. And I have grid modernization responsibilities. I appreciate the opportunity to be here today on behalf of Duke Energy. I give you thanks, give you our thoughts on a number of topics that have been identified for discussion in the panel.

The supply of reliable, affordable electricity is critical to the economic vitality of our communities and states, as well as our overall quality of life. For that reason, and because of the grid utilized to deliver our product to our customers the relationship and interactions of utilities and their customers have been highly regulated. In that regulated world emphasis has been placed on reliability supply, least-cost options, and obligation to everybody is all customers, the need to treat all customers equally and fairly and the receipt of a fair return by investors in the business.

The electric utility industry takes a long-term view, and stability has generally been favored over risk-taking. Additionally, matters of public policy find a way into the business via statutory and administrative requirements, incentives and penalties, but the changing expectations of customers, emerging technologies, and new energy economies are requiring the electric utility industry to rethink its business after operating under traditional cost of service regulation for more than a century.

As we look to the future, we've developed a long-term strategy for our regulated businesses that we call the road ahead. Our vision is to lead the way to cleaner, smarter energy solutions that customers value. The strategy has four elements, transform the customer experience, modernize the grid, generate cleaner energy, and engage our employees and stake-holders along the way.

I've included more details in my written statement.
I've also included in the written statement isn't other suggestions on policy, legislative and research and development areas that we believe would be helpful to an energy industry in

transmission. So during my brief remarks today I want to renew our clean energy future as well as a few of the things we have addressed for the changing landscape.

Our regulated business we serve about 24 million people in six states in the Southeast and Midwest. We believe that customers in our regulated states benefit from the vertically integrated utility model. It allows Duke to optimize the complete value chain from power generation to delivery and service to our customers. It is critically important that Federal policy accommodates the varying business models that are providing value to our customers across the many different environments in the U.S.

This slide depicts the Duke service territories for our regulated utilities on the left and the investments in renewable energy and battery technology by our commercial businesses on the right.

Because of the breadth of Duke's regulated businesses across multiple parts of the U.S. we have a unique perspective and a great appreciation for the notion: One size does not fit all when it comes to electric energy policies. We operate in regulated states, deregulated states, states that participate in regional transmission organizations and those that don't, and states that have adopted renewable energy policies and those that have not.

While there are differences to varying degrees, we believe we are successfully producing a valued product for our customers in all of these environments.

Our road ahead vision, we include the movement to cleaner energy future and we've been on that road for some time now. We are retiring coal plants and any natural gas replace it. Also promoting energy efficiency with our customers and within our own operations to reduce the amount of energy needed. We develop our portfolio generation primarily through our state integrated resource planning processes which consider all resource options as well as energy efficiency.

Those resource plans are also a driver of our transmission planning. The transmission of our fleet from 2005 to today along with our view of where we believe our generation portfolio will be by 2030 is outlined on this slide.

While this shows the anticipated view across all our states we work specifically with state regulators and other stake-holders to plan the energy future in each of our states.

Autopsy this localized planning process results in info 58tive solutions that are developed in collaboration to partnership with the key stake-holders in the communities that we serve. This type of constructive engagement will continue to be important as we develop the policies that support continued investment in our energy infrastructure to provide the essentially service that has become so critical to our country's economic vitality. I want to give you a few examples.

In western Carolinas, we initially proposed to retire an existing coal plan and replace it with a new natural gas plant and solar. Because of certain risks, we included a new transition line into the Asheville area, which met with criticism. We ultimately agreed to reduce the size of the new gas units, add a gas unit to the mix, and eliminate the need for the transmission line.

In addition, we agreed to defer construction of the additional gas unit to give those in the region a chance to avoid the need for that unit through energy efficiency. In South Carolina we've collaborated with solar developers, environmental groups and others for rooftop solar while encouraging more utility solar investments in the state. We are also investing in the grid, including metering to give us greater intelligence and provide better information to our customers, integrated volt support reducing line losses and sectionalizing the grid so we can better pin point outages and restore power quicker. As we think about the many challenges that we are experiencing in the industry today, I would urge us not to lose focus on the long-term policies that are needed to set the direction for the energy future of 2050.

Substantial carbon reductions will not be possible without recognizing the value of 24/7-generation, particularly carbon-free generation.

There should be continued investment in research and development related to carbon capture technologies. And it is critical to gain public and regulatory support for the necessary investments in the grid that will better support two-way power flows, customer information, more energy efficiency, distributed generation and storage. I appreciate the opportunity to represent Duke Energy on this panel. And I look forward to answering your questions, any questions you may have. Thank you.

>> CHRIS KELLEY: Thank you, Doug, and finally, Lisa.

>> LISA JOHNSON: Thank you, Chris. I do have some PowerPoint slides, I don't know if they're... Well, good morning, I would also like to thank Secretary Moniz and the Department of Energy for facilitating this process and inviting me to participate.

With the uncertainty in our industry and rapid shifts we are facing in energy policy and regulation, small consumer owned utilities like electric cooperatives are finding themselves with the most strenuous future compliance goals regarding bulk power and transmission and the least resources to deal with them. One primary point I want to make today is that the Department of Energy does have a role, ensuring regulatory changes are implemented in a way that brings us into a new energy future without creating inequitable or discretion proportionate outcomes, small entities in especially rural America should not be shouldering the greatest costs of the new energy future.

Let me step back for a moment and introduce electric cooperatives and specifically Seminole Electric Cooperative. Promise of electricity in the modern convenience that it brings was one of the greatest achievements of the late 19th and early 20th centuries, almost 90% of urban dwellers had electricity. By the 1930s, only 10% of rural dwellers did. Recognizing the inequity

of this issue the Federal Government acted and created the Rural Electrification Administration to empower underserved Americans to create their own utilities.

This program is often cited as one of the most successful public/private partnerships in history and resulted in 98% of all farms in the United States having electric service by the early 1970s.

While the REA was successful in its mission to electrify rural America it could not change the reality that bringing it to rural area more expensive and less attractive for investors than urban densely populated areas. The United States has a history of recognizing this fact in its public policy and continues to support the RUS program and its sister programs to bring jobs and economic development to rural America.

Recent initiatives like the Clean Power Plan, without careful consideration for the delicate balance of rural America, threaten to unravel our past successes. Let me explain.

The cooperative is a generation in transmission cooperative serving nine member distributions throughout Florida. Approximately 1.6 million people rely on it for electricity. Our members provide essential electric service in primarily rural and low income areas of Florida, stretching from west of Tallahassee to south of Lake Okeechobee.

Approximately one third of the customers have incomes below the poverty level. Some cooperatives serve as few as 4.6 consumers per electric line. We operate two stations. Seminole, two units; and the other, 810-megawatt gas-fired facility with a combined cycle unit and an additional peaking capacity. Neither one of these facilities currently meet the rate based emissions requirements outlined in the final Clean Power Plan as proposed by the EPA. We cannot meet the rates through I technological or operational changes without significantly curtailing operation, shuttering the plants under a future program that does not currently exist.

Built during the era of the Arab oil embargo and the Power Plant and Industrial Fuel Use Act, when oil and natural gas regulation were precluded by law, it is the most efficient in the State of Florida and has been recognized by Power Magazine as one of the top plants in the world.

The plant is financed through 2042. Has a useful life through 2045. And employees 300 individuals in rural Putnam County, the poorest in the State of Florida. Seminole also receives power from renewable energy facilities including waste to energy, landfill gas to energy and biomass and this year we are launching our new solar cooperative project.

The facility features more than 84 solar panels and is rated at 2.2 megawatts. Cooperatives will be able to offer portions of the output of this facility to their members next year, nationwide electric cooperatives in 37 states have more than 550 megawatts of solar capacity online or on the drawing board. The diversity reduces exposure to changing market conditions, helping manage risk and keep rates competitive.

Since the last panel today is going to be talking about financing infrastructure, I think it's worth pointing out the risk facing Seminole and other utilities when regulation, combined with market forces, results in an economic mismatch of the plant's remaining useful life.

Though it is currently staid, should the Clean Power Plan force the closure of the station, Floridians would be left to pay off outstanding debt much of which is tied to environmental controls systems on a defunct facility. 3,000 jobs would be lost and it would lose the single largest tax.

Our consumers will be -- I would add, this today as we discuss our future, let's not abandon the past. Let's work together to make sure that our future, the future of our energy policy is fair and equitable and continues to support access to that same safe, affordable and reliable electricity in rural America. We can move America's energy future forward, without causing our rural economies to slide backward.

For example, electric cooperatives across America, as I mentioned before, including Seminole, are developing and deploying other technologies to provide our membership with renewable energy.

Also, our energy future will require new generation facilities, new transmission infrastructure, both gas and power, and new permitting.

Any collaborative efforts to streamline permitting, expedite construction, and facilitate new technology will be helpful. Let's work on these new projects together and allow existing generating stations, like the Seminole Generating Station, to remain open through their useful lives so that tax payers and our member owners can realize the value of investments already made while we transition into the future.

Thank you for your time. I look forward to the discussion.

>> CHRIS KELLEY: Thank you, Lisa. So I'm going to step up here, just so you can see me so we have time for a few questions, supply assurance. I've been told that if you could speak directly into the microphone, folks may be able to hear you here in the room but on the live stream it's difficult if you don't speak directly into the microphone.

So, supply assurance. So although we're in the south, it does get cold here from time to time. So, Stacy, you mentioned limited or at-capacity gas transmission lines servicing Florida.

So, my question is: How do you or all of your entities deal with these cold snaps when more gas is needed for generation? Do you have a plan in place, are you addressing these challenges? Stacy, do you want to take that first.

>> STACY DOCHODA: Certainly, Chris, as one of our roles, we are the reliability coordinator, and we have a long history of working with the utilities that are our members, and also with the

Gas Transportation Companies, and the other entities serving customers in the state, to coordinate and work through disruptions and those sorts of issues.
So that's a longstanding, relationship-based collaboration that we have and that we continue -- we drill on, and work together on.

>> CHRIS KELLEY: Thank you, anyone else want to address it?
Lisa.

>> LISA JOHNSON: I'll just mention, Chris, I think it brings the question of fuel diversity into play, and the importance of having multiple sources of fuel, storable fuels, in particular, and because Florida is a bit unique as a peninsula, in many ways, we operate more like an island. And so over-reliance on one particular fuel source, particularly as Stacy mentioned, high reliance on natural gas today means you are highly reliant on pipelines to deliver that gas in real time from sources that are not in the state, and from a source that cannot be stored in the state.

So it goes to the issue of the importance of diversity, coal, nuclear, renewables, smaller sources that can be controlled onsite, locally and those fuels can be stored in order to help address any kind of -- whether it be a weather anomaly or whether it be another natural disaster, hurricane, something like that, where we need more flexibility in the system to respond.

>> CHRIS KELLEY: Other comments?

>> DOUG ESAMANN: Chris, I guess I would add, I think it's a multi-prong approach, Stacy mentioned the Sabal Trail pipeline. Duke Energy is a co-investor in that pipeline to bring more gas into the state as we are in the Atlantic coast pipeline down into North Carolina. So I think in addition to the local sources Wyeth we are continuing to invest in infrastructure to bring more gas supply into it.

>> CHRIS KELLEY: Other comments?

>> STACY DOCHODA: And I would just add that I think Lisa mentioned this, but dual fuel capability is also important in our region and we do have a number of units that are capable of dual fuel firing.

>> CHRIS KELLEY: So I guess I have a similar sort of corollary question to this, again, you also mentioned choke points on the electricity transmission system. Just -- or maybe choke point is a little bit too strong, but limited interconnection to the Eastern InterConnect.

So, same kind of question, you all have talked at one point or another about diversity and generation. Are you seeing more generation coming online? Is it being more represented on the renewable side? Is it because gas is a potential issue? Are you seeing less gas generation being turned online, anyone want to do that?

>> STACY DOCHODA: I'll begin Chris.

>> CHRIS KELLEY: Sure.

>> STACY DOCHODA: In Florida, the utilities file, every April 1st, a ten-year site plan. And so those were recently filed, and we're working through those to consolidate all the information.

But what we are seeing right now are largely near-term projections of new builds, being additional natural gas. A little bit outside our planning horizon, we do have several nuclear plants that are still on the planning table for a couple of our utilities as well.
Currently our renewables forecast are still relatively modest.

>> CHRIS KELLEY: Other comments?

>> DOUG ESAMANN: Well, at Duke Energy, and I think in the markets that we're involved in most of the generation is natural gas, it's driven by economics, obviously, the low price of gas. It's allowed us to reach higher carbon coal plants that were built back in the '40s and '50s, retire those plants, even the '60s into lower carbon plants that are more efficient and produce low cost efficiency.

And the other major investment in the utility scale renewables, primarily solar, but some wind, but we've seen mostly solar in the regions that we serve, and we see investments in those areas as well.

So that's been driving most of the new investment in generation with the corollary being a lot of retirements of coal units as has been mentioned a couple of times.

>> LISA JOHNSON: And I'll just add, Seminole is currently in a long-term planning process as we speak and are looking at alternatives in the market as well as alternatives for our own ability to bring generation online, and I will just tell you as a -- as kind of a sampling of what we're seeing in the market, the predominant form of generation for generation replacement, new, additional resources, is coming from natural gas-fired generation.

In terms of volume, obviously, as well as controllable, dispatchable resources, we are seeing renewables, and they are kind of running the gamut from what I call the more traditional in Florida, biomass, waste-to-energy type facilities, as well as mostly solar.

>> BRIAN THUMM: I cited some statistics in my opening remarks, by and large, gas generation is the largest driver of generation resources (inaudible) close to 12,000 megawatts of gas-fired generation, which far out paces all other resources).

We see more of our renewable resources cropping up on the western border, not to say that there's not a level or utility level initiatives in place to drive renewable energy. But we tend to see it occur in pockets, especially closer to where it's windy or sunny.

In terms of the large influx of gas generation, we are concerned about the natural gas electric sector interdependencies. And both we and at the national level are taking a deeper dive this year, looking at some of the risks (inaudible). Detrimental to put all of your resource eggs in one basket so-to-speak.

So we favor resource diversity in that light. We think having a portfolio certainly helps clients on one particular fuel. And, as prices fluctuate, there are advantages there.

>> CHRIS KELLEY: Any other comments?

>> MIKE LANGFORD: You know, I would just like to make a comment about the fact that, you know, thing, putting all your eggs in one basket.

Natural gas prices are cheap today, but there's a lot of competition starting to be in Europe. Natural gas is five times the cost of what it is here in the United States.
So there is a lot -- a push to sell to Europe. Also, in the manufacturing of chemicals and plastics, they rely heavily on natural gas.

So, as that market changes, and that market starts to increase, the costs of natural gas will obviously increase. And to put everything into that, which is still producing carbon, natural gas still produces carbon, and it's actually creating an issue with our nuclear facilities, emits 0 carbon.

And so, you know, you have to have that mix how many of you remember the polar vortex, there was a choke hold. You couldn't supply, you had to shut factories down on the East Coast, because you couldn't get energy to it. We had oil-burning power plants that you could not start up because it took natural gas to start them, and there wouldn't be enough residential gas for residential usage. So, you can see, you have to have a diverse -- and there's no panacea here.

There's no, you know, golden or silver bullet, because it makes me nervous to think we put all of our focus on this cheap natural gas. It's not there forever, this stuff is cyclable.

>> CHRIS KELLEY: Thank you. So since we're with you, Mike, let me ask a question about workforce, so you did touch a little bit on this in your opening remarks, but this is really a question, I'd like to kind of open up to anybody who would like to address it.

So we have heard from numerous panels, from time to time, you know, in other cities about challenges in addressing would, force, you certainly, you know, touched on that, as well. Whether it's hiring or training, especially in light of new technologies that are being put on the grid.

So my question to the group at large is: Is that challenge you're seeing here in this region? Are there specific technologies where we're lacking in those skillsets? And I guess what is the labor force doing to try to overcome these challenges? We'll start with you, Mike.

>> MIKE LANGFORD: We've created a multi-employer trust that does that type of training and we're putting in the state of art all aspects of training. When I say all aspects, you know, the high technology and the welding skills, you know, power plant operators, nuclear control room operators, (inaudible) operators, mechanics, maintenance, if you look at engineers and technicians in our field, we're putting a lot of investment into those areas, and again, with continuous learning, there is the change and we have to adapt and change with it.

So this knowledge transfer, like I was saying earlier, the fact that so many people are eligible to retire in our industry, up to about 50%, when you look at it across-the-board, is, we're trying to tap those folks prior to leaving into this whole training aspect.

And, because there's a huge -- going to be a huge gap there, and tap that knowledge transfer. So we're working with a lot of our utility partners throughout the country.

We're also bringing in a large pool of veterans, which, through our utility worker military assistance program, where some of these vets have skills in our industry.

And we're -- been able to put literally so far, you know, hundreds and hundreds of veterans to work in the utility industry, which is a good thing.

>> CHRIS KELLEY: Lisa.

>> LISA JOHNSON: I'll just make a quick note. Seminole, given our history, we became an operating cooperative back in the late '70s. And so, by the very nature of that time-frame, we've been experiencing our retirement wave over these last several years.

And -- and the good thing that I see is that we've had very skilled, very experienced employees that have been able to reach that retirement, and move out of the organization, and sort of happily move into retirement.

But at the same time, we're adapting our recruiting processes, we're continuing to expand our training processes, really, to accommodate the new workforce, and the opportunity to bring new folks into the organization.

And it's been very successful so far.

This is going to be something that we, in the industry, are going to have to stay focused on for many years to come. Because this is going to be cyclical. And as soon as we sort of get through our initial wave, there will be another one right behind it. So I think training is crucial.

I agree with Mike. Transferring knowledge is really important, particularly when you know you have a group of employees moving toward retirement to the extent that you can match them up with some of the newer employees and allow them to mentor and transfer their experience, it's a very helpful part of the process.

>> CHRIS KELLEY: Thank you. Other comments?

>> DOUG ESAMANN: Yeah. I'd add to it, it's a mixed bag, really, I think, you know, we have an in aging workforce, I think everybody is in the same position, like any industry, I think we're constantly looking for skilled workers.

No, that's a challenge in any state that I've been to, when they think about economic development. So, continuing to train potential employees with skills that we need for our industry are all really important things.

The other thing I would say though is, it's interesting. In our business, you heard a lot of the investment that we're going to be making in our industry, in the infrastructure business and in technology. And that creates a little more of excitement in the younger population to come into our business.

I think we've been viewed a little bit as a bit of a staid industry that doesn't change that much. And I think with the technology investments and the need for those workers to come in and help us install the new technologies as well as maintain and manage those, and manage data that we get from our customers, I think that creates some exciting opportunities for new perspective employees for us.

So it's a mixed bag, but, certainly something that we stay on top of each and every one every day.

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

So, Mike, I want to make a -- I guess I want to go back to you for a comment that you made in the beginning, and I'm curious to hear from the rest of the panel.

So you advocated for enhanced regulation of electricity (inaudible) markets. I wonder if you could expand on this and maybe for the rest of the panel.

Do you agree with -- that there needs to be more regulation here, or do you have recommendations on where that might be?

>> MIKE LANGFORD: Do you want me to expand on that?

CHRIS KELLEY: Sure, if you don't mind.

>> MIKE LANGFORD: The reason I bring that up is, again, I just mentioned to you about nuclear power plants in this country are shutting down prematurely just due to the fact of the cheap natural gas, not because of the EPA regs or rules but just due to the fact.

There's really -- it's not a fair market out there. It's not an open market. It's a subsidized market. And you know, I'm all for renewables, but I think if it was a regulated market, you could actually mandate to where renewables were made, because it's all about being able to make a profit. This distributed generation out there is really putting us at risk.

I mean, there's people that are here today, gone tomorrow. You know, you have a lot of people trying to break into the renewable energies and solar and wind. And they just can't get started.

Under a regulated market like the old home-grown utilities where they guaranteed reliable services and spending reserve for a country that, you know, we pride ourself on being, you know, the manufacturing -- well, not so much manufacturing of the world but just the fact that natural -- you know, our national security is at risk when our system is rated at a D minus. And there is only one manufacturer in this country that builds transformers of 765,000 KV. That's Mitsubishi in Tennessee. And you can't just go to your hardware store and buy a general -- a transformer.

Think about this: We have strategic oil reserves in this country, but we do not have a strategic transformer reserves in this country.

You could knock out nine key substations in this country. That could blackout this country for literally months, because when you buy transformers, a lot of them come from South Korea. It takes literally a year to two years from start to completion. So, that's why I go back to the fact that just some things need regulating. And this is an industry for short-term gains rather than being there for profits and Wall Street. It should be more for the residents, the consumers, the communities that we live in, and for the security of this country.

I mean, that's my beliefs on why we need to take a hard look, and if we really want to reduce the carbon that's the best way to go about it.

>> CHRIS KELLEY: Thank you. Other comments?

(Pause.)

>> DOUG ESAMANN: I feel compelled.

>> CHRIS KELLEY: Thank you.

>> DOUG ESAMANN: So, we operate, as I mentioned, in many different markets. Primarily, we operate in vertically integrated regulated states, and we think those produce value for customers.

We -- we do get market signals, and we respond to market signals in our business, whether it's in the transmission organizations that we're part of, where they dispatch the lowest cost generation, or whether it's in our areas where we're actually doing economic dispatch, under the purview of various folks watching what we're doing and making sure we're getting the lowest cost generation to our customers.
The -- you know, there are challenges in, would go in the -- in the various marketplaces.

And I believe the biggest issue that we are concerned about at Duke Energy is the lack of long-term capacity signaling to the marketplace for building of new capacity when you're generally outside of a regulated market.

So, if you're within a confine of a state resource planning environment through an integrated planning process, those states tend to manage more towards reserve margin that they feel they need to make sure that power flows to all the customers within their particular state or jurisdiction.

And I think outside of that, where you are relying on price signals, I think the concern is that no one, at this point, any way, is building a long-term generation with the price signals they're seeing from the various marketplaces.

So that, I think, is the biggest concern that we see. And we hope that there will be continued dialogue about how to make sure that there's investment, in the future generation, beyond sort of the near term where we're headed today.

>> CHRIS KELLEY: Any other comments?

>> LISA JOHNSON: Just a little different perspective.
As a member-owned cooperative system, we -- we are an operating utility in the State of Florida. We are a generation transmission entity. We are subject to any variety of -- of regulatory requirements as any other utility in the country. I don't certainly see that changing, but from a rate regulation perspective, we are rate-regulated by our members. So we are governed by a board that is made up of members, representative from each of our nine distribution cooperative members. And they, of course, have boards that are made up of representatives from the members that own them, the member consumers that they serve.

And I think, it's just a different business model in our industry, but from a rate perspective, from a long-term planning perspective, the governance that our board provides as not only the investor in our business, but also the -- those that pay our costs, not-for-profit entity that we are, we are passing on direct costs of our business to our member cooperatives, and they, onto their member consumers.

So that governance model is different. That rate regulation model is different.

It works very well for us. I -- I'm particularly fond of the fact that our members have the ability to influence and participate in the process of identifying the costs that we incur.

And those -- how those costs play out into our long-term plans, our resource plans, et cetera. But ultimately, that they have the ability to oversee that process as they are setting those rates for their consumers.

>> BRIAN THUMM: I've been fortunate over my career to work for a couple different investor-owned utilities, some in market regions, some not in market regions. Now, from SERC we don't really deal much with market participation at all. Our role is much different.

But thinking back now to the days and thinking about this in terms of its own membership they provide a role both in ancillary services, capacity resource analysis, for trying to set the right signals, price signals and otherwise to try to spur generation and transition development.

But I can't really opine whether markets are good or bad. Utilities as large as Duke certainly operate much in the same way.

They -- they have a number of registered entities (inaudible). All of the various (inaudible). They operate mostly as a coordinated dispatch.

So they can perform some of their own coordinated dispatch. They can generate their own market type signals. They have a number of large entities. They were even rolled up into five reliability coordinators.

So we do have some reliability in a quasi-market sense, even though we don't operate fully as a full market. You know, I think that there's pros and cons of the market, itself. As long as the signals are coming, as long as there's a way to extract the information that you would want from the market, even in a bilateral market sense, I think both can be successful.

I did want to pick up on something you said, Mike. You were talking about strategic reserves for things like oil, lamenting the lack of reserves in the transmission space. One thing that the industry itself has done both at a utility level, and at a much more broad level through some of the organizations like EEEI is to put forth a strategic (inaudible) transformer reserve program.

So there is an opportunity for the utilities to come together and hopefully (off-mic.)

Some of the equipment in locations that can benefit all the organizations that participate.

I would like to see more of that, if there's a way to encourage that from the Federal level, from the national level, the levels one the regional levels.

But an opportunity to strategically position, where do we get these transformers, because you're right. Whether they build it in South Korea or Tennessee, it's going to take you over a year to wire the transformer, it's just a fact. Reactors are long-lead time items. Breakers are pushing a year now.

There's an opportunity to do better in spare equipment repositories in strategic locations. I will agree with you on that point.

>> CHRIS KELLEY: Thank you. Other comments?

So, Lisa, you had an interesting slide, showing the complexities or your view of the complexities associated with the Clean Power Plan. I just wonder if the other panelists could comment maybe on challenges they might have in meeting goals of the plan, or if your entities are getting value, or you're at least making some changes to accommodate the plan. So, let me open that up to whoever would like to speak to the Clean Power Plan.

>> DOUG ESEMANN: Well, for the Clean Power Plan, again, we're in six different states. And the biggest challenges tend to reside in the States that have the highest usage of coal.
So when you think of Lisa's portfolio, she's got half or so of her portfolio in coal and the other half in other carbon fuels. So those are challenges when we're in our states, like North Carolina, South Carolina, where we have 40% of our energy from nuclear.

I think the road to get to compliance with the Clean Power Plan, should it continue in its current form, it seems a little more manageable, going forward.

And similarly, in Florida, I think, you know, we -- I think we see pretty good situation in Florida. We have less coal there. But when I look to the Midwest, we don't have generation in Ohio, because it's a deregulated market, and we sold it. But our Indiana and Kentucky portfolios, which are more coal-intensive are the areas where we see the biggest challenge. And that's going to take a concerted effort on the part of all the utilities in the state as well as, you know, the Department of Environmental Management in those states to work a plan that we think can be -- can achieve compliance with the Clean Power Plan and can be affordable and less impactful to our customers. Those are drivers for us.

>> CHRIS KELLEY: Thank you, Doug.
Others.

>> BRIAN THUMM: Whether the Clean Power Plan survives its legal challenges or not, the natural evolution of the power grid is towards a cleaner, modern, environmentally-friendly industry. I think the Clean Power Plan simply accelerates that transition. So -- and whether it comes to fruition or otherwise, I think -- I think the industry, itself, has enough invested in the transition (inaudible). A lot of the resource changes are going to come to fruition.

>> CHRIS KELLEY: Thank you. Other comments? Lisa.

>> LISA JOHNSON: I'll just -- I'll comment on my slide, and the fact that it is meant to represent the significant complexity that is brought about by the Clean Power Plan as we know it today.

And although we don't know the fate of the plan, I think it's important to acknowledge that the timing and flexibility are critical.

I think Brian mentioned, we are making movement toward a different and new energy future already. Some of that doesn't get taken into account in rurals like the Clean Power Plan. So timing and flexibility is critical, and in particular, optimization.

I think it's -- it's imperative that those of us in this industry, if we want to continue to provide what I think everybody expects, which is safe and affordable and reliable electricity for years to come, we need to make sure we're optimizing this transition, that we're -- we're optimally combining and integrating our existing resources, and allow those that have strong performance the ability to continue to contribute to the system to continue on for a reasonable period while we make the transition to new resources and new system implementations; and that we do that as optimally as possible; because if we don't, there's going to be higher costs. It's going to be less efficient. And it's not something we want to have to continue to have to fix or redo every time that we want to make a significant shift.

So time and flexibility is very important. And when you have something as complex as the Clean Power Plan, with as many interactions that it causes, that raises the challenge in terms of being able to manage (inaudible) the process, thanks.

>> CHRIS KELLEY: Other comments? So, I think we have time for maybe two more questions, so my second to last is just one of general reliability. So many of you spoke of diverse generation as a way to ensure supply reliability. But this -- this region is particularly subject to natural disasters, weather related issues, other threats to reliability.

So I'm curious to know just, you know, what do you see that must be unique in this region or what are you doing to accommodate and address these potential challenges?

>> STACY DOCHODA: I'll begin.

So in Florida, of course, being prepared to be resilient to storms has been part of the long history for Florida. I think at the NERC level now, the regional level in addition to thinking about storms we're also thinking of course about cyber and physical security. And there's been a lot of focus on standards and preventive issues but now there's also a renewed focus on resilience from cyber and physical security attacks as well.

So I think in general the whole issue of resilience has really risen in the reliability sphere as a very important issue we need to be prepared for.

And one of the things that we'll be doing with NERC in future grid exercises we will be looking more closing at restoration and resilience after attacks.

>> CHRIS KELLEY: All right.

>> BRIAN THUMM: I want to pick up on Stacy's comments, resiliency is one of the top buzz-words of the industry right now. And it's -- transcends not just physical and cybersecurity, but also traditional planning methods.

I see utilities now starting to speak of resiliency in the context of minus 1, minus 1 and minus 2 planning. How do you maintain the system throughout, whether it's security or cybersecurity or not. How do you know how far your system is going to cascade, given any number of drivers. Oak Ridge National Labs in our region is doing a lot of work to see how they're packaging that and rolling it out to the industry.

So, first perspective, in addition to the stuff Stacy mentions, we're facilitating the stuff to our members, is: How do we incorporate resiliency into not only members' standards, but what can we do to facilitate regional resilience (inaudible).

>> CHRIS KELLEY: Thank you. Others? Okay, so with that, let's turn to our closing comments, so I think we have time for about two minutes a piece, if you'd like to just provide your closing comments, if recommendations, we have the QER Task Force in front of you really representing all the branches of the Federal government.

And as was mentioned I'll just remind you earlier today, the Secretary mentioned that a number of recommendations came out of the first QER. We expect the same. So this is a good opportunity for you to hear your final comments.
We'll start with you, Stacy.

>> STACY DOCHODA: For FRCC and for Florida, I think the focus in the near term really will be around the integrated resource planning and the regional look that we provide.

I appreciate some of the discussions that have happened already this morning about the focus on the differences among regions, and I think if you've watched the different panels they have gone across, you certainly see the differences from the west and over to Florida in the Southeast.

So FRCC will be continuing to stay in its position of watching those evolutions that are happening in markets outside of Florida, being prepared to address those as they (inaudible) sorts of items become more of issue for us, but that's likely to be much further into the future for us.

>> CHRIS KELLEY: Thank you, Stacy. Brian?

>> BRIAN THUMM: We focused a lot of the discussion today on the integration of new resources. Indeed, changing resource mix came up I think in all of our discussions and how do we ensure the right generation mix.

I want to make insures transmission doesn't get left on the cutting room floor.
It's a lot easier to set targets for fuel portfolios than it is to describe anything about the transmission system, and yet each and every one every one of those generation resources needs to be deliverable to load.

Otherwise, we're just increasing more costs, whether you're in a regulated market that will -- that will calculate and quantify congestion costs or whether it's the operational effects of not being able to deliver generation because of congested transmission lines.

I want to make sure that as we roll out the Clean Power Plan or discussion about polar vortex whatever the cause du jour is that we want to solve if we're going to change it with a changing resource mix, let's make sure that we invest enough time to understand both the needs of the transmission system and the societal costs that will come with the infrastructure needed to do that.

I think a lot of the things we were talking about today are great initiatives, great way to move the electric system forward. I want to make sure we do it in a collaborative step. That's our role to make sure that we're looking at all the pieces of the pie.

And hopefully that will continue to be the case, even with the recommendations that come out of QER.

>> CHRIS KELLEY: Thank you. Mike.

>> MIKE LANGFORD: All right. And, again, I want to continue that we engaged millennials and what good jobs that these are. These are life supporting jobs. And the education that goes into it and that they start early in the skills that are needed in this industry.

Also, the (inaudible) training, again, is minimum 4 to 6 years. And it is important that we -- we put the emphasis on that, and that as we move into a whole mixture in combinations of different types of generation, that we can sustain those and make them good jobs.

The transmission system, you know, you hear a lot about smart grids, expanding the grid. It's easy word to say, but it's not so easy to make real, because, you know, how many of you in this room would like to have a transmission tower in your backyard? Answer's probably nobody.

And so, see, there's -- it's a hard thing to accomplish, but to really make the renewables more profitable and accessible to the grid system, we're going to have to really look at how do we build these, and expand these transmission systems. And by doing that, we're creating work, we're creating jobs, jobs that can't be offshored, and, again, life-sustaining jobs, so I say -- I

can't say it enough, that we keep that human infrastructure aspect as a part of this, as we move forward.

>> CHRIS KELLEY: Thank you, Mike. Doug?

>> DOUG ESAMANN: Well, I appreciate being here on behalf of the 29,000 Duke Energy employees. You know, they get up every day and make sure that when you flip a light switch or plug in whatever you're plugging in, that it works, and that the power's there. And they focus every day on reliability, and they focus every day on affordability, and generating cleaner energy. And there's a tension that always exists with that. And the utilities are sort of in the midst of that, but they take their responsibilities seriously to make sure we have power to power our communities, and our states that we serve.

As I mentioned in my remarks, the industry's changing. You know, customer expectations, in particular, are driving a lot of this. The technology is certainly there, driving a lot of this, the things you could do, and on your iPhone today, and what you can -- what changes your expectations of what you expect from the utility company that serves you. And we understand that.
But we've got a long way to go, to invest, to make sure we're staying up with the trends of today, and we can provide our customers with, you know, convenience, and choices.
And that's something that really hasn't been valued a lot in our industry in the past. But certainly in the future, that's something that we hear from our customers a lot.

They want choices, they want convenience, they want options and we need to drive to make that happen.

So these are exciting times in our industry, a lot of challenges, certainly. And we, at Duke Energy, look forward to the opportunities to collaborate with folks in the industry and outside the industry to make sure we have a secure energy future.

Thanks.

>> CHRIS KELLEY: Thank you. And finally, Lisa.

>> LISA JOHNSON: Thank you. First, I'd like to just commend DoE on the QER process, particularly this second installment and the approach that's being taken.

I think the analytical approach, as well as the comprehensive nature of looking at all the components that make up what we call our electricity system in this country. It's important to do that. It's important not to exclude certain -- certain of those components or to -- to give less recognition to some than others, because it works, because it is such a comprehensive and complex system.

As a representative of a wholesale provider to our rural electric distribution cooperatives, as part of kind of the fabric of the cooperative system in the U.S., I hope that we can continue to see the success of the very successful private/public partnership that's been in play for so long, particularly through the Department of Agriculture and the RUS.
That is something that has helped continue to advance and identify the needs of rural America, and I'd like to make sure that we see that continuing as we set energy policy in the future.

Just in summary, a few things that I think are maybe most meaningful to me, as I've thought through this discussion today. From a regulatory perspective, we want to make sure that our regulation and requirements, that landscape continues to provide the necessary time and the necessary flexibility to our system as we transition to this new energy future.

Secondly, we've talked a lot about infrastructure. And I think infrastructure is going to be an absolute necessity, whether it is significant transmission or pipeline infrastructure, interstate or intrastate.

Whether it is distribution infrastructure, enabling some of these new technologies, or whether it's the human infrastructure that Mike just mentioned, we need to make sure that that infrastructure is -- is planned, and that the costs are appropriate as we -- as we move toward making that infrastructure a reality.

And then lastly, I'll just mention, again, optimal integration. It's so important that we manage through this transition, looking at all of our resources, both existing and new. Optimize that in a way that allows us to maintain diversity in our electric system, that allows us to maintain affordability which is so important to our consumers, and that ultimately we end up establishing energy policy for the future that is truly all-inclusive. Thank you.

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

(Applause.)

>> CHRIS KELLEY: So we are now scheduled to take a break for lunch. I understand there are a few options around. Directly across the street is a place to grab some lunch. We will reconvene here at 1:15 promptly and get started with this afternoon's agenda. So you'll be hearing from two more panels, so one that's focused on electricity distribution end use and another that will focus on our kind of unique specialty area in this particular meeting which is financing new electricity infrastructure. So just a reminder, if you haven't signed up to provide comments at the end and you'd like to do so please do that at the entrance and again for those that are joining us online, you can submit your comments the website. We'll get started at 1:15 Eastern. Thank you.

(Lunch.)

Remarks by Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy David Friedman

>> CHRIS KELLEY: So welcome back from lunch, everybody. I'd like to invite Karen Wayland back up. She's going to be introducing our guest speaker, and then we'll turn right to the next panel. So, Karen.

>> Dr. Karen Wayland: Thank you very much. I pause for the awkwardness for lunch. We at the Federal Government are not even allowed to buy you coffee which is inconvenient given that you have taken the day off and traveled to come here on your own dime but that is the restrictions of spending taxpayer dollars. So let me turn out, as I mentioned this is both an interagency process but it's also an inter DoE policies, the secretary's policy should and is the secretariat for the overall effort but we work very closely within DoE with our -- with the protection gram offices, the energy program offices and so today to kick off the afternoon session, we have David Friedman who is the acting Assistant Secretary, sort of -- shortly to be the acting Assistant Secretary for Energy Efficiency and Renewable Energy, I've known Dave for many many many years where he worked for 12 years at the Union of Concerned Scientists at a whole range of fuel efficiency technologies and clean energy work. He was then over at the -- at the Department of Transportation, as both the deputy and Acting Administrator of the National Highway Transportation Safety Administration, before he came over to the Department of Energy to work on energy efficiency and renewable energy. So with that, let me turn the podium to David.

>> DAVID FRIEDMAN: Thanks so much, Karen. Really appreciate the opportunity to be here. My first time here at Georgia Tech Institute. It's great to see that all of you are here to talk about what I think are some pretty important topics, so as I think you already heard from Secretary Moniz this morning, this is really the last of our six regional meetings that we've been holding, in order to really get critical information for this, our second installment of the Quadrennial Energy Review.

Basically looking at the electricity system from soup to nuts, and this comes based on a request from President Obama where he really challenged us at the Department of Energy to work across the administration, to answer some really fundamental questions.
First off, what should the grid look like in 2040?
And second, what policies do we need to put in place today to help realize the grid of the future?

Now, it's not an easy question, which is why this is an administration wide effort and why input from all of you is also so critical to a successful product at the end of the day.
In fact, we're not just working with -- with our own partners at the Federal level, including states, local governments, advocates, NGOs, and even in some cases international partners,

because more and more he were live in a world where the international grid is so critical to the success of this effort. And it's also critical that as we look at the future, as we look at the kind of grid we need, it's got to modernize, because if we don't, we're going to face a future of electricity that's less reliable, less secure, more expensive, and more polluting than, frankly, it needs to be.

So, to me that creates and outlines great opportunity, but it also outlines great challenges. And that's why the QER Interagency Task Force is really here today, so that we can gain a firsthand understanding of our nation's incredible range of electricity opportunities and challenges.

I think the Southeast Region is a great example of some of those. It's been an especially fertile area for financing of some types of low carbon electricity. It's also an area where solar power is now making gains, thanks, in part, to its costs and benefits being included in utility-integrated resource plans.

It's also a region that has relatively low to moderately priced electricity. Be thankful for that. And it has -- has had a lack of major blackouts in modern times, and already, some significant efforts at grid modernization, even without those high electricity prices. But clearly, I think we've got a lot to learn from all of you. And part of that is because we know the U.S. grid has provided huge benefits along the way.

I mean, if we look at the enormous advancements in our quality of life, thanks to the electric grid over the last hundred years, it's really clear why, when you look at it, the developing -- the electric grid has been one of the most important engineering feats of the last 100 years, well alongside our highway system, cars and planes. It really has been transformative. We look at it, the grid has reliably powered our homes, our businesses, offices, hospitals and more and more of these fancy little devices that we carry around every day that drive our lives and inform our lives. Electricity is the critical glue that helps make information technology and so much more happen every single day.

Now, at the same time, we also face some real challenges with increased weather events that are really putting more and more pressure on the reliability and resilience of our system. There are extremes and challenges that are only going to grow as our climate changes.

We also face significant challenges when it comes to emerging cyber and physical attacks on our electricity infrastructure.

So, in short, the 21st Century fundamentally needs a 21st Century grid, one that can seamlessly integrate both conventional and renewable Energy Resources while incorporating storage and central and Distributed Energy generation. And I think these are some of the critical topics, along with financing that it's going to be really important for you all to discuss are for the rest of the day.

And these are some of the topics that are fundamental to that 21st Century grid that I think conserve not just as an opportunity to overcome those challenges, but also, as an engine for economic growth, an engine for job growth, and an engine for global competitiveness.

The world is getting harder and harder to survive and 35 in. And our grid can be one of the core tools, a 21st Century grid can be one of the core tools that helps us survive, 35, and compete on a global scale.

Now, this global race is really where my office, the Office of Energy efficiency and renewable energy, comes into play. When you look around the world, our $2 billion a year investment represents the single largest government investment in clean energy and energy efficiency around the world.

We are literally trying to shape that future of clean energy, as we work with entrepreneurs, industries, our National Labs, universities, states, and many others, to build that grid of the future, to build that clean energy economy of the future. So what we like to say about ourselves is when it comes to clean energy and energy efficiency, we are the solutions people. And we want to make sure that we're working with all of you to make sure that those solutions are the best possible. And that's really at its core why I think my job is so fantastic and why it's such a great opportunity, because we are literally in the middle of a clean energy revolution, where we can grab hold of those opportunities, if, if we make the right choices along the way.

First off, costs have dramatically dropped when it comes to renewable power and other clean sources of energy, but even with that, we need more research and development to help continue driving down those costs and driving up the affordability of our grid, not just in energy efficiency and renewable energy but also in nuclear power and fossil fuel systems through carbon capture and storage and other key solutions. But even that's not enough. R&D alone won't get us where we need to go.

We also have to figure out how to integrate these increasingly cost competitive technologies into the grid as we dramatically decrease the carbon footprint of our power sector. And we need to do all of this while maintaining and even improving the affordability, the resiliency, the security, and the reliability of our grid.

Part of what this means, part of what this requires is a more flexible grid, one that can work with demand responsive buildings, grid connected electric vehicles, grid scale energy storage, SmartGrid infrastructure, fast response gas generation, and whole new ways of integrating new technologies into the grid.

That's why at the Department of Energy, and my Office of Energy efficiency and renewable energy we're working with our partners in the policy office, in the office of electricity, to launch what we call our Grid Modernization Initiative or GMI.

Now, the focus of our GMI is on new concepts and tools, platforms and technologies that will help us better measure, analyze, predict, and control this grid of the future, this 21st Century grid.

This initiative will also help enhance state and industry capabilities for designing the physical and regulatory tools we need for that successful grid modernization effort. And all of this is in service of a wide variety of critical goals from reducing the societal costs of power outage, cutting the cost of reserve margins and dramatically reducing the cost of integrating wind, solar and other Distributed Energy resources.

And if we achieve our goals, one of the things that we think we can truly deliver is more than $7 billion in annual benefits to our economy from that 21st Century grid alone.
Now, delivering on these outcomes is not going to be easy, it's going to require a lot of work, and it's going to require a systems approach.

And that's part of why one of the things Secretary Moniz asked us to do was to create an integrated strategy for this grid modernization effort.

But working with the office of electricity we've developed a multi-year program plan targeted at laying out that blew print. And over the last several months we've held five regional workshops to get feedback on that plan. To hear from stake-holders like all of you about the challenges and opportunities for grid modernization in different regions of the country.

In fact, just last week we held one of those listening sessions here at Georgia Tech Research Institute. So thank you to anyone here who helped us with that effort.

Now, in addition to planning and listening, we can spend a lot of time doing all of that, but we also have to act. We've got to put our money where our mouth is.

And that's why we have put -- we have invested over $200 million into a strategic partnership between the Department of Energy Headquarters and our National Laboratories.
All this call this our Grid Modernization Laboratory Consortium. And its goal is to bring in leading experts in order to collaborate on more than 80 highly coordinated cutting-edge projects over the next three years.

One of the parts of this effort is a proposal for a set of early stage public/private collaborative projects that are going to bring together folks at the regional level on grid modernization so that we can focus on the unique challenges that exist in specific regions around the country.

We all know that we don't have one national grid. Maybe we can get there some day, but if we're going to get along on that path one of the first things we need to do is to solve our regional challenges. Of course, this is only just the beginning of what we're trying to do.

Part of a modern grid is one that takes full advantage of the opportunity to significantly reduce electricity demand through updated approaches to energy efficiency.

When we look into the future, when we think about the role and the potential for energy efficiency, it's one in which buildings and facilities around the nation are connected with consumers and businesses to save billions in energy costs through a mix of traditional approaches to energy efficiency and smart buildings, buildings that talk to one another and talk to the grid so that they can reduce the need for peaking power. So that they can enhance the integration of renewables and other low carbon resources.

In part by sharing data and by matching demand with supply at levels we've never been able to think of before. Including integrating storage into that mix. This is really, truly the core definition of what a modernized grid can look like if we make those right choices, if we get those right policies in place.

Of course, again, to get there, we need more R&D in this area. We need to double down, in fact, on investments in R&D, which I think the secretary talked to a little bit about earlier. It also is going to take a lot more coordination at the Federal level, at the state level, at the local level, with industry, advocacy groups and consumers around the nation. It's also going to take the integration not just of smart buildings, but smarter and more widespread Distributed Energy resources.

And inability to match the low to the demand, inability to be flexible, resilient, reliable in the face of all the challenges we face is going to be inherently tied to a more distributed system, a more flexible system, that works well with the centralized system that we have been used to for decades.

Now, we can't do that alone, we can't simply coordinate all those different technologies centrally the sail way we do with grid power plants today, but we can build bridges to that through sharing data, through ensuring cybersecurity, and gaining access to that data, through rethinking the way we control our systems, rethinking the way we interact with and engage with utilities and another industries to change all of those dynamics and really take advantage of the opportunity that we have in front of us to deliver greater reliability and lower costs and lower carbon, all at the same time.

I think distributed takes is a great example of that. A little later on today one of the things I'm going to do is celebrate some progress that we've made in our community solar alliance, an effort to bring distributed solar resources to low income and diverse communities who currently aren't having as much of an opportunity to benefit from not only the clean power, but the jobs and consumer savings that you can get through distributed photovoltaic power. So the progress is happening and it's real, we have to make sure we're working closely together to turn that progress into reality. And that's part of where financing is so incredibly important to the future of this modern grid, especially things like third-party ownership.

Similar to leasing a car, I think a lot of you may already know, third-party ownership allows consumers to benefit from lower electricity payments without, for example, the cost of purchasing the entire photovoltaic system and this has been incredibly successful. In fact, third-party financing accounted for more than 72% of U.S. residential systems installed in 2014. We have the orders of those residential units financed through a third-party. It's a real revolution, not just in technology but in the way we bring that technology out to consumers.

And it's not just the only tool that we can use. We have 0 down solar loans in play. We've got pace, the property assessed clean energy financing tools that more and more folks can take advantage of. And we've got that shared community solar efforts that are making it much easier and more affordable for consumers to install PV either on their home or to tie into community solar projects.

Now, finally, I'd be remiss if I also didn't point out that when it comes to the future of renewables integrating into the grid, I would argue, and pardon the pun that the future is a lot brighter than it was before last December. And that's thanks in part to Congress extending the investment and production tax credits for solar and wind power another five years.

And those five years, in many ways can make all the difference in the world. In fact, analysis from our National Renewable Energy Labs has shown that that extension will result in more than 50 additional gigawatts of wind and solar capacity by 20 between compared to scenarios without that extension. This can lead to 60% more solar and wind capacity in 2020 than what we expect this year. 60% more. In just four more years, thanks to one policy change. It's incredible the leverage that it can create.

And the extension of these credits provides really important certainty for the renewable power sector. And I would also argue, a much sooner handoff to the Clean Power Plan.
Combine both of those policies, they're putting us in a position to drive down global warming pollution and other harmful emissions from power plants. And at the same time, when leveraging our R&D efforts to drive down the costs of renewable electricity to levels that have never been seen in the market before, paving the way for even further growth into the future.
So, as I think hopefully many of you already know and as you can see from what I've said today, there are incredible number of opportunities for energy efficiency, renewable energy, and other clean energy sources on the grid. But to realize those opportunities, we need a grid for the next 100 years, not for the last 100.

That's why I'm really looking forward to hearing the feedback from the sessions that you all are going to have this afternoon and the ones you had this morning, so that we can better understand your perspectives on our plans and the opportunities for modernizing the grid. And what you see is the real critical opportunities and challenges that we're going to face along the way.

Because at the end of the day, we have to seize this opportunity. We have to ensure that the United States is competitive in the global scale as clean energy and the clean energy economy and the clean energy revolution are moving forward.

If you look back to the Paris climate talks and the signing of hundreds of nations around the country to step up on clean energy, on reducing global warming pollution, as the secretary often notes we're talking about trials of dollars in opportunity on the table. And we want to make sure that opportunity is seized by the United States to the benefit of all of you and everyone across the country.

So, thank you, everyone, for taking part in these sessions today, and for contributing your ideas, and we look forward to working together, going forward of the enjoy the rest of the day. Thank you.

(Applause.)

>> CHRIS KELLEY: So thank you, Deputy Assistant Secretary Friedman. I appreciate those comments as we lead into the afternoon. So we'll jump right into our next panel. So I'd ask if you're on this panel, please join me up front and as we're transitioning here, just once again a reminder, if you'd like to provide comments at the end, please do sign up at the entrance to provide public comments at the very end of our last panel. We'll get started in a moment.

Panel 2

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

>> CHRIS KELLEY: Okay. So the next panel, we started with generation to transmission, and we're moving down the pike to distribution and end use. So the focus of this panel is electricity, distribution and end use, how do we manage challenges and opportunities. So certainly a broad topic

For today's panel, but we will be hearing a lot of interesting comments from our panelists, so let me introduce our panelists now.

We have Gordon Gillette, President of Tampa Electric and People's Gas Systems. Greg Merritt, Vice President Marketing and Public Affairs, Cree Incorporated. Dr. Deepak Divan; John E. Pippin, Chair and Georgia Research Alliance Eminent Scholar, Director for Georgia Tech Center for distributed energy and Professor, School of Electrical and Computer Engineering, Georgia Institute of Technology. I'm not going to take that time out of your five minutes by the way. That's very distinguished credentials there. And we have Cameron Griffith, Energy Solutions

Advisor from TRAIN. And finally Stan Wise, Commissioner from the Georgia Public Service Commission. So a diverse and interesting group that you're going to hear from today.

Panelists, as a reminder, as I did with the last panel, you have five to seven minutes. We will go down the line and give you a chance to have your opening remarks in that five to seven minutes. There is a series of colored lights here in front of you. When the red light goes on, it means five minutes are left, so you still have another couple of minutes and then it will come back to me and I have a chance -- Questions? So with that, why don't we get started on the end?

>> GORDON GILLETTE: Thank you very much. And thank you for the opportunity to speak this afternoon. Tampa Electric is an investor-owned utility, vertically integrated and TKO Energy's largest subsidiary. Our Tampa electric division serves retail customers in west central Florida. We have about 700,000 customers with a system generating capacity of about five thousand megawatts. We have been around since 1899 and are very proud of our long history and commitment to our community including understanding the needs of our customers. You may know that our parent company, TKO energy is in the process of merging with a Canadian company named Amira out of Nova Scotia and together we will be a top 20 energy utility in North America. Just to talk about Florida a little bit, there are
57 electric utilities in Florida. 27 gas utilities.

There are four large investor-owned utilities in Florida that serve about 85% of the load. Florida's mode of regulation is investor owned with vertical integration and rates of return like most in the southeast. Florida has had active demand-side management cogeneration and independent power rules and programs and open access transmission since the '80s. The utilities have had aggressive distribution storm hardening programs and investments ongoing since 2004.

Utility rates in Florida are well below the national average, even though Florida has no indigenous fuel resources. This is important because almost 20% of Florida's population is over 65 years of age and on fixed income. Our low rates in Florida have been made possible through the careful work on the parts of regulators and utilities, on planning and on the policy front and sticking to some fundamental principles which include cost effectiveness, constructing the system and implementing programs like DSM in ways that don't impact customer rates negatively. Cost of allocation making sure that costs are allocated correctly among the various customer classes, subsidies, only using subsidies, very judiciously to kick start new technologies and only keeping them in place for as long as needed and then removing them. Customer experience, making sure that everything we do maintains or enhances the customer experience. Local business, keeping in mind that the utility business is fundamentally a local business and every utility has different economic conditions, customer types, demographics, weather and customer taste and needs.

And basic need, that customers view electricity as a basic need, one that they don't want to spend a lot of time thinking about, they simply want it there.

I believe that we have been successful in Florida by applying these principles to our decision making, from planning, generation and transmission, distribution and demand side management. We are at a hugely exciting time in our industry, especially on the distribution and demand sides of the business. Solar power, both universal and rooftop are taking hold, numerous smart distribution and metering technologies are becoming available, LED area lighting is taking off. New ways of working with the customers on billing and customer relations and new service offerings and behind the meter technologies are emerging.

It's my belief if we keep the basic principles that I talked about in mind, as we implement these strategies, our customers will get the best end results. In Florida, solar power is emerging. Even though we're known as the Sunshine State, Florida has been slower in implementing solar power than other states largely because of our very low rates for electricity. But solar is becoming more cost-effective. The focus on maintaining affordability and reliability in Florida has produced a debate around the most cost effective method for increasing solar energy in the state. At Tampa Electric we're aggressively pursuing the development of solar power.

We believe that universal solar power or as it is sometimes called, large scale or utility scale solar, is the most cost-effective and reliable way to deliver solar energy to customers in Florida, increase renewables and reduce statewide carbon emissions. More specifically, universal solar is more cost effective than rooftop solar, because it takes advantage of economies of scale and it's also designed to be more efficient in using the sun's energy. However, the principle advantage of universal solar power is the fact that every single customer contributes equally to the cost and benefits -- from the cost and benefits of solar installations. We are working to ensure all of our customers are treated fairly and receive consumer protections they're due, which is why we're supportive of the solar amendment which will be on the ballot this year, filed by a group called Consumers for Smart Solar. This amendment would guarantee state and local governments continue to protect consumers and from predatory sales practices and unreliable service.

The CSS amendment would also make sure that electric customers who have their own solar systems are not subsidized by those who cannot or do not have solar. The CSS constitutional amendment speaks to most of the principles that I talked about earlier including cost-effectiveness, fair cost allocation and the elimination of subsidies, more generally we think it's very important that policy makers, utilities, regulators and other market participants adhere to the basic principles that I discussed as we pursue current and new distribution and demand side management side options. Thank you
Very much.

>> CHRIS KELLEY: Thank you, Gordon. Greg?

>> GREG MERRITT: Thanks Chris. I would like to thank the
Department of Energy for the invitation. I think I'm the first person who is going to talk about the things connected to the network as opposed to the network – [inaudible] Cree is a leading

U.S. developer and supplier of LEDs, LED lighting technology and LED products and systems. Over the past technology we have seen LEDs evolve from a technology with potential to replace traditional lighting to what has really become the accepted standard for energy efficient lighting. I would like to recognize and thank the DOE's efforts, the early days of LED technology deployment, the lighting industry association helped in a number of ways to get the industry jump-started and ensure that we didn't have false steps. The widespread deployment of LED lighting has the potential to reduce the electricity usage in this country for lighting by over 50%. If you think about that, that's the about to take 10 percent of the load off of the grid.

We're talking about a big number. We can do that and at the same time improve the user's lighting experiences and actually bringing additional value added services. However, we won't get there with just the status quo. Let me explain what I mean by that. We started the LED revolution in the U.S. over a decade ago with the availability of the first economical LED products. At the outset, and I would argue through the first phase of LED lighting, the objective was really to mimic the products that went before. We were trying to make LED or lighting products that looked like what people were used to and operated like people were used to. But we were going to do so using much less energy and longer lifetime therefore saving money. I would argue that we were successful in that first phase as I mentioned, and LED lighting is generally expected to replace almost all traditional lighting products over the next several years. Right now I'm embarking on what I call the second phase of LED lighting. What I mean by that, we have the opportunity to leverage the technology and deliver lighting experiences that were not possible before. We can deliver better lighting experiences and provide the capability to go well beyond what was possible.

So, what possibility or what opportunities does this create for both building owners but also the electrical demand? We are talking about the fact that LED lights can go from passive consumers on the network to active participants. LED lighting products are essentially high-powered digital appliances that can be equipped with sensors, intelligence, memory, software and communications capabilities which provides a platform to both sense and also actively affect the environments which they are deployed. The context of the Internet of Things – LED lighting can actually enable the widespread deployment of the Internet of Things within buildings. Cost effectively deploying the aforementioned high powered appliances roughly every eight feet in every space that people occupancy.

I would argue there's no other technology that justifies this type of pervasive deployment of these type of devices. Deploying intelligent connected LED lighting gives building managers and their occupants the valuable opportunity to collect continuous data about lighting usage, building occupancy, ambient light levels and depending upon what sensors are deployed, room temperatures, carbon monoxide levels and other environmental characteristics. Not to mention video cameras and audio sensors. At the same time, the lighting can respond to changes in the environment, either an intelligent response to the censored data or a programmed or scheduled behavior. Some examples include --and some of these are obvious, sensing room occupancy to turn lights on and off. Although you would be surprised how many few rooms actually have that capability in this country. Reacting to ambient light levels in a room. Like this

one, but one that has windows we can react to the amount of ambient light to dim the LED lights, therefore, maintaining the same level of light in the room. We can actually change the light color to accommodate preferences of the people in the room, so you can think about hoteling Offices depending on who has checked in there. One person may like warm light, one person might like cool light, one person might like full levels of brightness, others might not. You can actual make those changes automated as opposed have to pulling out an app on your phone and change it. I would argue that's the difference in intelligence lighting and obedient lighting. If I have to pull out an app and tell the lighting what to do, it's obedient. You can also provide finding in response to emergency situations and even scheduled lighting color changes to accommodate circadian protocols. For instance, in a health care education situation.

The intelligence and data gathering capabilities of these systems can be used to deliver much higher levels of energy efficiency than possible today. Through data analytics, building managers can turn space usage and associated systems including HVAC and security to maximize energy efficiency while providing an increased level of service to the building and inhabitants. One example of this is Cree recently announced a system we call our Smart Cast power Ethernet system. This system uses a standard based Cisco power of Ethernet network infrastructure to both power the lights as well as provide networking and secure communications. Through the system building, users can achieve energy efficiency up to 70% higher than what was available through standard LED lighting systems. That means you can get up to 85-90% energy savings over a traditional lighting system. In addition, because the system uses standard applications programming interface capabilities and is based on the standard protocols, we are able to interconnect it with other external building management systems such as I mentioned – HVAC systems and security systems to deliver much higher levels of building efficiency. The better light experiences not only improve the buildings for the users, but save significantly more energy.

>> CHRIS KELLEY: So Deepak, I will turn to you in a moment but I just want to remind folks, we are live streaming this, and these microphones are sensitive. If you just move your head a little bit it loses it. So just speak directly into it. And it's also being transcribed so it helps the transcribers to catch every word. So the floor is years.

>> DEEPAK DIVAN: So again we appreciate the chance to kind of talk out here. I am the Director of the Center for Distributed Energy on campus out here. And I have been actively working on grid control. I spent the last four years in California running a startup where we had introduced a whole range of what we call grid edge control technologies in of which are now beginning to be deployed at reasonable scale. And with some really good impact.

So again, I think we have had some discussions here about the evolving grid and the fact that the grid has performed a marvelous function our entire growth, our entire GDB growth, everything has kind of really been based on that and we're seeing a significant change that is starting to occur. Some of it is driven by new needs. I call these exponential technologies, LEDs and PV are both exponential technologies, where the price is dropping exponentially and the

demand and use is growing exponentially and that has a very big impacts how the grid operates and works.

We have big initiatives in terms of improving the operational, economic and energy efficiency of the system and finally, resiliency has been talked about quite a bit so we see significant changes coming and much of what we see being discussed is really -- we're going to do all of the things we did until now but we will do it smarter and a little bit better. I think what we're beginning to see is that really it's going to be are very tough. And again I'm going to throw some charts at you guys, not to overwhelm you, but to show you that the patterns are changing dramatically. For instance, when we had think about how utilities are operating the distribution feeders, we think about a very smooth linear process where the voltage starts high near the substation and slowly goes down towards the end of the line and that is kind of the objective or the way the planners have designed the networks forever.

On the right out there is data from a southern company feeder, actually without much solar on it, and you can see, it doesn't look anything like what was expected. And in fact I mean when we start looking at the dynamics, we are seeing that utilities don't really have models to be able to explain what is happening. And then you take solar and put it on this and that becomes much worse. In fact, in every place we are seeing, whether it's Hawaii, whether it's California, in almost every case, the ability to absorb more solar on your distribution system is primarily limitation is voltage constraints and voltage limits, okay, and really under existing technologies, it's very tough, you know, to be able to manage this kind of a system. And this is just one example of the things that we are actually beginning to see and this is a little scary because again, I think grid modernization very important, but it's not just putting sensors and making things smarter. I think we forget sometimes that there are physics involved here and it's all math you know and I think -- I'm just reminding people there's real physics that we need to pay attention to. We're trying to go from this network that we have, which is the legacy grid, which is nice and structured and works well, simple schedule and slow to a very complex and dynamic system where everybody wants to be a producer, everybody wants to manage systems and be in the market and all of that stuff. It's chaotic.

How do you go from a structured system to a chaotic system? Even if you wanted to rip out the infrastructure, there's no money for that. If you have to put another $2 trillion in the infrastructure, you want to ultimately sell less energy at lower cost, I mean how in the hell are you going to recover that investment? Therein lies the challenge that the industry is facing, and our approach that we're thinking about is that you have to overlay, augment and incrementally deploy the intelligence on the system in such a way that when the new things don't work, the old system is there, and as an underpinning it works fine.

You have to at the grid edge essentially deploy the storage, the PV, the LEDs, the Smart Energy appliances, all of these things fit at the grid edge and then you have autonomous control which is very tough, to be able to control hundreds of devices with no communication between them, is very, very challenging and then you have to have some kind of coordination with the center and there's a whole new architecture that needs to be developed and in our recommendation

to the DOE, I made a presentation at the Electricity Advisory Council and I think we had the same kind of recommendation at that point in time. Can this be done? It sounds challenging. I just want to show you some really interesting things.

On the left we have the voltage profile on this feeder, which is all of that chaotic stuff we were seeing, and then we have these devices that we developed that Southern has deployed actually and many utilities have now deployed, which sits on the edge near the transformer pole and injects volts and VARS on the system and you can see the essential chart is what is being done. And the utilities who think they can sit at some central location and figure out how much each of these units has to inject to the edge are dreaming. There's no way to do that. But there's a way to do this with the right technology thrown at it and on the right you can see this is what the utility was thinking they were going to have and now we are able to deliver that. So this is a whole new paradigm change. We also can apply the same kinds of technologies when you have high solar penetration. So you can see, this is voltage profile along the feeder, without solar, with solar you can start to see it gets worse and with the right technologies you can see it gets better. Again I don't want to drown everybody in technology, but I think we're talking about a different paradigm.

And until we acknowledge that the paradigm is different, I think we're going to have a hard time resolving it, so we're going from centralized control to distributed control with a whole new set of new properties. Again we have shown that grid edge control is able to unlock a lot of benefits. You are able to get grid-side demand control, so you can kind of literally have a knob, the utility can have and you can get plus or minus
5% or even higher levels of demand control and improve efficiency, you can absorb more solars, there's a whole host of different things that can come.

I want to take the paradigm a bit further and say when you take a system and make it intelligent everywhere with autonomous devices, it starts look like a living system. In many ways. It is not centrally controlled system because we cannot centrally control it. And again I think there's a whole bunch of research that needs to be done and now do you get these autonomous systems, like living systems, to actually function, how does my hand work? Everything is kind of the same way that we're able to do this. And finally I think we have a bunch of recommendations here in terms of what the DOE might be able to focus on to help meet the objectives of grid modernization that they have described. So with that, thank you very much and I'm happy to take, you know, any specific questions somebody might have offline as well.

>> CHRIS KELLEY: You're going to need it for my questions. So next up, we have Cameron. Would you like to speak from up here as well?

>> CAMERON GRIFFIN: I would like to speak from up here. Mr. Merritt and Cree, TRANE works on the demand side of the energy equation here and you have heard of TRANE from our slogan, it’s hard to stop a TRANE. And that's known in our commercial and residential HVAC business. We are also very well known for our demand side projects with significant customers. Today, I

want to talk about a project here in Atlanta at the Georgia World Congress Center, which is our convention center here, using energy performance contracting procurement. So energy performance contracting is a procurement method which uses future energy savings to offset cost of facility upgrades and those energy savings are always greater than the costs are going to be paid for a project over the course of 10 to 20 years and so the benefit of this is it's low risk to the customer because a company like TRANE called Energy Services Company, guarantees the savings every year that are going to be greater than the cost that are fixed. This is the sales guy versus the professor here.

So if it's simple that's the best a sales guy can do right here. So when you look at a building, it uses energy for its purpose. Typically, you have the necessary energy usage and operations expense for a building and then there's no matter how new or how high-tech building is, there's going to be wasted energy. So what an energy performance contract does is that it uses that waste to fund upgrades that would be necessary over the course of its life and that replaces the capitol budget that would be required.

A little bit about the Georgia World Congress Center. I'm born and raised Atlantan. So this is near and dear to my heart, a top five convention center in the U.S. There's a 3.9 million square foot under roof. It's a large facility. And it's very important to the state to generate around a billion dollars of economic benefit every year with all of the shows and the events that go on. And sustainability is important to them. Their impact on -- they showed that by becoming LEED EB Certified, that's silver certification and that's no small feat for such a facility.

Their peek energy usage is like a small city on a heavy day up to 14-megawatts which our utility guys will know that's a lot and they spend over five million dollars a year on energy. So when you look at this facility, it varies in age between 15 and 40 years old depending on what phase you're looking at, and so they had aging infrastructure where they need tens of millions of dollars to upgrade it. So they took a proactive approach using a state procurement method in order to take action. So they're a strong operations team. I'm giving them credit for using this new state procurement method. It's energy performance contracting and the legislation was passed here in Georgia in 2010 and it allows state entities to do these energy performance contracting projects. So the projects began in 2013 and right now there's $90 million of contracts that are under construction or under contract and the Georgia World Congress Center is the most high-profile project going on at the state, and it's -- They're going to do almost $28 million of upgrades using this procurement method. What TRANE signed up to is to is save them over two million dollars a year in energy cost. That's nearly 40%. That's that waste piece that we identified. So that comprises 20 million kilowatt hours, 17 million gallons of water so there's a lot of opportunities to upgrade using waste there, not mention 240,000 therms of natural gas. The biggest benefits are not these reductions.

It's really to the business aspect of what the Georgia World Congress Center does and I want to highlight three of those business things that this project helps. And with Cree of course, LED lighting is the huge benefit to the Georgia World Congress Center. It is the most noticeable and interactive building system to visitors. And I want to give a couple of examples here when you

are going into your convention spaces. That new Tesla model 3 you ordered, when you go under these new lights, that color is going to pop or the sustainable lipstick that Kim Kardashian is pushing your young girls, it's going to look excellent in there. So that is the fun side of these projects. The behind-the-scenes piece is what TRANE is best at, the HVAC.

We put in a brand new, state-of-the-art chiller and boiler plant that will last 30 years. This is a great simplification of their operation over time. The other benefit here is what we call low hanging fruit in the industry which is stuff that pays back fast and it has a great business pay back. We use that to fix things that are broken that have no pay back. For example, the George World Congress Center, just for this project, can go from lead silver to lead gold and that's a huge benefit of this project, that is ancillary, it's not even a part of the project that they would not be able to do without this project. And so that is really where I wanted to leave this off is that TRANE is a player and we support doing demand side projects to help the grid. And to really -- it's for business results for owners not just for reducing electricity usage. Thank you.

>> CHRIS KELLEY: Thank you Cameron, and finally, Stan.

>> STAN WISE: Thank you and good afternoon everyone. Always a pleasure to -- wonderful facility that is part of Georgia Tech. I'm also pleased to note that a number of the Georgia Commission staff are here today, and several of them are proud graduates and have their degrees. I will lead with my mantra that has been a part of what I have said about what we have in Georgia. I have said it for over two decades now. Reliable, dependable and affordable. [Inaudible] and although my message will surround the relationship that the Commission we have in this state with the investor owned utility, Georgia Power, many of my comments are directly crediting the electric cities in our state and the rural co-ops who also do many of the parallel things that we have seen -- that make us reliable, dependable and affordable.
We certainly have competitive electricity rates. They're still significantly below the national average.

High reliability and a robust infrastructure, energy infrastructure, that is gas and electricity, and a diverse and increasingly cleaner energy supply for natural gas, nuclear, renewables and a coal fleet with all of the environmental protections and controls. Our state utilities have invested heavily in SmartGrid technologies and automated metering infrastructure. These improvements have improved reliability and decreased the length of outages when they do occur. We have innovative rates including real time pricing, time of use, residential demand pilot and special EV charging rates. In the southeast and in Georgia, the pace of change has perhaps been slower than some would wish, as we have seen even in our IRP where the second round of hearings we concluded with a variety of groups and advocacy folks that were advocating certainly a full array of different asks and demands and advice for the Commission to take.

But generally customers have a high satisfaction with their utilities and the rates are, as I said, below the average. While we continue to have some solar potential, solar is not as cost effective as it might be in the desert Southwest. The Commission and the Georgia legislature as it is true across the Southeast, have taken a measured approach to distributed technologies

such as solar PV, because we do want to continue to make sure that electricity remains reliable and affordable. It's particularly important in a region such as ours with a large population of low income customers.

Not piled on incentives for customer adoption of distributed generation and most importantly we do have solar leasing and net metering as a result. We do not have -- while we do have solar leasing and net metering as a result of action by the legislator, sales of excess power from DG utility must be at the utility's avoided cost. We think this is the right policy as we strive to ensure all customers that all customers at a minimum are not harmed by the actions taken by a small select group of customers that may wish to generate their own power. It ensures that when a customer adopts DG they are doing so and it's the right economic choice, not because they can take advantage of subsidies from other customers that result from net metering at the full retail rate.

I have never wavered on that issue. I don't see that changing at any time in the future. Certainly with solar DG in Georgia, the Georgia Power Advanced Solar Initiative was originated in 2012 to procure 210 megawatts of solar capacity, it was created to spur economic growth within the solar community of Georgia offering pricing that encourages more renewable development, avoids upper pressure on rates. In 2013 the commission added another 525 of solar capacity. In 2016, the company is offering another 525 megawatts. Let me say Georgia now has the largest voluntary non-mandated solar portfolio in the nation, all done without the need for [inaudible]. We certainly have challenges with DG and it's not a big part of our energy mix. We do recognize that the amount will increase over time and will put increasing pressure on judicial and regulatory policies. But as a commissioner we want to support responsible cost-effective growth of DG in our state.

We want to ensure that customers are fairly compensated and paying their fair share. I noticed a workshop and inquiry last year to make sure that we did know what those costs are and will be in our state. The Georgia Commission realizes that it has a lot of challenges and opportunities ahead. We look forward to working with the Department of Energy and other stakeholders represented here to address the many changes and challenges that we have in the most advantageous way for Georgia residents and electricity customers.

>> CHRIS KELLEY: And so with that, let's turn right to the questions. Since you spoke about costs quite a bit in your comments, let's stick with that, and I will open this up to all of the panelists but even earlier today on our panel, a lot of folks talked about how important the cost of electricity is and how managing this cost is critical in this region. Gordon, you mentioned 40% of the population in your state is over 65 years old. Assuming that means fixed income so that the cost is Important. Yet in other regions, other meetings like we have had like this, utilities might lead with a focus on reliability, or maybe even some, you know, greenhouse gas reduction, those types of things.

So I guess my question to you all is how important is cost in this region. It sounds like from what I'm hearing, it's very important and may even be more important than other factors that are considered in the electric grid. But I just want to make sure that we have that right. Anyone want to comment?

>> STAN WISE: You know, it's funny. If we have the slightest increase or charge in our state for the retail cost of electricity, it's usually above the fold in the daily newspaper here in town. This year we have twice reduced the rates primarily because of fuel cost reductions, natural gas, lower prices, not a mumbling word was heard out of the "Atlanta Journal-Constitution." Close to 8%, I think, was the reductions in the retail rate. So are we aware of comment and at least the media and what they talk about? Yeah. Because that's what has that drum beat, and they love to talk about that. So we're always very aware of that. Our industrial customers weigh-in heavily on any increase in cost.

And they are active participants as interveners at the Public Service Commission, and they're not only competing against their competitors in the global economy, they're competing within divisions in this country and different parts of the country and are very aware of what is being done with demand side management, with retail rates, with efficiencies. And so it's something that we hear, our staff hears and the Commissioners hear, so it doesn't matter if it's the retail customer, the industrial customer, the commercial customer, they are weighing in and there's a great deal more knowledgeable energy people that are participating in the Georgia Commission Hearings.

>> CHRIS KELLEY: Comments?

>> GORDON GILLETTE: This is Gordon: I would piggyback on what Stan said. In Florida, the same. Our regulators and the utilities are very focused on costs. We have one significant benefit in Florida, and that is growth. And as we have grown over time we have been able to put in the most efficient low cost technologies like natural gas combined cycle and those kinds of things that I think have been to the benefit of Florida customers and that's another reason that our rates have stayed low but I think echoing what Stan said, across customer classes, costs are very, very important, and with the growth that we have had in Florida, actually, our electric utility went for 16 years, 1992 to 2008 without a rate case, and I will tell you during the recessionary years we did have a rate case. And so growth is very important in all that.

>> CHRIS KELLEY: Yeah, Deepak?

>> DEEPAK DIVAN: [Inaudible] but on the other hand I do see --

[Inaudible]

>> CHRIS KELLEY: Can you move the microphone close.

>> DEEPAK DIVAN: I'm seeing that, you know, we're really talking about research and what the future holds in some sense out here. I see a very fast drop in PV prices. In fact, we're expected to drop that about 40% in the next two years, and that is going to bring in grid parity pretty much in 80% of the world and start approaching it out here. So if you're starting to -- at that point in time if you want to drop prices, you're going to have to have a much higher mix of solar and if you have a much higher mix of solar we don't know how to do it right now and that's the question that I was asking.

>> CHRIS KELLEY: Thank you.

>> GREG MERRITT: I think as Cameron and I both discussed, we think the best way to address cost is to use significantly less electricity. If we can take 10% of your usage out, that's 10% of your bill out.

>> CHRIS KELLEY: Thank you Greg. Other comments? Cameron, I guess you're the last? Okay. Good so I would like to now turn to -- since we're talking about cost and customers, I just want to maybe talk a little bit about customer experience and this goes back to a comment I heard, Gordon you mentioned in your opening remarks about just looking at new ways of improving how you interact with customers. So my question is: Can you talk about how you're seeing customers evolve and what they expect from utilities or maybe for the rest of you the question more broadly is, are you seeing customers embrace some of these new energy efficiency technologies at the rate that you would expect?

>> GORDON GILLETTE: I mentioned before customers I think view the use of Electricity and the availability of electricity as very Basic, but I think as time is going on, customers are more sensitive to energy use and conservation, and so I think that's one evolution that we're seeing in customers' needs. Basically the utilities job is in front the meter to do all of the things that I was talking about, to make sure that costs are allocated correctly. Our services are cost effective. But I think that customers have a role behind the meter in an area that really does have retail competition to decide how they're going to use the product, and I think as utilities, we have a role in helping advise customers on just how to do that. Another kind of evolution or maybe even revolution in kind of the customer experience is in information. We're in the process of installing a new state of the art customer relationship management system, which will allow customers to pay bills by their cell phones and do many things that we really don't have the functionality of a utility to be able to do. And the step behind that for us will be installation of automated meters or AMI meters which will again allow some two-way communication between us and our customers, and so I think on that part of the business, there maybe is a real revolution going on in terms of two-way communication as opposed to evolution.

>> CHRIS KELLEY: Cameron?

>> CAMERON GRIFFIN: I will speak from an in user basis, when working with Georgia Power, local utility -- [inaudible] projects and working with the account reps that --

[Inaudible] if they don't sell a kilowatt-hour -- [Inaudible] very excellent with helping us with working with their customers as well as the energy [inaudible] – items that require calculations. [inaudible] setting that up right.

>> CHRIS KELLEY: Thank you. Other comments okay. Stan?

>> STAN WISE: You know, it's nice to hear that because clearly efficiencies have really changed the dynamic, although we're increasing generation and we're a growing state, efficiencies and the lack of selling those kilowatt hours has changed the dynamic in this state, we will continue to see that happen. But the only way that we get there is to have that opportunity, if we're going to have the increasing renewables and work on those efficiencies we're going to have to try to figure out a way to replace that base load power, and that comes -- if coal continues to stay under attack, as we suspect it will, then clearly we have a greater opportunity to grow renewables in our state because of the next generation of nuclear power. So it's not lost on the commission, the staff, and the companies that do business in our state, that this is a well-managed, well-run company, that has done a good job for a long time. We hope to do our part to keep that –

>> CHRIS KELLEY: Thank you. So my next question is really -- I think I heard earlier that there's sort of this universal interest Across customer classes, commercial industrial residential customers and in terms of cost savings but I just wanted to, I guess, ask a question of Greg. So you had mentioned 10% of grid load improvement is a potential with LED lighting, are you seeing that happening in the industrial, commercial space? Is it residential or across the board?

>> GREG MERRITT: Well, the truth is that the bulk of the lighting electricity usage is in the commercial space and it's primarily been retail, hospitality, commercial office space have adopted first. Industry has been fairly slow and it's not because of a lack of interest, it's more because of replacing a thousand watt HID is actually a little challenging to do with an LED product. So those products have just recently become available. But it was for sure retail is probably -- outdoor was first, parking facilities predominately, if you think about a parking deck, lights are on 24/7 and. Vehicular traffic is not real conducive to long life of lightbulbs. So that was the first thing, we have seen go into commercial, retail, hospitality and now moving pretty strongly into industrial, and manufacturing. Consumer adoption has predominantly been through light bulbs. But most people are looking at retrofitting what they currently have with an LED bulb. We released some stats recently that showed 200% growth in LED bulb sales last year, so very rapid adoption there as well.

>> CHRIS KELLEY: Cameron? I was going to ask a similar question for you, but if you have an answer there?

>> CAMERON GRIFFIN: It's similar in terms of the [Inaudible] I think there's a strong. . . [Inaudible] A lot of times they have a longer payback. [inaudible] I think there is a strong – [inaudible]

>> CHRIS KELLEY: Go ahead, Deepak.

>> DEEPAK DIVAN: I want to add a slightly different perspective. I think energy Savings can come from getting the energy consumed by the appliances down. There's another way in which energy savings can come and that's really by managing the voltage properly. In the old days when you didn't have the ability to control the voltage precisely, you couldn't get that change. Okay. What we have been able to demonstrate now is that with new technologies, if you can manage the voltage precisely you can squeeze 6, 7% of demand without having to impact the quality of service or return -- I think that's a big deal in some PAC's they are looking at that on a 24/7 basis to deliver energy conservation as well. But at least in terms of demand management and control this is an interesting job.

>> CHRIS KELLEY: Or utility level efficiencies.

>> GORDON GILLETTE: If I can just add one more thought to that. So I think what he's talking about, is you can save energy without changing anything at the end user level and I want to add a related thought. I talked about it earlier about the connected intelligent lighting and that gives us the ability to respond to --response signals from utilities, for instance, if they enter a peak load situation you can actually tell your facility to turn the lights down 20%. None of you will notice.

>> CHRIS KELLEY: That leads me to my next question which is one of peak load management. We haven't talked much about that and I guess we have representatives from both sides of that equation here. So really my question is: Do you see the renewables or the energy efficiency equipment that is being deployed as a way to manage peaks? Is that a problem in the region? Are you as utilities or commissioners taking that on as a challenge? Peak management. So the question is. We have heard from other panels in other cities that using energy efficiency types of devices like we heard about here today and new ways of operating utilities, have been ways to address peaks and the region. But we haven't really heard -- earlier today we didn't hear much about peak load management. So the question is, do you feel that the technologies that you have right now are sufficient and the process is sufficient to manage peaks?

>> GREG MERRITT: I believe it does. And clearly, we have real issues in the southern states with peak in the summertime. Industrial demands are up, residential use is up, and what
The commission just clearly has been careful in doing is adding measured incremental response to not mess with the reliability and dependability that we're so proud of and of course there is always somebody that wants to add more, do less, change the reserve margins, but at the same time the phones light up at the Commission or at the company if power is out in August. That's one of the things that we're always working hard and we're careful about adding anything that risks that dependability and reliability.

>> CHRIS KELLEY: Gordon did have a comment?

>> GORDON GILLETTE: Just a word from Florida utility's viewpoint, very interesting. In the beginning of my career, Tampa Electric was viewed as a winter-peaking utility and you have to think about Florida for a second. You really have to have those three or four days of freezing weather, which only come every three or four years to really have a winter peak in Florida. But when you do, we viewed Tampa Electric as being a winter peaking utility. Over time, we have installed a lot of combustion turbines on the system, which operate better in the winter, you get more capacity out of them, because of the cooler temperatures and, as a result, summer reserve margin has been driving the need for new capacity in the state. We have a standard in the state of a 20% reserve margin, and the power plant that we're adding right now, the need for it was driven off a summer reserve margin, but it's very interesting because as we have looked at adding more solar to our system over time, solar can be effective and there's some coincidence of solar generation at the time of the summer peak.

But in Florida, we have a bimodal winter peak that occurs at seven o'clock in the morning and then at seven o'clock in the evening and solar isn't going to be generating that much at that time. So it's interesting as we look at adding more solar it's going to help our summer need for capacity, but there's a point where, if there's enough solar on our system, we become winter peaking again and solar doesn't help. So it's a phenomenon that we're only starting to get our hands around and something to think about. And the other thing comment I would add on this, is this is an area where I think as planners of utility systems, it gets a little confusing because the lines between the supply and demand side get the a little blurry. Is solar a supply side technology or is it a demand side technology? In this context, I'm not sure.

>> GREG MERRITT: Gordon, let me say if you're talking about what solar does to peak demand, isn't that some of the problems that some of the problems that California is facing now as they add significant new solar and it could and maybe within weeks effect reliability and dependability in their state.

>> DEEPAK DIVAN: There's one more parameter here that we don't tend to look at because we always have dispatchable generation so then we think about generation, we think of it being available at any point in time, that we need it, but solar is not like that and wind is not like that. So there's a temporal component that needs to be taken into account as well, which makes it much more challenging.

And finally, as you start seeing much higher levels of penetration and you look at the dynamics and the variability as the clouds come in and out and sun comes in and out, you get starting ramp rate limitations as well. This is the famous California duck curve discussion where in the evening, as people go home and turn on air conditioners and the sun goes down; you can see enormous rates of rise of the power with time. And we don't have the resources to meet that properly so there's a bunch of discussions that start coming up when we start looking at demand with that lens. Certainly I mentioned already the fact that demand itself can be controlled without impacting quality service.

>> CHRIS KELLEY: Deepak, let me stick with you with a question. You made an interesting comment that I wanted to probe a little deeper on in your opening remarks and that was the concept of this need for autonomous control of devices at the grid edge. So devices that function autonomously or independently and yet historically, in the near history, let's say, when we talk about Smart Grid it's typically defined by communication, interconnection of these devices, talking back to the mother ship of the utility so I want to probe a little bit about where you see the future there, is there less connection and communication?

>> DEEPAK DIVAN: I think we see this all the time. I mean, Communications are being a ubiquitous part of utility operations. We see this, the utilities want you to have devices that will go on the grid and work 30 or 40 years but communication protocol changes every three years. So what do we mean by that? There are real discrepancies out there. We have deployed thousands of devices now and the biggest challenge is communication latency and the fact that sometimes it's not acting properly. So how do you have a very reliable system of operation when communication tends to have some of these issues and particular latencies. So and finally, the utility – we are very comfortable when we work with linear models for the system and we can manage powerful calculations and we can do some estimation and figure out what we need to do to reasonably optimize the network.

And now when you start putting active devices at the edge, like PV inverters, like micro grids, like more wind, more storage, and all of a sudden you have got a million devices to control. Each of them requiring different response based on local conditions that are visible to the utility without big latencies involved in there. So it's very challenging. When we don't put the engineering perspective in, it's easy to say, oh yeah, we can communicate and we will still do it, we have done it a hundred years. But when you start taking in the scale and then [unintelligible] of what we're trying to do it's not possible.

So I think it's becoming very, very clear and I think Southern has been very helpful in proving these concepts out at scale on big feeders where we have now shown that these devices can work autonomously. They actually need to work autonomously and when they do, there are really challenging technology problems to be solved, which we are beginning to show that solutions are possible and being deployed right now, and all of a sudden it changes the paradigm completely and it actually -- what we have been able to show is that by putting these autonomous devices, the utilities actually get the grid they thought they had, so they can now go back to centrally controlling it and getting the results that they want. So we're not talking about throwing everything away, but really putting the right level of shock absorber or whatever you need to.

>> CHRIS KELLEY: Gordon, did you have a comment on this one? No. Anyone else? So sticking with the idea of technology and devices being deployed, we heard about a lot of different types of devices on the panel here today. But it strikes me, with introducing this new technology and some communication ability to some of these devices, that it introduces, you know, points of vulnerability from a cyber security perspective. So I guess my question is to all of you for the

organizations that you represent, can you talk a little bit about how cyber security plays into the solution and offer that you're deploying?

>> STAN WISE: I have had a number of briefings from the company, and some outside parties that have been very aware of the efforts making to protect against cyber-attacks, clearly in the utilities it's not as great as it might be in technology, banking finance, or some form of retail intrusion. But the fact that many of the systems are working hard, that there's backup in redundancy in these centers to make sure that any attack would be limited to a small area has been very helpful and comforting and the fact that the Federal Government continues to pay attention to this and work with the utilities. I'll not bang on the Federal intrusion on this particular issue. I think it's very helpful.

>> CHRIS KELLEY: Thank you. Other comments?

>> GORDON GILLETTE: I would just add that we have been in cyber security for a lot of years with the North American Reliability Council and the Federal Energy Regulatory Commission and I think there's been a lot of evolution. At the same time there's been a lot of evolution of the threat as well. And I think that the general view of the industry and I know the view of our company is that the threat is going to continue to evolve. It may come in the form of identity theft. It may come in the form of ransom wear. You know, it may come in the form of, you know, command and control issues like the attack in the Ukraine and it may come from other threats that we haven't even conceived of. And as a result of that, I think it's going to continue to evolve and our industry and going to have to continue to evolve and protect against these threats. The other thing I would say from the discussion this morning, we heard resiliency being important on the generation side for storms and those kinds of things. I think the same thing goes for cyber security. The reality is that there are going to be breaches, and I think what we've got to be able to do as an industry is be able to react and protect as quickly as possible when there are breaches.

>> CHRIS KELLEY: Deepak?

>> DEEPAK DIVAN: I think I agree with all of these things. Because I think it's a growing threat and I think the threat is growing faster than our ability to defend against it, I suspect. But the other way to kind of tackle this is through this whole concept of distributed systems. So if you can take the grid and go back to a hundred years back, they were fragmented islands anyway and we interconnected them to get efficiencies and economies of scale. In some sense. The micro grids are really trying to go back to that, although I suspect the technologies haven't been fully ironed out. It still adds cost to add a micro grid, but there's no reason it should, Okay? I think by allowing autonomous operation, okay, you reduce the amount of threat that you have in cyber security quite dramatically and they allow islands to keep operating as central communication links are down and things like that. I think you know, I do see that there will be an evolution over time of more distributed islands that are interconnected in some way and that's going to provide you the resiliency to come back from the storms. All of those things comes [inaudible] from that fragmented nature.

>> CHRIS KELLEY: Any other comments on cyber? We have time for the final question and summary, so we will give you a chance to each provide a summary of your remarks. Or if you would like to bring up a comment, you are welcome to do that. We have enough time for about two minutes of comments per person, so we will start with Gordon.

>> GORDON GILLETTE: Very good. I would just reiterate what I said earlier. I think planning utility systems in this ever-changing technology environment is -- it seems very daunting in some respects and seems very new in a lot of respects but I think there are tried and true principles that I think are very important that apply even in the changing word that we're in and those include the things I mentioned; the importance of looking at cost effectiveness, the importance of allocating costs right, the importance of not going too crazy with subsidies, the importance of always looking out for the customer and their experience, keeping in mind that local utilities are fundamentally local businesses and they're different and different regions and even different cities within states, and keeping in mind that customers really don't have to lot of time to think about electricity and worry about it. You know it's for our industry and our government to worry about.

>> CHRIS KELLEY: Thank you. Greg?

>> GREG MERRITT: Let's go back to the concept of lighting moving from passive, unconnected devices to dynamic intelligent connected devices really brings up a couple of areas I want to highlight. One is the need for changes in the way we do regulations and codes and guidelines and standards. Typically, we regulated the device, so the device had to be a certain number of lumens per watt, or we regulated the space had to be a certain number of watts per square foot. Those were static measurements and there was no capability to take into effect behavioral changes or intelligence. So I think we're now going to have to move to more of a systems metric and I guess I will echo what you heard David Friedman say. He was talking about the grids. But now we have to look at a systems approach to energy efficiency, because the consumption of the device will change throughout the day depending on the environment and the usage and in fact, the consumption of the building is going to change throughout the day, depending on its adaptation to the environment. So I think we are going to need to start look perhaps at building level efficiencies and that's going to involve multiple systems interconnected. The other point I wanted to bring is up, is that I did mention the need for open standards based architectures. I think of the challenges that we are seeing in the industry is the option of systems with proprietary and closed architectures by a number of vendors in the industry. I think that is a threat to adoption and to the ability for customers to leverage these systems. It takes no bigger example than the internet to show the power of having something be open and accessible versus closed and proprietary. I did spend about 25 years in the telecom industry and closed and proprietary always loses.

>> CHRIS KELLEY: Thank you, Deepak?

>> DEEPAK DIVAN: When I think about the QER process that's going on in the role of DOE, in my mind it's a forward-looking type of exercise and we're anticipating the issues that we're going to be tacking as we kind of transition to the new grid and to support the new economy. There's a tendency very frequently to look backwards and position the forward looking view in very much the same image. I'm afraid with some of the exponential technologies that we're seeing right now, that is not the case. And it would be a mistake not to grapple directly with the impact that we're going to have on the grid, the role the grid is going to play and the role cyber security is going to play, and I think these are questions that we don't understand fully and it would be a mistake so say, we have seen the past and it is going to look like very much what the future is going to look like and we will make incremental changes and carry on. I don't think it will be incremental changes in the very fundamental issues that need to be tackled. And I think distributed solutions are really are the only way of getting the resiliency, the performance and savings and the ability to put people in control and make them smarter. All of these things come back. My vision of how the future is going to look, is there's going to be central, obviously, for economies of scale, but it's going to be augmented completely by a very solid network at the distributed level so –

>> CHRIS KELLEY: Cameron?

>> CAMERON GRIFFIN: Thank you. TRANE is a key player in the demand side market, using energy savings and smart meter data to better building owner's business results. We work with building owners to understand their business and operational goals, and then we uncover whether their buildings are helping or hindering their path to business results. The process we find best is to analyze utility data and building operations, take action and make recommendations, validate the results and then use savings to reinvest in other facilities. Clients value the ability to meet them where they are, working on a project, to make sure it meets their comfort level. Projects deliver pure financial impact, energy savings that hit their bottom line. Business key performance indicators. Increase productivity, improve safety, risk mitigation and more predictable utility usage. Mission impact. Positive mission oriented results – [inaudible] carbon footprint, thank you.

>> CHRIS KELLEY: And Stan?

>> STAN WISE: I have always made a part of what I talk about, the concerns that I have about the effects on reliability and dependability, not only in our state, but in this country. The intrusions into the traditional states role of resource planning, I think, subjects us to real risk there. The impact of the clean power plan is a clear example and at the same time, in the states that allow retail competition, where it appears that resource planning is not the goal that it once was, and probably reference Secretary Moniz's comments from last week about the potential loss of some of our nuclear fleet in this country, because of the inability to find a way to pay for it. And I love that the Secretary has weighed in on that, somebody at that level, [with the respect that he has, it's clear that if we're going to find a way to keep reliability in this country and be competitive in the global economy, then we are gonna have to find a way to

finance [inaudible] around the country where there is retail competition and effective resource planning.

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

[applause]

So we will go through one more transition here to our third and final panel of the day. So if you are on that third panel, will ask that you make your way up to the stage. While we're doing that, just one more reminder, if you haven't signed up and you would like to provide comments at the very end, immediately after this panel we will open up the microphones for public comment and we will call you based on you signing up and again if you're joining via the web, you can submit your comments at www.energy.gov/QER. And we will get started in a moment.

Panel 3

Financing New Electricity Infrastructure

>> CHRIS KELLEY: It looks like we have our third and final panel. Just a reminder to folks. This one will be on financing new electricity infrastructure, so at every one of these QER events, that we have had across the country, this will be our seventh now, each one of them we take the third panel and we focus on something different. So we have had a panel on cyber security, we have had a panel on addressing greenhouse gas emission standards, the focus for today is on finance so that's going to make things interesting here. So we have a very distinguished panel once again, joining me up here on stage. I have Bruce Edelston, the Vice President for Energy Policy at Southern Company. Cheryl Roberto, Partner, Utility Transformation and Regulation, 21st Century Utilities, LLC. We have Jim Fuller, President and Chief Executive Officer for the Municipal Electric Authority of Georgia (MEAG); and we do have Tres Carpenter, the principle for ZWJ Investment Counsel; and finally John Mercer, Chairman of Mercer Thompson, LLC.

Just a reminder to our panelists, what we will do is I will give you all five to seven minutes to provide opening remarks. Again, we do have the colored lights here in the front, when the red light goes on, that's five minutes and you still have two minutes to go and we will go through all of the panelists and it will come back to me for questions at the end. Why don't we go ahead and get started with Bruce?

>> BRUCE EDELSTON: Thanks, Chris. Before I get started I did have to wish my daughter a happy birthday. I promised I would. This is the way I will figure out if she is actually watching on the Internet.

>> CHRIS KELLEY: We will save that for public comments.

>> BRUCE EDELSTON: Okay. I think most of the people that have stayed this long probably know who Southern Company is. But just in case, we're the parent company of four electric utilities that operate here in the southeast. We also own a competitive nonregulated generation company known as Southern Power which operates in the wholesale markets nationwide. We are an operator of three nuclear generating plants through our southern nuclear subsidiary. We also provide fiber optics and wireless services through two telecommunication subsidiaries, Southern Telecom and SouthernLINC.

We also recently acquired Power Secure International, which is a North Carolina company engaged in providing distributed generation energy efficiency services in utility infrastructure across the United States. And you probably have heard that we also announced the proposed acquisition of AJL Resources here in Atlanta, the nation's largest gas distribution company which brings us into the gas sector for the first time although we are one of the nation's largest consumers of natural gas. All four of our regulated retail subsidiaries own and operate generation transmission distribution and customer service in a vertically integrated structure in franchise retail service areas regulated by public, state public service commissions and retail regulation is based on cost of service. We also have a very active wholesale market in the southeast which is competitive. We are not part of the centralized market under a regional transmission organization but nonetheless, we believe there's a very vibrant wholesale market in the region that works on the basis of bilateral and multi-lateral contracts among the parties.

They are publicly available indices for standardized products which provide price transparency and liquidity within these wholesale markets and we think they operate very well. The southeast wholesale energy market includes over 60 participants comprising buyers and sellers from every industry group, IOU's, federal utilities, municipal utilities, cooperatives, merchant generators and energy market and traders. We transact in the southeast over 49,000 megawatts hours of energy. Every day and numerous different products. As the background briefing memo for this phase of the QER study noted, the southeast is just one of the few areas of the country where vertically integrated retail regulated franchise utilities still constitute the predominant market and regulatory structure. So we are a little bit different.

Because of the very limited amount of time today I wanted to focus on what I believe distinguishes our situation from many others that DOE has heard from in the context both of this round of QER meetings and hopefully clear up any misconceptions which may exist. For example, the briefing memo points to a patchwork of rate and regulator mechanisms and structures that govern electricity markets in the associated investments and the maintenance expansion and modernization of the system. Complexities on top of those associated with innovation and the introduction of new technologies that may add barriers to investment. While since this panel is supposed to deal with finance, I wanted to address that statement more directly and hope to convince all of you in DOE that the market and regulatory structure here in the southeast not only isn’t a barrier to new investment, but rather effectively supports our investment needs at a low cost to customers. We believe we are we are well positioned to meet the financing and other needs of a rapidly changing industry. The current market and

regulatory structure in the southeast have allowed us to meet the needs of customers while adapting to changing external requirements such as increasing regulation and interest and concern about greenhouse gas emissions and the rapidly changing technology that it's giving customers new options and choices.

Let me provide a few examples of what we're doing to respond to the changing industry. Southern Company, we think is the only utility in the country that is truly adopting in all of the above energy strategy. Its portfolio includes two of the only four new nuclear units currently under construction, Vogtle units three and four here in Georgia. We have CCS or 21st century coal as we like to call it, coal gasification in Kemper County Mississippi. We, as I mentioned already, use quite a bit of natural gas and in fact have shifted from generating 71% of our electricity from coal and 11% from natural gas in 2005 to 46% from natural gas and 34% from coal in 2015. Energy efficiency is an increasing part of our energy mix. Our retail subsidiaries are helping customers find new ways to use electricity more efficiently and productively. We have developed relationships with NEST, Tesla and Google to try out new technologies.

And as a system, we have saved enough energy to power over one million homes through a portfolio of incentive programs, for residential and business customers, critical peak pricing programs in energy conservation audits. On the demand-response side, or the peak reduction side, we have avoided the construction over 2300 megawatts of generating capacity. On renewables, as Commissioner Wise mentioned, we are admittedly somewhat late to the game. Mostly because, until recently, we didn't think that the economics worked for either us or for our customers. But recent gains in solar PV technology have made renewables a more cost effective option for sure, particularly for large scale solar which is what we're primarily adopting here in the Southeast. Our retail subsidiaries added over 4,000 megawatts of renewables in our four services areas and Southern Power added an additional 2,000 megawatts across the country in wholesale markets. We're proud to be the only utility working on renewable projects with every branch of the U.S. military and we're not resting on our past accomplishments.

We have a robust R&D research program, probably the largest in-house program in the industry that is focusing on developing the next generation of clean safe reliable and affordable generation delivery systems and technology. We have also established an innovation center here on the Georgia Tech campus. Secretary Moniz had an opportunity to visit that center earlier today and I think his eyes were wide open when we had saw all of the toys that we're playing with. The department pointed several times to the need for increased planning coordination among generation delivery and end use technology developers to ensure optimal expansion of the overall electricity system. We couldn't agree more. It's something that we have always been focused on here with vertically integrated utilities in the Southeast, and we do integrated resource planning at all four of our retail subsidiaries to determine the best mix of resources supply and demand side as well as transmission and distribution expansion to meet the future needs and desires of our customers and focusing on environmental requirements and affordability.

We recognize that customer needs and desires are changing, perhaps not as quickly here as in other parts of the country. We do have lower rates here. We do have very high levels of customer satisfaction with the current service. But as the industry changes in response to changing customer needs, we expect that we will change as well. But we hope to maintain that customer focus.

The constructive regulatory environment in the Southeast is a critical component of our success and this works well ensuring a proper balance between our customer's desire for reliable power and affordable rates and fair returns for shareholders. Our Chairman has a saying that if you keep your customers happy, that will keep the regulators happy. If regulators are happy, shareholders will be happy and if shareholders are happy, management is happy. He calls it the "circle of life," but I think that is very true. Because we're a large company with a stable regulated environment, we can very easily raise capital and we can do it at very favorable debt-to-equity ratios of around 55 and 45%. Unlike other more commodity focused industries like oil and gas, EMP, which has to have equity levels around 75%, we only need around 45% and we are much more capital intensive, about five times more capital intensive than the oil and gas MP sector.

Other businesses like independent power browsers operating in competitive markets, relying on commodity price swings have similar kinds of equity requirements. What does that mean for us? It means that we're able to raise capital fairly easily, with cost savings to our customers. We don't earn an extra penny on sales of debt so the fact that we're able to raise large amounts of debt relative to our equity are savings are accrue directly to customers. In fact, that's one of the reasons why Power Secure International, the distributed generation company, decided that it was best to combine with us because they believe that it's part of a very large financially healthy company, with a significant balance sheet behind it, they would be able to sell to customers that heretofore before had been worried about their dependability, financial capability or long-term viability.

>> CHRIS KELLEY: Bruce, could I just ask you to turn to your conclusions.

>> BRUCE EDELSTON: So our combination provider, win-win for them and for us. I could go on and on. I know my time is up. But we want to leave time for discussion. I will just say in closing that Southern Company and I believe every other utility in the Southeast are fully prepared to meet the challenges of the changing industry.

>> CHRIS KELLEY: Thank you. Cheryl?

>> CHERYL ROBERTO: Thank you for inviting me here today. I'm representing 21st Century Utilities. 21st Century Utilities is startup firm begun last year by Larry Kellerman and Peter Corsel. We are currently assembling [inaudible] $5 billion in capital from 8 to 12 investors, these are investors who are seeking long-term stable attractive returns. They typically are infrastructure investors, pension funds and even impact investors. We are looking to raise that capital for the purpose of acquiring an investor owned regulated electric utility and we intend

to then manage it in a way – to manage it to achieve the type of 21st century utility that – well, I think Dr. Divan described it best in the last panel, so I will skip to that. I would like to just frame my comments with an anecdote that my managing partner Larry shares with us and that is, I would like to take you back to 1912, a little more than a hundred years ago, across the Midwest, there was an energy source that was driving powering, sawing, even electricity generation. It was wind.

About 6 million turbines of wind that were owned and operated by a number of firms, one of this U.S. Wind. At that time if there was such a thing as a Fortune 500, U.S. Wind would be on it. A mere 10 years later it was defunct. What happened in the intervening time? Well, 1914 is when the state of Illinois began regulating monopoly utility electricity. They chose a technology and supported it with monopoly status that was the centralized grid fired by coal powered plants in Illinois and it supported monopoly status which delivered to us low cost of capital and scale. And with that low cost of capital and scale, utility planners were able to deliver universal cost effective service, which is phenomenal and we were thrilled with it for a century. Now we're talking about the type of world that is now possible because of the number of changes that are taking place and I bucket those changes into needs, and resources. I think that we have additional needs now in our digital world. We have challenges around reliability and resilience that we never had before. We now have a need to integrate new fuel, new resources, renewable resources. We have desire for cleaner resources. And we need to find a way to meet the challenge of falling demand while making these investments.

On the resource side or the opportunity side of the equation, I'd point out that now we know that we have elasticity of demand and ways to take advantage of it. We have tremendous falling prices in distributed generation, we have a diversity of fuel supply with renewables which created the integration problem that can also help to be solved by the demand-response opportunity that we have with the elasticity of demand. We have the digital and data and information that makes resilience and reliability so important, but it also can fuel our ability to run systems with much more granular control. Ask we also have storage. So we take all of those needs and resources together. We know that we need another energy infrastructure. We want it to look somewhat is different. What is the utility's role in that? Well we propose to you that it looks different but with an elegant and simple shift, we take advantage of the two prime benefits of the monopoly status of the regulated utility.

We still have below cost of capital and we still have scale but what I will suggest to you is that instead of relying on planning and planning alone what we want to have is an innovation and innovation doesn't occur through planning. Innovation occurs as it occurs and it just grows. So the utility's role needs to be in this new paradigm, a role of nurturing and enabling and empowering that innovation and I will suggest to you that will happen in a market structure. So the utility's role, with that combining the cost of capital, with the scale and the need to animate a market, is what we call a million rate base model. And what that looks like is, we envision creating a market on the edges of our utility at the distribution edge. It would involve ensuring that there are price signals, ensuring that data is shared, both customer data, to the extent that customer wishes that to occur and system data. It includes customer acquisition for third party

vendors assisting them in matching with willing customers who wish to be part of the grid edge solutions, whether those are energy efficiency, storage, distributed generation, demand response, how will those customers be animated? We see that as by third party entrepreneurs and vendors who will find customers who are interested in their services and develop services that their customers will find interesting. The utility then takes the role of supporting both the vendors and the customers with our low cost of capital. What we will do is we will stay out of that ecosystem and allow the vendors to operate.

But when the customer finds something that they would like to invest in, an energy service that is interesting to them, then they will be able to co-design with their collaborator and the vendor ecosystem a service that they want, and they can purchase that from us, the utility. The way they will do that, they will work with their vendor and they'll agree on whatever service it is they want, they come up with a price tag and tell the utility. The utility puts it on the balance sheet. We fund it at the weighted average cost of capital, and the customer pays for that service on their bill over the period of time it takes to depreciate the resource.

We would ask them to pay as we ask to recover capital on the other investments that we make which is a recovery of and on the capital at the weighted average cost of capital. This would enable the market to thrive because we enable those customers who have high up-front costs to find a low cost of capital. They are matched with innovators who are not controlled by the utility; in fact, our view of our relationship with those vendors is that we will invite them in, help them to understand our customer base, we will require of them that they offer our customers the lowest possible price, and we will help them match with willing customers. As a result of that, we will see a system in which customers will have access to the distributor resources that are interesting to them. This will be not just the customers who have FICA scores north of 700. Any customer who pays a utility bill will be able to participate in this. The local economy will thrive because vendors will grow their businesses and finally the utility itself will have the benefit of an animated market in which we can find services to help us manage that platform to assemble and deliver a balance resources. I'm past my time. Thank you.

>> CHRIS KELLEY: Thank you, Cheryl. Jim?

>> JIM FULLER: Good afternoon. My name is James Fuller. I'm President and Chief Executive Officer for the Municipal Electric Authority of Georgia. Commonly known as MEAG Power. I appreciate the opportunity of being here with you today to share the MEAG Power experiences on financing of [inaudible] structure. MEAG Power was solely created for one purpose, to serve 49 participants, public power communities in Georgia with reliable and affordable wholesale electricity. We operate without profit and have no shareholders. Our costs are incurred for the supply of power and they're directly reflected in the electric bills of the retail electric consumers and our 49 communities.

It's on behalf of the citizens of the 49 communities that I provide these comments today. MEAG Power has ownership in four nuclear units, four coal plants and wholly owns a natural gas combined cycle facility. Additionally, we own approximately 1300 miles of transmission lines

throughout the state of Georgia, which are a part of the Georgia integrated transmission system. Also MEAG schedules and delivers the hydropower that MEAG participant communities subscribe to through the Southeast Power Administration, or SPA. MEAG also has a 22.7 ownership share in the new nuclear units at plant Vogtle. These units are assets that are expected to provide 40 plus years of emission free energy at stable prices, largely satisfying the growth needs of our member communities for decades. The Federal Government has Definitely shown an ability to shaped the energy industry, for example, renewable energy grants and tax credits have spurred investment in innovation, and led to consumers having access to more and decreasingly expensive green energy. These have been some -- there has been some collateral damage and confusion in the process but the Federal Government has had an impact in an area that important to many of our customers.

Also, nuclear licensing and improvements in financing incentives have contributed to the survival, if not quite the revival of the nuclear industry. Most industry experts would probably agree that our country needs carbon free base load resource alternative. With a current very low natural gas prices, the cost of nuclear is not as compelling as it was when we made the designation to proceed. But with moderate delays and construction cost increases offset by very favorable financing costs, the cost of nuclear for MEAG power remains very close to projections we made almost ten years ago. The Federal Government has played a major role in preserving nuclear as a viable alternative for now and the future when we might really need it. Regarding natural gas, thanking the Federal Government for what it has not done, but many are calling for, severely curtailing hydraulic fracturing. Whichever side of that debate you might be on, we are in the middle of an energy revolution in the United States. It is hard to tell what would be happening if we had $120 barrel oil or $8 natural gas and limited U.S. production, but the economy would be much different if consumers were paying one trillion more a year for energy and most of that going overseas.

Transmission, FERC has been accommodated for some very different regional transmission models and investment is occurring but not fast enough and not fair enough for some participates. When you're talking about a 50-year asset where technology is changing rapidly, maybe slow is not necessarily bad. It all adds up to a passing grade for the Federal government's role in the energy industry. More over more can be done and more efficiently and effectively. From a public power standpoint there are ways that the Federal Government can more efficiently apply the financial benefits and risk assumptions involved in its programs that accomplish these goals.

Here are a few examples: Some of the federal nuclear incentives do not provide their highest possible benefit to customers. In some cases, this is because they were developed or implemented based on existing incentives for nonnuclear programs. For example, the DOE Nuclear Loan Guarantee program [inaudible] loan programs for renewable technologies that had shorter expected lives and much shorter construction schedules. The Nuclear Loan Program provides very effective 30-year financing, but with a six to eight-year construction period and a 40 plus year expected life, repaying a 40 to 60-year asset in 30 years is particularly difficult in the public power financing model that typically amortized debt over the useful lives

of the assets. DOE financial assistance framework for electric projects needs to be developed to provide a better understanding of the credit aspects and the financing structures of nonprofit utilities, this applies to both wholesale and retail participants in the industry and includes municipal, state, cooperative and federal utilities. Together these entities account for something approaching one third of the utility industry.

It's important to know that generally speaking, these entities function with very little equity. The equity that they do have is generally obtained from retained earnings which makes it difficult to build equity to significant levels since one of the main purposes behind their very existence is to provide electricity at the lowest possible cost. Also the nonprofit segment of the industry cannot, for legal and structural reasons, go into the market and raise equity through the issuance of common and preferred stock, because of their nonprofit nature they cannot generate the level of coverage that investor owned utilities enjoy. However, notwithstanding this, the nonprofit segment of the industry is generally regarded by both rating agencies and investors as having the highest credit quality. Federal utilities are rated double-A and AAA municipal utilities are generally rated A, double-A and electric cooperatives are rated A, A +. It is important to note that for legal reasons it is often difficult for Federal and municipal utilities to finance on a secured basis. This runs counter to the expectations of many in the DOE structure but they need to gain an understanding of this in the elements that make this segment of the industry a better credit. For instance, rates of nonprofit utilities are usually not regulated. This means that they can implement rate increases as needed and without risk of regulatory review or interference.

Wholesale nonprofit electric utilities have strong contracts that allow for the billing of all costs on a timely basis to the retail systems customers that have strongly protected service areas with generally little exposure to retail competition. The development of units three and four at plant Vogtle is a capital intensive project requiring substantial up front funding to construct the plant, exchange for low stable operating cost over an expansive time frame. Given this capital requirement and the fact that MEAG power has no shareholders, MEAG must utilize external sources to secure the funding for this project. In the case of the new Vogtle units, MEAG Power has largely relied on two funding sources of public fixed rate debt including Build America bonds and the Department of Energy Federal Loan Guarantee. In the case of the Build America Bond Program, which was implemented as part of the President Obama's stimulus package in 2009, it presented an opportunity for MEAG power as well as many other public power providers across the country to reinvigorate the economy through infrastructure improvements of which plant Vogtle is a prime example. However, despite the common commitment by the United States Government and the contractual obligations associated with the transaction, the Build America Bond program was included in sequestration.

>> CHRIS KELLEY: Could I ask you to turn to your closing comments? Thanks.

>> JIM FULLER: The other point I would like to say is the Clean
Power Plan has massive implications for our cities. And we have invested about $500 million in the plan. It gets amortized over 2042. We have high amount of nuclear and hydro and large

percentages of power and it's important to our cities given their high percentage of minorities and high percentage of below the national average for wealth that the Federal government recognizes this [inaudible].

>> CHRIS KELLEY: Thank you. Tres?

>> TRES CARPENTER: Does that work? Can everyone hear me? Good afternoon. I'm Tres Carpenter. I would like to thank you all for being here this afternoon to listen to us. Thanks for sticking with us. I work for ZWJ Investment Counsel in midtown, just actually across the connector there, not too far. And I have been a professional investor now for 13 years and publicly traded securities as well. Started ZWJ about eight years ago and over that period of time we have been invested in companies such as Portland General, AGL Resources. Thank you for that one by the way, Southern Company. We have been invested in WGL Holdings, another gas utility and recently picked up shares in Exelon. We have been pretty handsomely rewarded being investors or financiers of public utilities over this period, we have generated about 100 percent total return, which is about 90% annualized return per year. I have to have a disclaimer, my compliance officer read me the riot act this morning that past results are no guarantee of future results. It's a portion of our portfolio and we're happy with it but it's -- [inaudible]

Why do investors like me matter for the industry? We matter because 40 to 45 percent of the balance sheet of publicly traded utilities are equity. So therefore it's very important for utilities to track the metrics that investors like myself like to look at and invest in, especially in times of significant rate base growth are where they really need to tap into the equity markets [inaudible]. What do I look for when I'm investing in utility companies? Evaluation is very important. I will touch on that here in a minute. But, ROE, also very important. Dividend yield of course, rate base growth. Derisking mechanisms such as weather normalization, decoupling, pension riders, anything to lower the overall risk profile and earning stream of the utility. Inaudible] that utility is by regulations or the [inaudible] evaluations -- a little bit more? I will hold it up. Okay. Thanks. Okay. Where was I?

So by evaluation, I'm focused on earnings multiples forward, earning multiples by about 12 months, and so, you know, preferably as a value investor I prefer lower evaluations for the stocks and some of the best stocks that we have had on our list have been utilities that are under earning their allowable ROE or they perhaps have been kind stagnant for the rate base for a while and are just getting ready to ramp up a significant overhaul of that rate base and generate [inaudible] -- however at the time they were trading at 10 to 12 times on four earning spaces versus historic average closer to 13, 14 times.

Of course, we have had success in this area. There's been a tremendous tail wind for us that we have enjoyed, which is the fact that we have had historically low interest rates in this country. Basically those eight years. And the low rates have pushed investors of all sorts into the stocks to chase the yields that they offer so -- it's not just related to utilities. It's Telcos. But basically because the bonds that they traditionally would have invested in have not been attractive

enough, they've come into utilities and pushed up multiples on the stocks which is great for those of us in them. The problem is that, now, the current sector evaluation is 19 times over the next 12-month period. I think it's actually back down to 18. They sold off a little bit from this information. But still it's very high relative to the 13 and a half to 14 times they have traded out over the last 14 years.

In fact, still as of last week, utilities were the best performing sector in the S&P year to date. The problem is that it's been so good for so long. That many of us are just kind of throwing back on our allocations to utilities and we recently reduced our sector allocation from 5% to 3%, which is all Exelon and the remaining that we have from AGL right now. And it's going forward and I think that is the point of this panel is how do you incentivize investors and financiers to stay involved in utilities so that they can tap into the equity they need to create the new generation technologies out there. So what we would want to do, to have more investment in this space; I talked about the evaluation risk. Basically for those of you not well versed in these matters, so essentially utilities have been historically considered as bond surrogates -- I'm already out of time. That went fast. Basically to make it not viewed as a bond surrogate you have to provide some sort of growth, where it's rate base growth equals earning growth, equals dividend growth and that off sets any substitution risk there is for going out of utilities and into bonds and that's really what you have to incentivize to do that. I will just cherry pick a couple here. Lots of things down here. Maybe we can come back to that later.

But I think ConEd's allowable ROE mechanism, where they index their ROE to the 30 years treasure rate plus 580 basis points, is very attractive to someone like me who is scared of rising rates because that would provide a hedge for that and I think there's a lot of opportunity for new revenue streams for both nuclear and hydro generation by issuing and creating a market and zero emission credits at the state level of course, which could sustain some of the more marginal nuclear facilities such as Quad City in Clinton, and also could incentivize more R&D dollars to follower the areas of study like modular nuclear reactors and hydropower.

>> CHRIS KELLEY: Thank you, Tres. And finally, John?

>> JOHN MERCER: Good afternoon, everyone. My name is John Mercer. Can you hear me okay? How is this microphone doing? Do we need to -- does that help at all?

Good afternoon. I'm going to see if it can't help wake everybody up. We're in a bit of a mid-afternoon stupor here. So I have to keep myself out of the stupor, too. You might wonder what Mercer Thompson LLC is and some of you might guess it is a law firm and it is. It's a different kind of a law firm, frankly. The only one I know of that is devoted exclusively to representing companies in the electric power industry, principally with matters that covers everything from large utilities and utility holding companies, public power entities. Jim, believe it or not, and independent power companies including recent years that are specializing in the development and finance of renewable resources and other carbon free emissions.

It's a particular pleasure for me to be here with some old friends. I have represented Bruce's company and its largest subsidiary for the last 39 years. They have been in partnership about that long with MEAG Power, the utility for which Jim now acts as the chief executive officer and I remember showing up early in my career, for work and I'm going to --well I can do this without the microphone if you want to me. Okay. Is that better? But I remember showing up for work about 39 years ago, and going to work for a senior partner. I tell people that I toted his bags to go and negotiate a deal with the company that Jim now acts as CEO for, for a large generating plant. In fact, I think it might have been plant Vogtle units one and two, Jim. So we have known each other for a long time and over that period of time, I have seen a number of financing mechanisms, frankly, for electricity infrastructure. I think that there's general agreement and has been general agreement today from the panels that have been here that we're now in an era of rapid change, accelerated change throughout the industry. And I certainly agree that is true. At the same time, we have in place some fundamentals for financing that infrastructure and while we need to develop new strategies and new products for financing new types of infrastructure, those fundamentals will remain with us. And one fundamental is the fundamental of credit quality. Last time I looked and Tres I think spoke to this but can confirm for us, that a poor credit and growth and stability profile don't particularly attract investors. Either debt investors or equity investors. And so there are certain kind of fundamentals that we need.

And I think as Bruce pointed out, quite honestly, here in the Southeast, those fundamentals have been present and we have been able to attract sufficient capital to develop and produce the kind of infrastructure that we need and that's been done really through, first of all, corporate credit, which is what Southern Company and its subsidiaries have traditionally used and as far as I know, plan to use into the future, that can be either on a secured or unsecured basis. There was a time again when I started practicing law when Georgia Power Company raised all of its debt through first mortgage bonds. Beginning in the 1990s, Georgia Power and a number of other utilities with high credit ratings in combination with investment bankers discovered that they could raise debt capital in the capital markets on an unsecured basis for the same premiums if you will or same interest rates as they could if their debt were secured by their assets.

At the same time, there are other electric companies that are operating in other parts of the United States that are not investment grade, below investment grade, and we find that those companies still are required to pledge all of their assets for their debt holders in order to be able to be able to effectively raise debt. We have also found, particularly in the infinite power production sector, that project finance has worked very effectively for the last 20 to 25 years, that is to say, the credit behind the debt obligations has been a series of contracts typically with investment grade off takers and that has been used very successfully. Jim has talked at length about the public finance model and again that's worked very successfully. We also have again as Jim discussed, the model for cooperatively owned utilities and they have been able to finance successfully using the first mortgage bond structure. So as we look about for different techniques, again the techniques evolve, we use leases in connection with many of those financing arrangements, using all of the types of credit that I have described in situations

whether it may be accounting or tax benefits from doing so. Use of credit enhancement, particularly the recent successes with the DOE Loan Guarantee Program have also been successful although we have seen the DOE Loan Guarantee Program apply to highly rated corporate credits to pure project finance kind of situations and various credit qualities in-between, and frankly I think with a very good record of success. I see that my time is up so, I will go ahead and yield to you.

>> CHRIS KELLEY: Thank you. So let's turn to questions. So my first one out of the gate here, we heard from earlier panelists about rapid changes occurring in generation and transmission distribution, even on the grid edge space. John, you touched on innovation as well. So given the pace of this change, my question to all of the panelists is: Are you seeing new financing mechanisms evolving to keep up? Are they already there where they need to be to support these changes? And do these mechanisms vary whether they need to be public or privately sourced? Yes, John?

>> JOHN MERCER: Let me go ahead and start since I was last – last time around. But one of the areas of innovation of course is the rapid growth of renewable energy in the total generation mix. Renewable energy is being developed through a combination of sources. First as Bruce mentioned, Southern Company has a subsidiary, Southern Power Company, that has added about two thousand megawatts primarily of solar energy around the country utility based solar projects and those have been done again primarily as balance sheet finance acquisitions. We see a number of other projects that are being developed on a project finance basis with the use of tax equity and that's a very important innovation. So to answer the question specifically, I think that the mechanisms are certainly in place, at least for as long as the investment tax credit and production tax credit at the Federal level continue. The industry I know it was particularly pleased with the five-year extension of those tax credits last December.

I think the only thing that's lacking now for financing those generation projects is an adequate supply of tax equity investors. Certainly one recommendation that we would make is that high net worth individuals be allowed or be permitted or be incented, if you will, to be tax equity investors right now. Only primarily corporate entities can take advantage because of the passive income rules and so unleashing the ability of high net worth individuals to participate as investors in that market I think would be something that would really enhance it.

>> CHRIS KELLEY: Thank you. Cheryl?

>> CHERYL ROBERTO: Chris, I think what I just described was a new financial tool, using the utility itself as a financial mechanism to offer up that tailored tariff that becomes a mechanism for customers on the grid edge to make investments that they might not otherwise make, while it also enables the utility to go out and assemble private equity, which is anxious to be deployed. And this is a vehicle for that private equity to go out to the grid edge and have a mechanism to find investors for what we see to be the true growth in the distribution edge which would be energy efficiency, storage, demand response, solar PV on the roofs, any type of

investment that we're seeing just blossoming could be accounted for within that as a structural mechanism for finance.

>> CHRIS KELLEY: Other comments. John?

>> JOHN MERCER: Yeah, I just wanted to ask Cheryl, because I listened very carefully to her initial presentation –

>> CHRIS KELLEY: Are you trying to take my job?

>> JOHN MERCER: No. The discussion of the products out on the edge of the existing system and the use of utility scale finance if you will, lower average cost of capital to make those products affordable, but the real question in my mind was, the source of revenue, and again I hear private equity being suggested. I just personally don't know any private equity investors who would be interested in doing something quite that innovative and untested. So my question, I guess is, where does this ability scale lower cost of capital –

>> CHERYL ROBERTO: The question is how we're doing on our capital raise. Very well. Thank you.

>> JOHN MERCER: Good. Good. And is that a private equity fund or

>> CHERYL ROBERTO: It is not a fund. We're seeking multiple investors. And they are coming from the perspective of some infrastructure funds, some pension funds, some impact investors, but we're assembling multiple investors, somewhere between eight to 12 of them who are interested in making this type of investment. And they understand the structure and they understand the transformation opportunity and the growth opportunity that is available on the distribution edge.

>> CHRIS KELLEY: Thank you. So just back to the original question, are you seeing these financing mechanisms keeping up with the new innovation? I want to open that up to the other panelists if they would like to address it. Jim?

>> JIM FULLER: I think public entities have access to very successful in raising capital and I think [inaudible] alternatives have not been problematic. The problems that we see is that some of the subsidies that the Federal Government puts out to the marketplace that tax-exempt entities haven't been able to share in those because the benefits get siphoned off to investors that [inaudible] use the tax credits and not [inaudible] we would like to see the Federal Government, when they come out with a plan to incentivize certain different [inaudible] to really involve more dialogue with the public entities, so this is fair for all areas and that our treatment isn't [inaudible].

>> CHRIS KELLEY: Thank you, Bruce?

>> BRUCE EDELSTON: If I could add one thing. Because we don't have retail competition in this area, I think it helps us significantly because we're able to sign long-term contracts with developers of new projects whether it be innovative technology, for example in Georgia, we have a battery storage solar project that we have a contract with the purchase the output. These large scale solar farms that are being built by third parties, we have long-term contracts to purchase the output and that definitely helps them with financing and at least from my perspective we haven't seen any problems with anybody either ourselves or third parties who want to develop projects have trouble getting the necessary financing.

>> TRES CARPENTER: I will agree with most of my fellow panelists here that on the generation side, I think there's plenty of new mechanisms and incentive out there to encourage new technologies, I-TC and PTC's, you have green bonds out there and yield co-'s that investors liked at least up until about a year ago. What you don't have as much is on the transmission side and I go back to, there's a 2003 blackout and [inaudible] provided a nice sweetener for investing in the grid with some enhanced ROE's and that and that doubled utility investment in the grid over at period of five years. It would be nice to see something like that come back.

>> CHRIS KELLEY: Thank you. So I would like to go back to a comment I heard you mention, Bruce, and that really is being echoed Throughout, but I want to make sure that I heard it right. And that is that there's an active competitive wholesale Bilateral, multi-lateral markets in the region. So my question is: Do you see these -- does everyone else agree? See these functions or these markets functioning well in this region, and since you do have touch points across the country, do you see other challenges in other regions in terms of markets and the structures? Anyone want to take that one?

>> BRUCE EDELSTON: Well I was going to save this for my closing remark, but this is following up on what Commissioner Wise had to say at the end of his presentation, but I worry a lot about the market regions. The capacity markets are just not working and I don't think will ever work. I think they're going to keep trying and trying to tweak them, but I think there's a fundamental problem that the markets are getting. They're getting plenty of capacity and reliability, is not an issue, but there is no mechanism in a competitive market to get field diversity and fuel security and without that, I think they're going to continue to struggle, and I worry that unless somebody takes the lead, the RTOs haven't yet recognized there's a problem. FERC has not recognized that there's a serious problem. I hope that maybe DOE would take this on, in this QER to talk about it as a serious problem.

We've heard the problems of the nuclear plants not being able to survive in these markets. That would be, I think a tragedy for this country if we lost 15 nuclear units. I think the Secretary referred to last week. So I think that is where the focus of this QER ought to be, is how do we fix those markets so we get some fuel diversity and not rely solely on natural gas and intermittent renewables?

>> CHRIS KELLEY: Any other comments?

>> JIM FULLER: I would add that the current bilateral market in the Southeast supports utility's ability to plan, acquire, operate and pay for these resources. Market structure allows MEAG to evaluate multiple structure for acquisition of resources through co-ownership, PPAs, acquisition of existing resources, bilateral contracts over a variety of terms in order to provide the most efficient economic cost to our ratepayers. I think if you look at the mandatory markets it questions whether the markets can provide reasonably priced and reliable long-term power supply and I think that the issue [inaudible] term capacity payments and not support long-term cash flows needed to build new generation and short-term payments have limited the resources added within these markets to natural gas generation; thus, on one fuel source, the mandatory capacity markets do not exhibit the features of competitive markets; rather, they are administrative process requiring elaborate rules and processes, and some rules my result in capacity owners having to pay twice for capacity if its own capacity does got clear the market auctions for capacity.

>> CHRIS KELLEY: Thank you, John?

>> JOHN MERCER: I was going to add, when we talk about financing new infrastructure and new types of infrastructure, my experience certainly indicates that a market with bilateral and multi-lateral contracts tends to work better and is more attractive to financiers than a competitive wholesale market. We had experienced for example, beginning with the economic downturn in 2003, we had a large number of gas fire plants across the United States that were financed on a merchant basis, that is to say, projection that sales in competitive markets like PJM or MIZO would be more than sufficient to service debt and provide equity, and we saw in that business cycle, a number of those plants fail. As Bruce indicated however there are innovative technologies that could be supported by entering into bilateral contracts with investment grade off takers.

>> CHRIS KELLEY: So earlier today we heard from Deputy Administer Josh Cohen of the Royal Utility Service who spoke about low cost government loans for rural electric utilities. And John, you also touched on other government backed mechanisms as well. I wonder if, just to open it up who the whole panel, if you see a role for additional government financing across not just co-ops but other utilities or general companies other than what you have seen thus far. Any thoughts there? Bruce?

>> BRUCE EDELSTON: No, I think government's role ought to be in research and development. I think we're satisfied with accessing the private capital markets. I know it's a different story for Jim because of the nature of his company, but I don't think that we need any kind of financing from the Federal Government.

>> CHRIS KELLEY: Thank you, John? Did you have a comment?

>> JOHN MERCER: Well I was simply going to remark that I think for the encouragement of some innovative products, Southern

Company certainly has a certain halo in the financial community that permits it to raise amounts of capital, but other entities out there in the marketplace that don't have that kind of reputation may very well need something like federal loan guarantees and I think on balance, DOE's program has worked well.

>> CHRIS KELLEY: Other comments. Jim?

>> JIM FULLER: I think if you look at the four units that are under development in South Carolina, Georgia, about a little less than 50 percent of that is sponsored by public entities whether it's [inaudible] or electric cooperatives and for me in that instance, typically we finance with tax-exempt bonds and it's unusual and expensive to go beyond about 35 years to raise capital and that seven-year construction period and at least a 40 year operating license and possibly 60, it was very critical for us to have the support of the Federal Government to be able to finance our 22.7% of that share of Vogtle and if it's important for the country to have reliable emission free base load generation, I think it's very important that the government continue to support base load nuclear.

>> CHRIS KELLEY: Thank you. Other comments. So sticking with the topic of nuclear we have heard from other panels in other cities a little bit about nuclear, but Jim you really made it part of your core message so I want to dig a little deeper there and you talked about, you know, the capital investment, you just mentioned the amount of time it takes, so given the cost of financing nuclear alternatives can you expand on why the nuclear investment is a better value? Is it base load generation issue or can you talk about that?

>> JIM FULLER: You know, from our perspective, we have a certain base load requirement, we own some of partial interest in Georgia Power and they're coming to the end of their 60 year period, the fuel volatility is a lot less than natural gas, and that's what is important. We want to provide stable prices to our underlying communities and access to capital either through the public markets or with assistance from the Federal government, takes a lot of the interest rate risk off the table. My experiences in the ‘80s and ‘70s, we saw tax exempt rates go from five and 3/8 to 13 and 5/8 within about four years [Inaudible] and had problems and overall interest rates were high. Between the public market, financing that we have raised we did a lot of Build America bonds and then the $1.8 billion federal loan guarantee, the net cost of the capital that we have raised and under the current schedule, we have the money or commitments is about 3.8%. That really takes a huge amount of exposure and interest rate risk off of our cities as well as the other co-owners. You really need to diversify the risk and have all of your partners show up with substantial [inaudible] access to capital when you're undertaking a project this large.

>> CHRIS KELLEY: Thank you. Anyone else want to comment on nuclear? Cheryl, I have a question for you. You mentioned this innovative solution that you have. But something kind of struck a chord, that has come up in some of our previous panels, was that you mentioned the concept of sharing customer data to enable this edge [inaudible] on this topic that has come up before, customer data privacy. Do you see utilities or customers willing to share this data? Are there issues with this is?

>> CHERYL ROBERTO: Two questions, yes. I think there are issues, but I think that there has been great progress across the country in having conversations that have been collaborative between utilities and customer organizations about what does a framework like look like for sharing customers' data, and the principles behind those are, it has to be at the customer's desire first. The customer has ownership of that data. What does the sharing look like, what form does it take, what is the frequency of the data? There are a couple of great models out there, one that ConEd has negotiated with CUB, is one that works well and I'm trying to think of another and I think there was one in SoCal, but I have to back and look. But the principles are not that complicated and they have been reached through collaboration. The other piece I raised on data was systems data and I think utilities need to be willing to disclose some system data when distributed resources can be of assistance. Managing and balancing the resources that are on the grid and that is something that Southern Cal has done. They have the red maps as an example. I think there is a lot that can be done in that area as well.

>> CHRIS KELLEY: Anyone else want to comment on customer data and sharing that? I know the utilities can be something that you are grappling with as well? Okay. With that I think we have enough time left for our wrap up comments. I just want would remind you we have the QER Task Force here, taking notes and looking at ways to integrate your comments into the QER document, as was mentioned earlier today. The original QER document resulted in over 60 recommendations of which quite a too were taken up by the federal legislature. So there's a big opportunity for you to provide input here. So I think we have enough time for two minutes a person. We will start here with Bruce.

>> BRUCE EDELSTON: I think everyone in industry and government have the same objectives. I think everyone wants a clean, safe, reliable and affordable electric system. I think that a lot of attention has been focused on clean, safe, which primarily means cyber security and physical security and reliable, but I don't think enough attention has been focused on affordable, so I would urge DOE to take that into account when they publish this 1.2 QER report because it's important. The other thing I think DOE should pay attention to is the absolute critical necessity for all of the above or at least a diverse energy supply in this country. We can't rely solely on natural gas, we can't rely solely on renewables, so we're going to need nuclear and we are going to need other kinds of base load. It might be 21st century coal, or it might be 24-hour bio mass or geo thermal facilities. But we need fuel diversity because that is so important to the national economy and our national security to have a lot of fuels that we can rely on moving forward to the future.

>> CHRIS KELLEY: Thank you. Cheryl?

>> CHERYL ROBERTO: Yes. I think my core message is that we should double down on the utility as a resource that can still offer us efficacy and as a public policy tool for transforming the energy system. It did a terrific job for the first hundred years. It can do tremendous job for us in the future. But we have to tweak it a little bit. The tweaking we are talking about is ensuring that the utility embraces its role as an integrator of multiple resources, ensuring that the utility

also embraces a role in nurturing and animating a market on the grid edge and offering up and deploying the lowest cost of the capital, weighted average cost of capital that the utility has access to on both sides of the meter without stepping in the way of competition in that grid edge ecosystem.

>> CHRIS KELLEY: Jim?

>> JIM FULLER: The main points I would like to get through to the DOE, when you're structuring incentives to promote environmental stewardship or whatever type of production, think about developing a level playing field where all customers are provided the same access to whatever incentives that you're promoting. When we look at, say, the production tax credits on the nuclear we applied for the production tax credits, we got allocated, but we don't have a way to monetize those credits and we have same and in some regards higher risk than a tax-paying entity, where money in a plant gets canceled they can deduct it against their income taxes and the MEAG communities have to pay a dollar for dollar of those costs and there's no one risk equation but we're not being given a vehicle to monetize the tax credits. The other thing is to recognize and consider the investments that have been made in [inaudible] MEAG has invested over 500 million dollars on new environmental controls on the fractional interest in the coal plants that we own, and that debt goes out to 2042, and you know if you look at 2015 between the nuclear we have and the hydro, we're 57% non-emitting which is a very good track record versus the balance of the industry but with the Clean Power Plan we're going to be asked to invest in additional resources above and beyond what we need to serve our customers and we will be left with the cost of all of all of the environmental improvements on the plants that we've done over the past 10 years that haven't been passed through to rate payers.

>> CHRIS KELLEY: Thank you. Tres?

>> TRES CARPENTER: Thank you for being here to listen to us. And I will close by saying that as long as rates stay low, there is a vast amount of capital searching for low volatility yield out there but it cannot get in the bond market like it used to, so there's a tremendous opportunity here for mechanisms that are properly placed to harness that appetite into utilities and new investment that will change the grid and, you know, transform some of the generation from new generation from the traditional generation. That said, I think that we need to be flexible and diversify, as Bruce had said, because we have gone through a very turbulent 10 years. Natural gas prices were $14 at MCF in 2005 and now we're at $2.10 roughly. I'm not going to say they're going back to $14, given the shale revolution, but they could easily go back to four and that really changes the the landscape of what we're investing in now and we need to be cognizant of that being that the oil and the interest rates, if the interest rates were to rise, that is going to change the game a lot for financing a lot of this need. So there's an opportunity, but it has to be crafted well.

>> CHRIS KELLEY: Thank you, Tres. John?

>> JOHN MERCER: From a finance perspective, which I think really is what we're trying to focus on in this panel, I believe that the capital resources are in place and the financing mechanisms are in place to finance innovative and changing products that are appearing in the marketplace. One area I think where we do need improvement and I'm going to pick up from remarks that Tres made, has to do with transmission of renewable energy. We know that many of the prime sources for production of renewable energy are located long distances from the load centers. There have been many attempts to finance merchant transmission that are vastly complicated by different regulatory regimes in each state, different methods of acquiring land and obtaining environmental permits and the like and that is an area where I think that the Federal Government could play a very important role.

>> CHRIS KELLEY: Thank you very much. With that please join me in Thanking our panel.

[Applause]

So this is normally the time during these meetings when we turn to public comments, but I have been informed that we haven't had anybody sign up for public comment here today, so I look to you and maybe put a little pressure on the audience. If you would like to provide some comments, please let me know by raise of hand. Anyone interested in providing comments today? You certainly still have an opportunity to do so via the web submission if you would like to do that. Karen, did you want to make any final comments before we wrap? No? One last chance? Well this represents our very last meeting of the QER stakeholder sessions that we held across the country. This one here in Atlanta is the 7th. On behalf of the QER team and myself at Energetics, I would like to thank you and the viewing public on the live stream for all of the contributions that you have made. Thanks to the industry, to the academics that have participated. It has really been a meaningful series of events and has resulted in gathering a lot of good quality information for the QER. So with that, thank you.

[Applause]