UNITED STATES DEPARTMENT OF ENERGY

ELECTRICITY ADVISORY COMMITTEE MEETING

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P R O C E E D I N G S

(8:10 a.m.)

CHAIRMAN COWART: Good morning. We've had a change in schedule this morning due to the availability of speakers. So we're going to advance the grid modernization initiative introduction to be the first thing on the agenda. And Pat Hoffman I'm told is in the building and will soon be here so she and Bill Parks will be the first to address us. But I think it'll be a minute before she arrives. So I just wanted to let you know that we are going to start pretty soon as soon as Pat Hoffman is here.

(Recess)

CHAIRMAN COWART: Good morning, everybody. I remind people that this is a formal meeting of the Electricity Advisory Committee. A transcript is being taken so please speak into your mics and turn them off when you're not using them. Are there any members of the public who have signed up to address the Committee in the public comment period? All right, I'm told there

are none. If anyone does appear who wants to address us during the comment period, please let me know and that will occur later in the agenda today.

Our first topic is the Department's grid modernization initiative that this committee has heard some things about at our prior meeting. And we're really interested to hear the update on that. And we have Pat Hoffman and Bill Parks from the Department on this topic. So over to you.

MS. HOFFMAN: So Bill's going to walk through the slides on some of the things that we're doing at DOE, but I know last EAC meeting we had a discussion I think from Kevin Lynn on some of the efforts that energy efficiency was looking at and as the Department continues to integrate its activities, what we're really going after is trying to demonstrate all the needs that are required with respect to grid modernization. That's a really broad topic, but the objective that we're trying to go after is a lot of people don't understand where are we heading in the

future of the electric grid?

And the issue is it's challenging because there's not a singular defined vision. There's regional differences, there's policy regulatory differences at all levels. And so how do we really raise the level of awareness of the investments that are required. I know there's numbers that come out from EPRI for investments in the future and other areas. But how do we really get everybody structured around the conversation. So we spent a lot of time in the Department trying to figure out how do we put some priorities, define some strong goals and metrics in this area, but also really pull out what the needs are and what the federal role is. And I think Hank asked that question yesterday on the federal role. And we're trying to really drive that down and get greater clarity on the different components. But it's extremely broad because we're talking about a network and a system. So I'm going to have Bill kind of go through the discussions and bring out some of the highlights of what the Department has

been talking about so we can get everybody's feedback here.

MR. PARKS: Good morning. A major theme with the Secretary has been how do we make sure we are marshalling our forces well? And we talked to you in the past about the grid tech team and the idea of what grid modernization is and how that's evolving, how we're trying to push that and really get it a sense of priorities and convey that sense as, you know, as really as one DOE. And so this is an effort that we used to map out and discuss with the Hill and others on all the things that are going on. So you see the EE programs like this in the solar program and all in the orange, and the blue are the OE programs, and EPSA represented by gray, and the coordination of all these things.

So in the green box in the left corner is the quadrennial technology review. We had one in 2011. The next one's underway. And the grid is a piece of that. And the QER, I think you've heard that update and Karen's going to talk you to

today about that. How does that coordinate into this institutional support area? And the position that we've said is that there we've kind of taken a lot in there are five priority areas right now that are pretty broad buckets, but we've got definitions behind them. And what we're here planning tools, controls, measurements, devices, and security, how do we move to a modern grid? Really leap frog forward and get ahead of some of the issues that are happening as the transitions occur today and really add value. And you've heard pieces of that before in storage and advanced grid modeling and those topical areas.

So we wanted to give you a feel for some of the coordination changes that we're contemplating and we're going to ask you to engage in an additional way as we go through this. But those are the topics. Institutional support, you know, obviously linked in this business to the technology side into the markets and how does that all that play together? So what we've done is said the four broad areas of which the technology

was broken out in the previous one, institutional alignment, technology, grid security, and resilience and the risk management toward multi-scale demonstrations, which really comes later as we get more evolution of these things.

And we've laid out some pretty aggressive goals and needs for a five-year plan for how that can go forward for each of those areas and the idea of can we, you know, can help in the debate on valuation of DG on new business models. And defining things that really, you know, make sure that we understand the federal and state role. All the things implied at that and at the same time to open up the market to the technologies that need to come into whichever segment of the market the region happens to be in.

And as you can see there is a host of targets here. But trying to clearly frame that we were talking about order of magnitude changes on some of the needs for data on some of the needs for the number of devices in the system for the way to handle two-way flow of electricity in the

distribution area, and how do we link it all together so that we are taking advantage of the design and planning that's going on associated with things like EMS, which this group has recommended that the Department put resources in and how that ties to DMS and even to the building management systems. And if we want to think about a future world where the option exists for buildings to play more in the grid space in the distribution sector to give you a mixed centralized, decentralized hybrid system or one in the future, how do we get there? And that's really what we're trying to do and present that as a total DOE effort.

So the Under Secretary for the five programs has challenged the labs to look at big ideas in the way that labs can play differently and add value beyond what they're already adding. And as you know, many of our labs have been engaged in many of the R-projects and many of the demonstrations and the activities and the research in all of the areas that I listed in the

beginning.

So what we've asked them to do is create an integrated approach to grid modernization from the lab side and really leverage all of the DOE/national lab efforts together. So can we force this into a wedge of activity that's really concentrating on the highest priority things? And we've asked them to form self-formed teams targeted at these areas. And we are going to put some of the effort into the labs and say you were charged with this, go forth and help lead into that area.

What you've seen historically has been how we've done things. Each office kind of says we'll work with a lab that we do this in or that in and everything. And the grid tech team has over the last few years coordinated budget formulation planning and execution, but we don't have budget authority. So what we're looking at is a model where we take that and we put some entity in there that forces that, you know, strategic direction into a cohesive unit from the

department side and into sending out early instructions to the labs on what we want them to accomplish in the sense of priorities.

And the specific thing that we're working with right now looks like this where we have an executive committee of the senior leadership, a DOE lead that has, you know, works with the DAS's and others where the money comes in and says, okay, this money is for grid modernization through the programs and the programs will provide strategic direction. And this money in buckets will go to the labs and with that strategic direction and orchestrate across labs. What we're asking the lab technical members is to work as a unit. To have lead integrators not just, okay, X lab is the lead for (inaudible). X lab is the lead for, you know, controls. It's form a team as the best team across the town in the labs and that team as a unit is responsible moving this out. So that's what we're trying to do.

And you'll see that the EAC sits up

here. And the question we want to ask you is we're looking for an advisory capacity, independent advisory, and look into this system as it evolves in the periodic role of making comments and reviewing independently back to the Secretary and to the executive committee what do you see what works here what does not work and what could be improved upon.

In addition to that, we want to link stakeholder review into both the normal peer review that we do in the programs and to the specific areas that we have here. So we're looking to create a way to get stakeholder input into the entire process because at the end of the day, this is a shared activity, states, the utility world, private sector, all be engaged in this and we're still looking for public- private partnerships in all of these arenas to be successful. And that in a nutshell is what we've come to talk about today.

MS. HOFFMAN: Bill, could you back up and talk a little bit more about each of the

different topic areas on the goals and the metrics because what I'd like the Advisory Committee, and I appreciate the work that we've done up to this far, continue to help us review each of our program lines and our elements from the strategic direction of what we're focused on, some of the goals and the strategy around the activities that we're working on. And so this is a little bit of a different construct than the program elements and the groupings that we've been reviewing to date and will continue to review from our different elements. So this is what we tried to do in pulling together activities across the Department. So I'd like Bill to explain that a little bit further.

MR. PARKS: So in walking through each of the institutional alignment is looking at EPSA's role for energy policy across the Department and looking at the judicial roles of a OE and EE and actually FE and played in this how do we again coordinate that with the idea that EPSA's doing the overall strategy for the

Department and we're doing, for example, in OE much of the work specifically to the electricity sector and how to make sure we're linked well are the studies that we do are coordinated. And I'll give an example of that next week. EPSA, EE, and OE are sponsoring with NARUC, NASEO, and NASUCA a conference DG valuation. And we're bringing in the authors of many of the reports for the last couple years, RMI, E3, different players, EPRI, to talk about how do we make sure we've got common, you know, definitions, terminologies. What do we really mean? What are the critical issues here? How can the DOE add any value through its labs and through analysis into that space that will help prevent some of the hostility that's happened in the last couple of years on the topic at the state level and see if we can't help move this forward in a way that's win-win for multiple parties. So those are the kind of things that we're looking at. Where does it make sense for us to play? And where does it make sense for us not to play from the federal level?

In additional to that we're working even stronger with we have long-term missions with groups like NASEO where we're coordinating with the State Energy Offices on energy plans for the states and the activities. And there's huge amount of effort has been, you know, at the state level on these topics and how do we get the synergies in that? And provide things like planning tools for decision makers where the federal government's not making the decision. We're giving information to and providing analysis and modeling help to the states and the regions on how to do it. Much like we've done through some of the ARRA processes and our historic role.

Design and planning tools really looking at some of the can we use the high performance computing? Can we look at new ways to do math? This is part of this effort is the good modeling work that Gil Bindewald and the Office of Science and ARPA-E have worked together on to try to say, hey, can we go back and design new math and computational constructs even to how we're looking

at electricity and more importantly, the evolving electricity world that may be. Okay, if we really see things out here with -- we're seeing a lot more data now at the, you know, distribution of PMUs and more visibility into the distribution system. How do we manage that? Are there ways to create tools that allow people to work on it?

In the system control and power flow it's how do we get more efficiencies out of the system from better devices and for power control to the number of devices and dealing with them. How do we get that coordination? And then how do we create enough useful data in as close to real time as possible for markets to operate or for activities to occur and maintain reliability of the system and things like that?

Sensing and measurements, what are the sensors you need out there? How can you get low cost sensors into the distribution system? What does it take to do that? How should they be put into the system? How are they dealt with? Devices, integrate, test them. How do you get the

coordination with the in-use devices? Whether it's buildings, how buildings can play differently in the electric vehicle world. Solar, how can it play? How can you get real valuation and, you know, technical performance out of those systems so that you're getting efficiencies throughout the system? And how do you effectively work with systems like you see in Hawaii and California that are already approaching very high levels of PV penetration for example? How does that work effectively without have to gold plate the system? How do you create a system that really makes that work optimally for ultimately the rate pair?

And then security measures response to cyber security. How do you build it in from the beginning? How do you integrate it with all of those things above to make sure that we're making the smartest decisions about it and not just overlaying cyber securities with band-aids as we go forward?

The last piece is how does it all come together? And how do we buy down the risk, the

historic risk of aversion the nature of buying the first one and the first reading or whatever. How do we get this out there, recognize the regional variability that you have throughout the United States and different things are going to work in different places for different reasons. And how do we prove that? Buy down the risk of that kind of activities similar to what we did in some of the ARRA demonstrations. And I think that's shown real returns. How do we create that? How do we also take a look at what's coming out of the Department and OE and ARPA-E and EE and from the science world and the laboratories and make sure that those are tested out and shown to be of value. So if ARPA-E is working on an advanced power control device or a impedance device or other things, how do those storage demonstrations get fully integrated in with the PV and the renewable energy demonstrations, those king of things?

So that's what we're looking to try to do is can we be smarter about it all? Can we leverage our own resources better and really get

results oriented toward where we're headed? Any questions on that? Clark.

CHAIRMAN COWART: Clark.

MR. GELLINGS: Thank you very much. I enjoyed some of those slides in particular it's very hard to describe such a complex organization in light of the complex issues that are faced. One of the things I don't know that we can really get to here at the moment, but what's always really puzzled me is the relationship with the national labs. Who's in charge anyway? You know, if I could I'd search on Amazon.com for a national lab for dummies book or something. Who controls the money? Why can't you have more control over what they actually do? And why can't we see more cohesive interaction between each of them? I think we all recognize often if there's a hot issue they're all working on it, which you could argue is beneficial, but not always.

MR. PARKS: So what we're trying to do is to make sure that like the State of California does and have 13 labs visiting them, you know, on

a single topic area and that doesn't happen too often but it happens sometimes, and that's not efficient. And so can we make sure there's a national point of contact on sensing? A national point of contact team on, you know, power flow control and that the entire Lab network points people to that for those issues. So now we've linked Sandia's efforts with PNL's efforts with NREL's effort on topic X. And there's nothing in the grid modern space that is not included in that statement, Clark, so we think we should be better organized ourselves and that's what we're going about in part here. And also to be more efficient at delivering that so we make sure that we spend taxpayer monies effectively.

MR. GELLINGS: So what message could the EAC officially give to DOE that would help you?

MR. PARKS: Feedback on does this make sense? Is it organized correctly? What's missing in this process? What could be more effective? What would you like to see? What outcomes would you like to see, would all be useful advice to the

Secretary. Pat, anything you'd add to that?

MS. HOFFMAN: And I would just say I know that the Committee's looking at R&D opportunities and I think to keep this in mind as you're looking at recommendations from an R&D point of view with definitely that OMB, the Hill, everybody's going after what is the outcome that we want to achieve? And I think it's very difficult to say that there's a singular outcome or a singular metric or representation of the future grid. So how do we all be able to characterize this of what are the needs that we have to have? What are the capabilities that the system has to have in the future? And I think that would be useful.

MR. PARKS: And just an example of that, Pat and Dave Danielson and Melanie Kenderdine went up to the Senate together earlier this year and said, you know, we need to organize and get these things going collectively. It doesn't make sense to do controls if you don't have something to control in the sensor side. If you don't really

have access to the building loads, you can't bring load in as a resource effectively. So we presented a solid front to the Hill and to OMB on these issues in starting to move forward.

Let me turn to Merwin. I think you were next. I apologize if I'm not getting the order correct.

MR. BROWN: Thank you, Bill. This is Merwin Brown, CIEE. First of all, I like the idea of going to the modern grid concept in contrast to the smart grid because to me the smart grid had the danger of leading the focus down the line of ending up what I call the inverse Frankenstein monster in which you develop something that's very smart but has a suboptimal body to be able to carry things out. And so the focus can get distorted with that, and I like that. On the other hand, when I looked at your diagram up there, I'm not sure where some of this hard stuff I call it would be developed. And an example would be a fault current controller. Is that in the thinking there?

MR. PARKS: Yes, and I think the 2011 QTR pointed out that hardware development is underfunded relative to a lot of other things, software development and other issues. And so we've embedded it really two places here for different reasons. Under the system control and power flow we would talk about solid state transformers with new capabilities, maybe fault current limiting built in for example. And also in the devices to make sure that we were getting at the distribution level the kind of things that we need. So the hardware is built into this and I think that'll dovetail with the directions from the QTR process as well.

MR. BROWN: If I may, a follow-up question on this slide. I notice under the risk mitigation item it says develop three to five megawatt scale demonstrations. I'm curious why that bound was put on it.

MR. PARKS: It's not an absolute. It's, you know, it's something we put out there that we saw the earlier ones really as some of the

distribution level kind of things and integration issues. But I think the thinking is that we won't over define the size and the scale demonstrations. So, for example, if WECC wanted to do X or if a Northeast region wanted to do Y, that's a different kind of demonstration than you would get for a, you know, generation 3.0 smart grid or that kind of thing. So we recognize that but this is kind of a starting point of where we're headed.

MR. BROWN: Okay, thank you.

MR. PARKS: Carl, I think you were next, and Anjan and Gordon.

MR. ZICHELLA: Thank you. Gordon's question prompted me to think about another who's in charge kind of situation with the Power Marketing Administration's controlling very substantial parts of the grid especially in the west. How do they factor into this? Obviously, there's modernization happening at Western, for example.

MR. PARKS: Correct.

MR. ZICHELLA: It could be a good

laboratory for some of these things as well. It'd be very helpful, you know.

MR. PARKS: We agree and we have historic strong ties to ETA, TVA, we've done a lot of demos and we see this as a way of expanding that. For example, Washington State has announced some awards are impressive that include the entities in the northwest. You know, and BPA is tied to that and so BPA has really been, Terry Oliver has been a leader in some of this stuff in some of the northwest demonstration went under our similar way. We see, for example, Brookhaven's not traditionally played recently as much in space, but New York is putting some money into Brookhaven. So we see that regional ability to link into a number of things. Similarly in Savannah River can bring in the Clemson consortium that has a lot of new capability on testing up to 15 megawatt systems and really trade from ACDC the same way that the ECIF facility or Florida State can. So we see as a better way to link into those capabilities and those are a resource that we

think long in the (inaudible).

MR. ZICHELLA: Yeah, I think there's a unique opportunity now with new leadership at Western and BPA. I'm a big Elliott Mainzer fan by the way. I think, you know, the market coordination effort there is really great. The coordination with Cal ISO on helping to facilitate Pacific Core's involvement in the EIM. And there's some really good stuff happening. And the same is true of Western, but I think, you know, they could use some help in terms of guidance, leadership, you know, they seem to be at times a little bit held hostage by the preference customers to really making changes.

MR. PARKS: And a value we can play is to help facilitate and convene some of those just coming in and say we don't have a cat in this fight. We're just trying to bring clarity to the issue. I think where we're going to be challenged is how do we prioritize because there are limited resources and so we have to make sure we target the right things and we continue to churn on what

are the right things and the right priorities and that's why we want input on some of these things to check what we're doing. Anjan, I believe you were next.

MR. BOSE: I think, Bill, just taking off on what you've said, the last couple of sentences about how to position this thing properly. I would suggest that you don't fall into the trap of trying to specifically say this is the hardware, this is the software. And the space where one of the questions that you face, DOE faces, you get phone calls which says why aren't you doing more work on HVDC? Why aren't you doing more work on electronic transformers? If you look at the resources needed to get to develop the next electronic transformer, it'll swamp all the budgets that you have in grid modernization today.

And so the caution is what is the main thing that this brings that your individual component oriented groups don't bring, which is the systems aspect to me. And so it's the way you

phrase some of these things I think you have to be careful of what is the image that you're putting. You know, when you say I think I'd go back to what Merwin was saying when you say develop three to five megawatt scale demonstrations, that almost automatically forces you to think about peaks and not systems. That is, yeah, let's test out some batteries, about that scale, and see if it helps the system. But the whole problem is that that phrase doesn't make any sense to test out your next generation EMS. Three to five megawatts doesn't make any sense on that respect. So I think it's what you portray. And I'm sure there's a lower level here where you clarify some of that.

MR. PARKS: Yeah, those are really good points. We'll take that into how we're presenting it because you're right, we're trying to not convey exactly that message and try to stay. An integrated message is critically important for us to continue to push from how we see it. And integrating across these lines and not creating new stovepipes within our system as well will be

critically important. Good comment. Thank you very much. I believe I had Gordon next.

MR. VAN WELIE: So, Bill, I just wanted to give you some feedback. I like this a lot so, you know, I've been watching you talk here over the last three or four years and I like this evolution and how you're structuring the problem. And I think it plays to DOE's strengths because it's technology focused and I think that's where you are the strongest. And I've noticed over the years there's always been a tendency for folk to want to put onto you the mantel of DOE go and drive certain outcomes in the marketplace, which of course is almost impossible for you to do because as the DOE, you don't write the laws and you don't control the purse strings. The purse strings are controlled by the FERC or the state regulators and the investors in the marketplace.

So what I like about this is it seems to me you're approaching it from the perspective of these are the components of grid modernization, the Lego building blocks and each region then will

assemble a solution to whatever challenge they're facing. And, you know, to Anjan's point, economics are going to constrain the speed at which people can move. But by sort of breaking down the barriers, the technology barriers in each one of these areas and sort of giving people tools, they can figure out for themselves how to construct their modern grid of the future. So I think this is a really very good evolution of your overall thinking. I'd like to commend you on it.

MR. PARKS: Thank you very much. I think it was Wanda and then over here.

MS. REDER: Yeah, I agree. It took me a while to kind of think through this because I think it's so well done. So I applaud you on that. One of the things that you might want to think about is when you tie all of this stuff together, what's the impact on reliability, resiliency, because I do think that there could be a tendency to kind of hone in on the different chunks. And I think it's well worth kind of stepping back and seeing where do we need to take

the infrastructure from a performance perspective? And I think that allows you to connect the message systems of systems to, you know, what's the need from the economy perspective and how do we drive the digital era and, you know, all of this storm business. So the metrics that this thing it needs to achieve is an important aspect.

And the other part that I'd add to that that I'm not sure where it pops, is to the extent that there's incremental differences in distribution design, more looping and meshing and, you know, adaptive protection that type of thing. I don't know where that fits in here either.

MR. PARKS: Two very good points. Thank you. And for brevity, I didn't include, but we kind of identified eight attributes that we think it's really important that we keep kind of in some balance from safety resiliency, cost, impact, kind of things. So we have that and I should have put that into this but I was trying to keep it short.

To the other point is the networking, the mesh networking concepts, the micro grid

concepts are also looking into those aspects and built into this. Looking at balance of ACDC at different levels is built into this. So they're things buried in here that just haven't gone into the detail for brevity, but very good points. Thank you. Yes, sir.

MR. MORRIS: Thank you. Representative Jeff Morris from Washington State. One of the takeaways I had and I think the whole chart flows well and so forth, is down towards the bottom it's just a thought I wanted to share. When I was head of the Northwest Energy Technology Collaborative working in the commercialization space, one of the biggest falls in the whole valley of death for energy start-ups trying to bring IEP out of the labs was they always misestimate the ability to find, particularly in electricity space, a customer, a utility willing to field test their product. And we found that one off demonstrations wasn't as big a need as actually kind of functional demonstration centers that allow people to kind of plug and play because most of the time

these start-ups run out of their friends and family money, the venture communities who risk adverse to take a piece of a company that doesn't have a product yet.

But, you know, examples of that are, and again, trying to set these up around Greenfield projects is much cheaper than trying to go back and retrofit an existing facility. So if you have biodigesters that have gas coming off of them, if you have sodium chloride factories that are evaporating hydrogen, if you have new developments, we can put a substation in with the modern appliances that people can come in and plug and play functionally. That's a huge acceleration through the commercialization process versus them trying to find the situations that fit what they're trying to do. So it's just a thought I wanted to throw out about the demonstration project space about something that might be more of a long lasting investment in commercializing intellectual property as opposed to kind of that one off.

MR. PARKS: I think that's an excellent point. I think we should be open to, and we've reflected on this, into there are different models for how those demonstrations will occur and how can we be effective at leveraging the most resources to get the maximum outcome of that? And I think there's a whole set of metrics around that process that we need to flush out. I believe I had Chris and then Anjan.

MR. PETERS: Yeah, Chris Peters, Entergy. I was just curious on the security and emergency response goal how that particular goal was developed. Was there an analysis of a federal and commercial technologies that were determined to not meet that particular capability?

MR. PARKS: Shoot that one to Pat.

MS. HOFFMAN: I'll try to tackle that one. There was not a thorough analysis done. And like Bill said, I think these goals were a first attempt to saying what is reasonable? It was probably built more around expectations. You look on the hurricane side of things, you know, after

the wind speeds get down below 35, then people go out and start doing assessments. And we've been pushed harder and harder to say we need to have the information faster. And so it was probably more built around expectations more so than what are the current capabilities or of the limitations of any current capabilities right now. So what was it supposed to represent is we need to have continuous monitoring tools, the ability to share information, the ability to do the forensics and analysis. But the same thing could be said on the physical, you know, the physical security side is what do we need to have in place to have a topic be well understood within a certain time period? And impact analysis. And so that was what was pulling around. But to me, you know, the hours or the timeframe can be adjusted either way. It's just trying to figure out is that from my point of view was representing what the expectations seemed to be had by customers as well as the federal government.

MR. PETERS: No, that's good feedback,

thanks.

MR. PARKS: Anjan? Okay, anyone else? I'm sorry, Merwin.

MR. BROWN: Merwin Brown, CIEE. Taking off what some of the others have said about I like this, and just to see if I understand it. To me, one of the positive things I like about this is that I think it makes it easier conceptually to think in terms of, and I'll give you an example. Take the synchrophaser program development, it had a focus unto itself. And the platform on which to develop the applications was focused on syncrophasers. Yet, to me there's the opportunity to bring in such things as thermal measurement, thermal monitoring. And in the future, even such things as the operation to maintenance signals from certain devices on the grid that could affect operations and could be integrated into that.

This kind of approach I think makes it at least psychologically easier to think in those terms of here's a whole bunch of different signals coming in that could be put into a platform that

integrates it into a message to the operator. So again, I'm just saying I like this process or this design.

MR. PARKS: Thank you. That was the intent. If we think part of role is to help develop those platforms and then let the industries figure out what the apps that go with some of those platforms are going to be.

MS. HOFFMAN: The one thing that I guess I want to add that's going to be a balance as we move forward is we're going to have the output metrics or the technical metrics of each of these technology or capability areas. But to the point that was made, I think it was Merwin or Clark, is we're still going to be asked for outcome impacts as we move forward of what does this really mean to society and from the societal goals. So we're still going to have to do that translation and we haven't found perfection or ideal in trying to get that here's all the capabilities and here's all the outcomes and being able to quantify those outcomes. It's still a little bit hard for us to

grasp and represent to, you know, the Hill stakeholders and other folks, so if anybody has any ideas. I think at the end of the day, we're all going to struggle with this.

And the one thing that we don't represent here is the Department will try to catalyze by doing proof of concepts and looking at what technology is capable of doing, but ultimately it's how is the financing going to occur, you know, to get the modernization to keep modernization moving? And I think the financing option's probably going to evolve. And I'm not saying that that's DOE's role, but that's another part of the equation that we got to think about.

MR. VAN WELIE: So, Pat, if I may just sort of give you some feedback there. I think that design and planning box has scope for evolution. At the moment it's focused on T&D. You know, I would presume that's in terms of how do you do these transmission studies more quickly and so on. But I think to your point here on outcomes, I don't see that the DOE can ever

guarantee outcomes. But what you can do is give people tools where they can analyze for themselves what the range of possible outcomes might be. So I think in that space, you can continue to develop capability. I think a lot of the recommendations in some of the reports that we are teeing up could fit into that space as well where you're not putting yourself in the position of saying it's the DOE's job to dictate a certain outcome. But you're really giving folk in the industry the ability to not only know that the technologies are real, which are the components below, but you're also giving them tools whereby they can sort of analyze future outcomes for themselves and then they can make their own decision.

MR. BOSE: May I also follow-up on that? I think Wanda mentioned a couple of metrics that you can use and this is going towards what do you gain in putting all these different technologies together into a grid? Why do we call that modernization? That's what you want to get to. And some of them are reliability, resiliency,

security, economics. And I think those have to be the main thing that you're going after because the people who are developing batteries, they're going after density and dollar value for the battery. But this is at a different level. This is modernization and the metrics are harder to measure to quantify. But I think if you don't do that, you're going to miss the whole ballgame.

MR. PARKS: All right, I think, Granger, you were next.

MR. MORGAN: Yeah, two comments. First, I would urge you to think some more about how you get the national labs to look outward towards who's doing what elsewhere. I mean for example, I sit on the Advisory Board and in the past I've chaired the Advisory Board for the E.ON, the E.ON Research Center at the University of Aachen. And most of the folks in the U.S. who I've talked with know nothing about what goes on in that center, but it has some spectacular DC hardware developments and that sort of thing. It strikes me that rather than reinventing the wheel, we need

to be pointing outward to try to understand and draw upon those sorts of results.

The second thing is I do understand the DOE internal environment and the need to do all these things through the national labs. At the same time, you know, there are a variety of places, I mean, staying just domestically across the U.S. at EPRI, at universities like Anjan's and others, at my own, that are working on a lot of these issues. And so if there isn't, I mean, I think the DOE needs, the labs, understand the difficulty of getting the labs engaged in that the money tends to all stick in the labs and not come out very much of it to others. But it really would make a richer undertaking if others across the U.S. who are engaged in working on similar sorts of things could be worked on.

MR. PARKS: So I tried to, and may have failed, to kind of create a picture here that we have overall grid modernization going on, which Pat is the lead for it for the Department. And we have really two streams that we're talking about.

The typical programmed areas are still going to put out (inaudible), are still going to work with the universities and that kind of thing. And the lab path, that doesn't mean that lab activities will be tied to only the labs, that there is this group of entities here that belong in that and --

MR. MORGAN: Sure, but there are groups across --

MR. PARKS: -- the one thing we've tasked --

MR. MORGAN: There are groups --

MR. PARKS: We've tasked the labs to do and they've done a first set and they're doing a second set, is what are real capabilities, and not just the capabilities funded by DOE that exist, but what other capabilities around the world and what are the capabilities in other places? And who else is funding you as the labs into doing what? So for example, if DHS or DOD is working on micro grids or cyber security, where is that? So can we lay out that entire landscape exactly to leverage and kind of things that you're talking

about? And I give just a case in point, Savannah River came in the other day with Clemson and talked about the worldwide capabilities for some of this, test capabilities that they have and what the contrast and how they can leverage certain things and doing that. And we want to build on things like the Curran Center where we're coinvesting with it and NSF on those kind of things. So I think your point is very well made and we are looking to do that. And again, feedback on do we have holes in what we're doing would be helpful. Wanda, I think you were next.

CHAIRMAN COWART: And I think we need to make this the last comment.

MS. REDER: It's probably a good last question then. I was thinking about the EAC's role in this process and also thinking about the R&D work that Clark's leading within the smart grid subcommittee wondering how we can be most helpful in the process. There's so much happening within, you know, your space going day-to-day, how do we stay engaged and, you know, actually provide

meaningful input along the way? Any thoughts?

MR. PARKS: I think we're looking for advice on that, so we don't have all the answers. I think we're talking about making sure that we have clear transparent reviews of the progress that we're making. And one thing we're talking about is having a national summit once a year that we bring all this in and let people see and invite people to come in and say what else is going on and are we on track again and have a national dialog about those things. And I think topically you'll see subsets of that and pulling in the right people and everything. And it's can we be coordinated enough? Can we really provide the leadership from DOE headquarters to make sure that we're accomplishing the priorities that have been set and, you know, any feedback on, hey, you're off base on this or you're on target is actually very helpful. So I think we're looking for ways to build that influence in and yet not have it, you know, impede, you know, progress. And so we're looking for that balance and this is the

construct that we want to start with that had your role here plus the roles at the stakeholder level and then the input that we'll get from the other program activities that are going on and how those are linked, and all those details are not fully worked out.

MS. HOFFMAN: I guess I'm going to push a little harder and say that what I would like is either it's going to be a subcommittee or the full committee to work with us to review each of these areas on a regular basis and provide us direct feedback on goals, progress, you know, gaps. And really set up more of, you know, I'm pushing a little harder, set up a formal structure that the EAC is actively engaged in the technologies and the directions we're going.

MR. PARKS: Thank you very much.

CHAIRMAN COWART: All right, thank you. Given the time, I think we need to just move into the next panel, and I think you're up. Everybody here?

MR. ROBERTI: Thanks, Richard. Good

morning everybody. While our panel gets assembled I'll make a couple comments here. As probably everybody knows I this room, the gas electric coordination issue has become a dominant concern in the electric industry particularly in organized markets. It's a subject being addressed by DOE and the quadrennial energy review, by FERC, by NASPI, and certainly wholesale market operators. Today we're going to hear from two regions, two RTOs who are addressing these concerns, PJM and ISO New England. I'll admit that the panel is weighted more heavily to ISO New England given what the Northeast has experienced in the last few winters. And what I think we in the Northeast would admit is a precarious position heading into this winter and the next several winters. I think I've said before I think it was at a Department of Energy event about a year and a half ago, I think Gordon van Welie who's an important member of the Advisory Committee on this topic, I remember saying that New England is indeed the canary in the coal mine with the issues we face.

And recently FERC Commissioner Phil Moeller testified to Congress that what is happening in New England will likely be repeated in other regions around the country given both the growing reliance on natural gas, but also coupled with the impending implementation of EPA's clean power plan that I think we all expect will drive further base load retirements in coal and a heavier reliance on natural gas.

So without going into the details and stealing any of the thunder of these panelists, we've got a great panel here so I'm going to turn it over to them. From New England we've got Robert Ethier, who's the Vice President of Market Operations at ISO New England. And his responsibilities include administration of the wholesale electricity markets. Bob has been there for a number of years. We've worked together and you won't hear from a brighter guy on how ISO New England is tackling these issues.

Then we'll hear from Andy Ott, Bob's counterpart at PJM. Andy is also responsible,

he's the Executive Vice President of Markets of PJM interconnection, and also responsible for PJM's market operations, market strategy, member training, state relations, customer relations, and performance compliance divisions.

Then we'll turn it over to a veteran from the industry, James Daly, who is the Vice President of Energy Supply at Northeast Utilities. As most know, Northeast Utilities acquired NSTAR not long ago. James is responsible for managing power and natural gas supplies to about three and a half million customers in Connecticut, New Hampshire, and Massachusetts. And as someone who like myself transitioned from the vertically integrated world into the world of organized markets, he definitely knows the intricacies of these difficult issues we're trying to solve.

Lastly, we'll end with Ben D'Antonio, who's a counsel and analyst at the New England States Committee on Electricity. NESCOE is the regional state advisory committee that was sanctioned by FERC as part of the creation of the

regional transmission operator, and basically represents the interests of the six New England states that are trying to tackle some of these issues outside of the markets.

And we'll hear about what we're trying to do within the market construct and probably what needs to be done outside of the market construct and to actually get infrastructure build. At the end of the day, I think the message is clear. There is no substitute for adequate infrastructure and there will be a big price to pay for it. In fact, Gordon and I were talking before we started the meeting this morning. Electricity prices in Massachusetts on a levelized basis over 2015 are expected to be north of 20 cents a kilowatt hour. And I can recall when John Rowe, the former CEO of New England Electric System, now National Grid, and also the CEO of Exelon, and his parting words warned about what would happen when retail rates went north of 20 cents a kilowatt hour. And that that was in his words the tipping point. Now, a lot of good

things can come out of that, but also a lot of troubling things as we face these cost increases that are going to hit the New England region this winter and perhaps over the next several winters.

So with that this is an issue that keeps many of us up at night lying in bed. I image some of Gordon's gray hair is because of this very issue. And I look forward to what I think will be a very good panel to really dig into this issue and give you all a comprehensive understanding of the challenges we currently face. And with that I'll turn it over to Dr. Ethier.

MR. ETHIER: Thanks Paul. I appreciate the opportunity to be here to sort of share New England's experience with sort of gas electric coordination over the last several years. And in New England really this issue predates the polar vortex. This sort of raised it to the national consciousness last winter. We've been dealing with constrained natural gas infrastructure, high natural gas crisis in the wintertime or during periods of pipeline constraints for a number of

years now. And really it goes all the way back to the winter of 2004, so almost a decade ago when we sort of had the first glimpse of this problem coming down the road. But then we didn't have weather that sort of brought this out for a number of years, but really then in the last three to four years, it's really sort of come roaring back. And we have a number of market enhancements proposed to address this issue and I'm going to sort of lay those out for you today.

So the real driver of all this sort of ironically is low gas prices. That's been incredibly disruptive to the New England electricity system. Folks tend to think of low prices as good for consumers and in general it is, but what it has done is radically change the way the infrastructure in New England is used or not used. So what has happened with low natural gas prices in New England is a number of things. One is a lot of the old resources, the sort of if you will legacy resources from the premarket period are now borderline economic or uneconomic. We've

got nuclear units retiring, oil units retiring, and coal units retiring. Then you have additional pressures including things like they're 40 or 50 years old, so they're relatively expensive to operate and relatively inefficient. But low gas prices certainly have sort of pushed them in that direction.

So you have units that are retiring. You have the desire to pull far more gas from the west than our current infrastructure can handle. And that leads to operational flow orders in the pipelines and limits to where our gas units get in the wintertime so they're not able to run flexibly. They may not be able to run at all. You get very, very high prices, gas prices in the wintertime. Prices that if you told people this five years ago we were going to be seeing, they wouldn't believe you. They're a order of magnitude higher than what you see on a day-to-day basis in the summertime or in the shoulder periods.

So we also have degraded performance

because what you have is these old oil and coal units that aren't making any money and they don't reinvest in their units. They don't, you know, maybe do the maintenance that they ideally would do or bring themselves back as quickly from outages as you might like to see happen. So all this has really been driven by low gas prices or at least accelerated by low gas prices.

So we're doing a couple of things to try to address that. First, we are trying to improve resources performance through changes to our capacity market. And second, we are trying to improve the investment climate in New England by again changing our capacity market to make those prices somewhat more predictable and more conducive to long-term investment. Both of those changes are probably best sort of done through the capacity market that we have in New England. And as I said are driven by the need to address the disruption that we see as a result of low gas prices.

The specific changes we're making are

something called pay-for-performance. That is tying your resources performance much closer to your capacity payment. That is if you perform poorly, you don't get a large capacity payment. If you perform well, you get a larger capacity payment, A. And B, a sloped demand curve, which instead of our current vertical demand curve in the capacity market, which if you're slightly long in capacity, you get very low prices, and if you're slightly short, you get very high, which leads to a very volatile set of prices and therefore revenues in the capacity market. We now have an administratively defined slope, which will moderate that volatility going forward, which should make it more attractive to investors and easier to finance because the revenue streams from the capacity market are more predictable. And all this is complemented by changes in our energy market, which will actually increase the prices during periods of reserve shortages or energy shortages. So that's sort of the big picture story of what's going on in New England.

I'll try to quickly click through some of the more, you know, supporting evidence of that and some of the more interesting supporting details. So if you can go to slide three, right there, you can see that the oil, coal, and natural gas columns that you see there, what you see is the blue bar is the percent of electricity generated in 2000 from oil, coal, and natural gas. And then the orange bar is 2013 for oil, coal, and natural gas. You can see oil production it went from 22 percent of our electricity needs to less than 1 percent, coal from 18 to 6, natural gas from 15 to 46 percent, huge changes. And, you know, the time scale is 13 years, but a lot of that, you know, my guesstimation would be a lot of that happened in the last four or five years. That's really it sort of sped up more recently.

And obviously, it's hard to imagine our side of the oil producing, much less than it does now. Coal is actually going to get worse because we just had a -- or lower, I should say, because we just had a large coal unit announce its

retirement and that will occur in the next couple of years. So and the only thing in New England that's prepared to step in in significant amounts to fill that gap is natural gas.

The next slide, please. You can also see, what you can see on this figure is the average forced outage rate in New England from 2007 to 2013. It's approximately doubled in that time span. And that's largely the result of you have these old fossil units that aren't called upon very often so they just kind of sit there. And machinery works best when it's used. It doesn't like to sit. And when you have resources with capacity factors in the one and two percent range, it's not surprising that when you go to turn it on after three months, heat up all that cold steel that problems arise. And you're seeing the evidence of that in the data that we have.

So skipping to let's go right to slide seven. So the Forward Capacity Market, what is the Forward Capacity Market? The thing that we are changing to improve unit performance and make

sure that we get new resources as these old resources retire. What the Forward Capacity Market does is it sets a capacity requirement that is a megawatt requirement that you can loosely think of it as our estimated summer peak load plus reserves plus estimated forced outages. Relatively simple calculations sort of in the abstract, and it says, okay, three years from now we're going to need that much capacity available to run our system in a reliable manner consistent with our reliability obligations. So we will run a market three plus years in advance to contract with those resources to make sure that they are there when we need them. And the ISO does this. We do the calculations for how much we need. We run an auction and all of our resources participate in this auction and compete to be the resources that are selected to provide us our capacity. In exchange for them agreeing to provide capacity, we agree to pay them money. We pay them money as they deliver the capacity and historically, that payment has been only loosely

tied to the performance of the resource. And what we are seeking to change is to more tightly couple the performance of the resource to the payment that you get. And this is what we hope will drive, improve performance, and improve investment in infrastructure.

If you'll go to the next slide, you know, why did we feel we needed to change and strengthen that connection between performance and the capacity payment and, you know, it's for a number of reasons. First in the current world, if you don't perform there are a bunch of excuses that is, oh, my unit's slow to start. The ISO didn't call me in time. Or I'm on outage. Things like that that sort of a number of get out of jail free cards in our current market, which, you know, does two things. One, is it doesn't give people good incentives to do everything they can to be available when we need them. But what it also does is it allows resources that don't meet our needs to continue to hang around in the capacity market, get paid, and not really do anything. So

you have sort of the, I don't know if it's ironic, but you have a situation where you have your most flexible resources. Think of a pump storage resource. They're held to a very high standard and if they don't turn on immediately in accordance with their physical capability, they might get a penalty in our current market. And they're called on all the time because they are always available and they are very quick to start and very quick to ramp up.

Then you have a 40-year-old oil unit with a 16- hour start time. They hardly ever get called because they're almost never in economic merit order, so they don't get picked up naturally in economics. And when the reliability need arises, most of the time they're off line and too far away to help. So they sit off line, say I'm available, I'm available, but they never get called. They never get graded for their performance and never face any penalties. So our current market has, you know, exactly the opposite incentives of what you would like to see of

rewarding folks who are very helpful in meeting our reliability needs and apply penalties to resources that actually aren't there when we need them.

So we're seeking to undue that by getting rid of the sort of the notes from mom that say it's okay that I'm not here. And instead, everybody's held to the same standard. If you're performing when we're short of reserves and/or short of energy, you get paid more. If you're not performing, you lose some of your payment. Quite simple, also quite controversial, but I won't get into that because that's a whole other talk.

If we could go to the next slide, so that's sort of the issue with our current world. And I already mentioned the vertical demand curve so two very recent FERC orders sort of granted us the market changes that we wanted to address those issues that I sort of opened my discussion with. The first is the sloped demand curve order. That's something ISO New England has sought for a decade now is a sloped demand curve in the

capacity market. FERC approved that just this past May, which is good news. It will go into effect for the first time in our February auction upcoming. And as I mentioned, that will work to smooth out the price signals in the capacity market, which should make it more attractive to investment. That's important because we're going into the next auction over 1,000 megawatts short of our installed capacity requirement. So we definitely need new resources to come to meet our region's reliability needs. So it's going to be a test of our market whether our markets can support brand new investment and, you know, large-scale investment in presumably combined cycle, gas-fired plants, as well as wind. Those are the two primary entrants that we see in New England.

The next thing is lower on that side is pay-for- performance. That is our solution to the sort of problem I just mentioned about poorly performing resources and highly performing resources getting treated sort of asymmetrically. Pay-for-performance is the name that we have for

more tightly linking capacity payments to resource performance. And interestingly, what it does is -- I was just on a panel earlier this week with somebody from ERCOT and it sort of occurred to me New England is probably the market that's going to be closest to ERCOT now that this is in. Because what ERCOT is doing is they're relying entirely on very high prices in the energy market to drive resource investment. What we have done is linked our capacity market very closely to conditions in the energy market and saying that's how you earn your capacity money. When you have very tight conditions in the energy market, that's how you earn your capacity money.

Those two things in the abstract actually look a lot alike. The only difference is really a forward component to that and do you get some revenue smoothing by selling your capacity in advance and stripping out any price volatility due to weather in any particular summer. So that is sort of the pay-for-performance aspect.

At this point, I think I should skip to

slide 10. So, okay, actually let's skip right to slide 13 then. So there are a few other things in addition to the sloped demand curve and the pay-for-performance changes. With the retirements that I mentioned, the ISO unfortunately in the view of its planning department can't sort of pick and chose where the retirements happen. They happen where the resources are uneconomic. But what that means is that we need to signal on a locational basis where we need new capacity because our transmission system depends on having a certain geographic mix of resources. We can't have all of our resources up in Maine trying to meet loads down in Connecticut and Massachusetts for example. So one of the other enhancements we have to make to our capacity market to sort of help with the investment challenges is locational capacity procurement driven by additional zones and sloped demand curves that govern the purchases in those zones. So that's on the table right now with our stakeholders. We hope to implement that for our next upcoming auction.

Finally, the other thing that we have going on in terms of addressing the gas-electric issue is if you'll go to slide 14, is how do we get from here to there? Because remember when I opened this discussion I noted that the Forward Capacity Market it's a forward market so we run the auction now for three-plus years from now. Well, we have to sort of get through the next three-plus years until these increased performance incentives come into play. So how are we going to go about doing that? And we're doing that with what we have done today is a couple of one-off programs that are designed to provide incentives for existing resources to bulk up their fuel supply or firm up their natural gas contracts to get us through the winter. We focused primarily on at least our first program focused primarily on oil units, getting more oil in the tanks. Our incentives in the markets were so de minimis that we had oil units that didn't have enough oil in their tanks to run when we need them in the wintertime a few years ago. So to respond to that

we had a one-year program that would basically subsidize the carrying of oil in tanks.

We've got a new program this year that's expanded somewhat, but it's aimed at the same end goal, which is getting more oil in the tanks and getting natural gas resources to contract with LNG facilities to bring in what is very expensive international LNG. Put it in the LNG facilities and then draw it down during cold weather periods. It's remarkably expensive to buy gas in the international markets relative to domestically. So unfortunately this seems to require subsidy for folks to make this big upfront investment to have the LNG park there for when we need it. And that program was recently approved by the FERC and we're running it for this winter. And then we are looking at what do we need to do for the next couple of winters until our capacity market reforms kick in and hopefully provide us with a longer term solution.

So in conclusion on slide 17, the growing dependence on natural gas in New England

coupled with very low natural gas prices has created, you know, a whole lot of issues for us to address. As a result, we've tried to improve our market design. I'm sure many somebodies have said never let a crisis go to waste. So we are using this, you know, genuine, you know, time of crisis in New England to improve our market in ways that we think will drive the behavior we need in this particular instance, but also I think will set us up well in the long term so that as resources get built, retire, fuel prices change, political preferences for all fuel types change, we're going to have a capacity market that's more resilient, that results in resources that our operators can use effectively to operate the system in a day-to-day way. So with that I'm not sure how you handle questions, Paul. Is it now or wait until the end?

MR. ROBERTI: Wait to the end.

MR. ETHIER: Okay, great. Well, thanks for your attention. I'll look forward to your questions.

MR. OTT: Good morning. Thank you again for the invitation to speak in front of you. Again, my name is Andy Ott. I am the loan representative from outside New England this morning on this panel. If you go to my next slide, PJM, as Bob was mentioning a Forward Capacity Market creates incentives for investment because it basically articulates the value of reliability and resource adequacy on a forward basis. PJM actually has a Forward Capacity Market with a sloped demand curve. We've had it since 2007 and it has worked remarkably well.

This slide actually shows the resources by fuel type that are committed in the Forward Capacity Market out through 2017. We have a question mark. It's three to four years forward. What we've seen though as time as gone on, is the amount, of course, it's pretty obvious up here, we've seen a tremendous amount of innovation in demand response. Customers actually signing up doing a forward contract to curtail their use of electricity, which essentially displaces the need

to firm up generators as capacity. So we've had a tremendous amount of demand response. In fact it was so successful that we had to increase the requirements on demand response, make the contract entitle more curtailment obligation. So we started to see a tail- off economically in the out years there you can see purple slide. But again, that was actually a fairly significant innovation.

The other major issue on this slide that you see is gas. We've tended to see a tremendous influx of gas. Of course, PJM sits right on top of Marcellus shale region. We have lots of gas. So effectively we're seeing fairly tremendous investment in gas-fired combined cycle. Coal plants are going out mostly due to MATS, frankly. We have 24 gigawatts of coal actually retiring in about a three to four-year span, fairly significant transformation in fuel. That's being replaced by gas and demand response. And that's in and of itself a great thing. The Forward Capacity Market has worked well in doing that. And markets in general work well to deliver

whatever product that you define in the market in the most cost-effective manner. That's what competitive markets do. They work very well to do that.

The issue is what is the definition of capacity? With demand response we had a bit of a growing pain there. We had to define what the contract was. For capacity though in PJM, the contract has been to be prepared to do everything we need to do to demonstrate that you can deliver energy at time of peak. But it's not an actual contract to deliver the energy. And what we found is that when we had the stress of the gas system, we had the stress of the coal units, the actual delivery became a problem.

So what we're looking at is capacity definitional change that actually looks more like a contract to deliver the energy on a forward basis at time of shortage. And I think that's a lot of like what Bob was talking about. Effectively what they're doing in New England is changing the product definition of what capacity

is to be much more rigorous. That's essentially what we're thinking about in PJM also. So at the end of the day we'll look a lot alike.

One thing about the gas market and the electric market, now, I'm talking about the actual day-to-day scheduling. This is pretty commonly known now in the industry. I think people said don't worry. The gas folks used to tell me don't worry. The fact that we're out of sync doesn't matter. There's so much gas, everything will be fine. And it really isn't fine. So what we have is the forward day ahead market, if you will, and for energy, power, and the daily markets for gas just don't line up well.

The dark blue box is when we actually allow bids and offers into our day ahead market for power generation. We clear those at noon. The timely gas nominations are out of sync with that. By the time we clear the gas noms had already gone for the day. Therefore, anybody who bought firm gas didn't make a timely nomination at 10:00 a.m., therefore, they look like non-firm

gas. So we're set up to fail essentially to deliver secure gas. So what we have to have happen today is the gas units have to speculate on the gas market and buy gas even though they don't know if they have a power award.

That's got to be fixed. I've talked to many, many people in the gas industry who say there's no problem yet. Really, we'd have to come to grips with this issue and certainly the changes needed on the power side as well as the gas side.

Another thing about gas and electricity is electricity, of course, is very volatile during the day in the winter. The black line is a winter load shape. In PJM we have the double peak and I think that's pretty common in the power industry. You look at when the gas day starts, it's right after our big morning ramp. So the people trying to buy gas for the day before it's at the tail end of the gas day, very few people are going to be able to get gas to ramp up those units with the tail end of the gas day. It's a very difficult timing. So gas noms would have to have been made

18 hours before to understand exactly what that ramp up in gas usage would be. It's a very difficult thing to do.

So what we've had in the gas industry is the gas distribution companies have paid for infrastructure to deal with the fluctuation in gas utilization. They do it with a combination of pipeline capacity, storage capacity, and they essentially synthesize for their customers the use of gas fluctuation over the day. The power industry's coming along saying, hey, we want to use gas, but we have fluctuation over the day too. We want your flexibility. Gas people are saying absolutely not. We've paid for this flexibility. There's no way you're getting it. There's no way. We're going to hold that flexibility for ourselves for our customers. Power can't have it.

So the point is we haven't articulated on the power side what are the needs? What's the definition? What do we need for fuel security for secure and flexible fuel supply from the power perspective, what do we need out of the gas

industry? We have to articulate that on a forward basis so that it can be priced in and the infrastructure can be built. And effectively I think Bob and I are saying the same thing. We have to put the contract definitions out there for what we need on the power side so that the gas side if they're going to be a viable growth industry for electric power generation, they got to get it right and we got to get it right. And that's really the definitional issues that we're struggling with right now on the power side.

So as we look forward in supply evolution, again there's a variety of things going on in the industry. Sometimes the excitement's a bit much right now I think for a lot of us. Obviously, we've got the traditional resources, our less and less flexible enviro limits, fuel limits, just economic limitations on the resources are really making most of the traditional resources flexibilities shrink. Obviously, the coal to gas transition has created fairly significant coordination issues.

PJM's issue with gas and electric coordination is not similar to New England's. New England can't get the gas. They're at the end of the pipe. We suck it all off before it ever gets anywhere near New England. And so our issue is not that we don't have the gas. The terms and conditions under which we have to use the gas for power generation when the pipeline comes constrained, all the flexibility gets thrown over and user reserved for the gas distribution companies who paid for it. So power gets fixed amounts of gas. If you can use the gas 24/7 at a constant rate in the PJM area and have all you want. We saw this in the winter. The problem with that is there's no flexibility then for the power plants to fluctuate with load. It became extremely expensive because the gas prices were high. We had to use it 24/7, which is sort of kind of intuitive. Price is high, therefore gas is scarce, but we have to use it 24/7 if we want it, which was a counter-intuitive result, but it's again the nature of the dysfunctionality between

the gas and electric markets we have to fix.

So the point is we have to articulate that from our perspective in the polar vortex. We're running about 12 gigawatts of gas units 24/7 all above market price. So it cost us about half a billion dollars in uneconomic operation because we couldn't get flexibility. We've got to change that. It's a lot of money in a very short period of time. You're talking one month in January. That's a very expensive lesson.

So what we're looking at on the energy market side as far as evolution is obviously looking at ways to get those prices of uneconomic gas out of what we call an uplift payment, the half billion dollar out of market payment and into power price. And the capacity product, as I said, we're looking at the product definition. We're moving exactly where New England's going. We were already half way there. We had the Forward Capacity Market with a sloped demand curve. They're headed there. They're also talking about definitional changes. And again, high level, the

definition is you've got to deliver the energy at peak. Not just tell us you can, you actually have to do it. So that will effectively create a fairly strong incentive for people to invest in infrastructure up front so that they have contracts to deliver.

So we'll set the performance expectations as Bob had outlined and our sense it would be contractual and looking really at the definition of what the market's asking for. And the market hopefully will deliver that and we feel pretty strongly that that'll occur.

The fuel security side, though, we also as an industry and we're all guilty I think in the power side, we haven't articulated what we absolutely have to have if we're going to depend on more and more gas. You need firm fuel. You need firm transportation and you need flexibility. You got to have all three. In gas world, that means you're buying pipe, commodity from the suppliers, and storage. And there's some combination of that that has to be reserved for

power use if we're going to continue to grow the utilization of gas as electricity generation. There's simply not enough storage especially to go around especially in the PJM region. So we need some infrastructure investment there and it's going to cost money. The power industry's got to pay for that. The gas industry is not going to pay for that.

Last then is grid services. Again, we've had a tremendous amount of innovation in grid services. That's not the subject of my talk today, but I think that's going to come a long also and help with some of the flexibility issues.

So in a nutshell, when we talk about capacity performance, and again, I think it's a very similar direction to where New England is going, we have three major tenants of product definition that will be changed in our capacity market for the year 2018. That's fuel security definition as I talked about. It's performance, meaning product definition says you will deliver or you will pay. And then last is operational

flexibility and availability. We've seen across the board in our power plants, gas isn't flexible, coal isn't flexible. I don't think we have any oil units left, but the intermittents aren't flexible. The point is, is somebody has to be moving in the direction of flexibility. We're going to pay for that and that's going to be a part of the definitional element of the capacity. And I thank you very much for your attention and look forward to questions. Thanks.

MR. DALY: Thank you. Thanks for the opportunity to speak. Those last two presentations really did an excellent job of setting up what some of the problems are in our marketplace. So what I will do is give a customer perspective on that from the three and a half million customers we serve if I can. And then explain a little bit about what we are trying to do as a company to solve some of these problems.

So just to start with so just defining the problems if you haven't got it at this point, the shift to natural gas for consumption for both

heating and power generation has caused a major change in our area speaking for the Northeast. And you've heard from the other two speakers in their regions as well. We also have retirements of older power plants. I'll show you some charts on that just to kind of give you a picture of what's happening.

But then we also have in our region in New England, very aggressive carbon reduction goals set in state mandates and state laws. So figures as startling as 80 percent reduction in carbon emissions by 2050, I mean, nobody really knows what the definition of the industry looks like if you have an 80 percent carbon reduction. How do you do that? So nobody's defined a solution, they've defined the goals. But those goals are driving some of the decisions we make in the region.

So Bob covered some of this so I won't spend a lot of time on it and remarkably our numbers agree because we used the same database. So the shift has been from 15 percent generation

in natural gas to 46 percent in '13, and that's growing even more, so at the expense of coal and oil. I mean, the big thing to understand about that shift is that we're moving from a fuel source that's largely stored onsite and is available for power generation when you need it to a fuel that arrives just in time or has to be scheduled to arrive just in time. So it's a big shift in terms of your security and reliability that's occurring. And if you combine that with you've got a shortage of transportation, you really are in uncharted territory to a big extent. So that's the story behind the numbers if you like, which is quite startling, really.

So that's the past and we're going to look at the future if you like in terms of what it is. So we have upcoming retirements announced, 4,100 megawatts. And some of the bigger ones are listed here, and mostly they're coal and oil units. And these are older units. They really are not economic to run especially competing against natural gas at low prices. And, you know,

as Bob says, we have lower prices for natural gas. We also have high prices for natural gas. So we have the best of time and the worst of times depending on where you're at. And that volatility is something I'm going to talk about in another couple of slides. But on the left-hand side here is announced retirements and then there's about 8,000 megawatts in all of units that are at risk of retirement included in that is that 4,100. So and what's the 8,000? It's about 25 percent of the actual capacity in New England. So it's a huge problem and you say, well, do we have a good model for investment in power generation in New England? The finance community are sitting on their hands largely in terms of investment in power generation.

So we have a number of structural problems. The right-hand side of this is new generation projected. And this is the ISO New England cue if you like for projects that are in that cue looking to get intraconnected. Now, you'll see natural gas and natural gas oil are the

biggest components here. So there's more of a drive to natural gas dependence, not less. And you'll see there's wind in there, but wind is an intermittent resource, which will require back-up by other fuels. So we're building on a problem more is what this says. And solar is a small number there. It's 16. That's because really a lot of that solar, there's a big solar program in New England, probably about 2,000 megawatts, which is a huge investment in solar. And New England isn't a very rich solar zone. It's too far north. So the capacity factors are around 13, 14 percent. So there's a huge investment in a pretty yield resource that's going on in that area. So about a couple of thousand megawatts and several billions of dollars. You can add up the numbers. It's probably $6 billion in investment to make that occur. So we're putting a lot of eggs in baskets that are not going to produce a lot of reliability for us. On a cold winter's day, the sun does go down in New England, you know, as the peak is coming up. So we've got problems structurally in

how that market is addressing reliability. And, you know, the programs being introduced by ISO New England to make performance much more critical are headed in the right direction. Whether they'll produce the desired result or enough result has yet to be seen.

So there's one other point I'd like to make about this slide is the left-hand side of that, the upcoming retirements, they're pretty certain. They've been announced. They're going to happen. The right-hand side of this, most of those resources are not under contract. They don't have financing, so they are very uncertain in terms of the renewable resources are supported by state policies and they'll probably occur, but they're not going to be firm fuel. So there's very significant structural problems being built into the market.

So how does all this affect customers? Well, just looking back so what we did was we calculated the cost of energy basically the clearing price of energy in the ISO New England

market in the months of December through March for the past few years and said clearing prices, we saw prices driven by shortages of natural gas in wintertime driven hugely, very, very volatile prices. So, you know, all we did was added up the cost of clearing prices by the load in New England during those months and you can see the increase in prices. These are in billions of dollars so I went from, you know, around that three billion mark to $6.8 billion just in the wintertime alone. So the bills went up about $3 billion just for the wintertime alone. So I'll show you the rate impacts coming up.

So you say, well, this is one winter and, yes, it was a cold winter, but in actual fact, we didn't have extreme cold days. We had a cold winter. We didn't have extreme cold days. So, you know, there's about 11,000 megawatts of gas-fired generation, only 3,000 megawatts of gas to run. And with the increase in demand from the heating sector and the manufacturing sector that's shifting to gas and away from oil, there's going

to be less of that available. So $3 billion in one winter is quite a significant bill. You know, next winter it's going to be another $3 billion because we're buying the power, we're locking in the prices for next winter already. So it's another $3 billion for next winter pretty much. People are not going to wait to see whether it's a really cold winter. The forward trades are building in the, you know, expected kind of winter, winter prices. So it's going to be in that range. So we paid the high prices last winter. We're going to pay them again this winter.

So, you know, this clearly for the political folks who are now all running for election in the fall campaigns, this has been a significant driver of concern for them is where our electric rate's going. So, you know, what I did here was plotted the residential rates for our company and we procure power on a certain program basis, usually one- year contracts that are staggered through time. But, you know, this gives

you a sense of where prices have been so, you know, back in '08, we're at the 12 cent rate, then it dropped down to the good times in 2011 and '12, you know, around that 7 cent rate. And they jumped up then in the second half of '13. First half of '14, we're looking at around 8 cent rates and then what's happening now coming into, you know, the first half '15, is those rates are going to around the 12-plus rate. That's an average annual rate. National Grid, one of our other large utilities in the region has just filed 17 cent rates effective November 1. So these 17 cent rates are coming along because they're all driven by winter fuel prices. They're billing cycle starts in November. So they've locked in a lot of expensive power for next winter. We're going to be doing it from starting January 1, but we'll average just a little more.

So what's happening is this volatility is coming into the market. This is just the commodity piece. When you add to this the delivery component, which is about another 8

cents, you're in the mid-twenties. So we're looking at mid-twenties this winter for some of the customers in the region for electricity. Those are the numbers as Paul said, you know, once you get into that area, customers start to react and not well in our view. They're not happy customers when their bills go up that much. And the other effect you have is that a lot of other technologies become attractive for customers. Just go off the grid for industrial customers, for example. So you get a Germany situation where the industrial customers say we can't compete with these high electric rates. We want to go off grid. So they want to generate their own power. And they'll probably use fossil fuels to do that. So some not good effects in the pipeline.

So we say, well, what are we going to do about it? So the New England governors' response is, well, let's expand natural gas infrastructure and let's expand transmission for imports. In the region we have large stocks of natural gas to our west. We have large hydropower to our north. We

just don't have any in our region. So if you expand transmission to a large hydro in Canada particularly and gas transportation to the west should solve the problem. So the solution is pretty obvious. We can combine, we can have more diversity with hydro and gas, add renewables and it should be all okay. The problem is getting there.

So states themselves are different interests, you know, some of them want gas expansion. They're not interested in renewable power. They're all concerned about reliability obviously. Cost allocation is an issue. This infrastructure, who are the winners and losers? So it's hard to get agreement among the states. So that is a work in progress. The proposal by the New England governors says, well, we'll establish a tariff, which ISO, with FERC will approve. And this tariff would allocate its gas transportation costs to electric customers since they're the beneficiaries. So that's pretty novel. That's not been done before in FERC world.

And there are people who don't want that to happen. If you're an owner of nuclear or even coal or hydro, you don't want natural gas transportation. You like the high prices. You're protecting your investment. So they're going to object to that. So if we did get a tariff approved and FERC says we're not sure we have the authority to do that. So on gas transportation there are several very significant issues and question marks about how to deliver that infrastructure.

On electric transmission, there are more vehicles to get that in place, but it's elective transmission upgrades type process. Who pays for it and is there, you know, who are the free riders? All that kind of thing. So there's a lot of untested territory here. We have a very good transmission tariff arrangement for reliability to build transmission for reliability and spread the cost over to our customers. So we have a very good and well-tested tariff mechanism to build for that, but not for this kind of we'll call it

elective transmission upgrades or economic transmission upgrades or merchant.

So those are some of the challenges. If we did get that tariff it would be administered by ISO New England and allocated to all customers, precedent setting as I said. So and Ben's going to follow-up on how the states are addressing that. So we said in looking at that challenge we as a utility said, hey, what can we do? So we said, well, we'll work with NESCOE to promote the development of electric transmission natural gas and we will support the use of an ISO tariff to expedite this construction. We say, you know, there is precedent to exist to lean on regulated utilities to solve these kinds of problems so we're willing to put our balance sheet and our cost allocation mechanisms if the states and FERC approve it. We're willing to do that.

And so we made a proposal. So we said, okay, we understand this is a very complex problem for NESCOE to try and solve. The governors charged NESCOE with solving this problem and

implementing this. So we said we'll give them one good solution if we can. So we, National Grid, and UI got together and says can we get a proposal to NESCOE here? So all we did was and this looks a little bit complicated, but talked to pipelines about what would it take to get infrastructure built and they said this tariff thing we're not so keen on that. We don't operate in those electric markets. We're not sure we could protect our revenues, but we like your balance sheet. Why don't we sign a contract with you? And we're already customers out among the gas LEC side so they said we know you. You know, you have A-rated balance sheets, looks nice. We don't have to worry about tariffs, you just sign it. So we said, all right, we'll put ourselves in the middle of this for argument's sake. So that's the electric EDCs, intracapacity contracts with the pipelines. So we paid them no matter what, but we recovered the costs through that ISO tariff I said, and allocated to New England Electric load.

So that's the concept. And then the

capacity itself we said we'll give that to a capacity manager, an independent third party to allocate. Essentially par generators today subscribe to capacity on pipelines and buy it themselves. So we just make it available to them and they'd really pay, you know, the economic plants would probably pay a little bit higher than everybody else. But most of the year they wouldn't pay much for it at all. So you'd be left with a bill to the customers. That's the way natural gas pipelines work. So you have to pay for it all year round for the 10 or 20 days a year that you really, really need it. So that's how it works.

So that's our proposal if you like. And Ben can talk a bit about how NESCOE viewed that. But in any event, I decided just to provoke a little bit of discussion here in terms of how it is because my business operates both natural gas and electric businesses, both in deregulated markets, but they're structured very differently. And we think the natural gas market works pretty

well and the electric market has the challenges we just described.

So just looking down these two columns here, on the Natural Gas Model, so, yeah, local distribution companies are responsible for long-term needs, long-term resources they're responsible for them. You can summon up pipelines in a day or a week or a month. So it's multi-year plans. So marketers operate in this market too. They typically have a horizon that's one to two years. It's pretty short. Not long enough to get those infrastructures in place. Some of them have the balance sheets and will do it, but by and large, that's not what they deliver. So the LDCs are in that provider of last resort role for their customers and in some states for all the customers.

So we have approved resource plans. The states require us to file plans, resource plans. It's the old resource planning concept that people said, well, we want to get away from that on the electric side. But it still exists on the gas

side and it works pretty well. So you have a forecasted load growth that goes on and the states, if you like, look at your resource plans and see its least cost and meets reliability, et cetera. So we have pipeline storage in LNG assets in that market so we have a portfolio of assets that we have full call on for our customers' needs. And the reliability standards then that we are meeting. So there's a reliability standard. It's the coldest winter in 30 years. That means it's not the coldest winter every year so there's 29 years out of 30 in which the surface capacity around and other people can use it and that's what's been happening. But when the cold winter comes along, that's when the problems hit. And now we're getting, you know, the tighter and tighter the capacity is it's not 1 in 30, it's nearly every year. So coldest day in 50 years, so these are very high standards because the gas industry can't tolerate an outage of natural gas. You have to go around to every pilot light and relight it. So it's not in the cards to do it.

So you plan not to have to do it. So it's all planned. Those storage facilities are full every winter going in. That's the way we plan for. We don't plan for, hey, we might get an average winter. We plan for a cold winter every year.

So on the electric model it's very different. So electric distribution companies we have supply obligations for one-year. So we go out and procure power for on one- year strips for our customers. And our customers are free to move. So marketers typically are again in the one to three-year kind of commitments. Some of them go longer. Some of them go less. Some of them are just spot market pricing for their customers so that they move around and it can get quite volatile. So I know there's a more stable offering. So there's no resource plans for the for the ECs, so there's no -- some states like Connecticut do actually resource plan. But most of the deregulated states in New England don't do resource plans. So we don't have responsibility to do it either. So it's done by market tools.

So the ISO market tools as the first two speakers have talked about, Forward Capacity Markets is a big tool. Performance incentives are another one, and then locational marginal pricing. So the idea is that everybody gets the highest price that clears in the marketplace and that should be incentive for them to make their investment decisions combined with revenues from these other markets. So that's the tool set that ISO has. ISO can't order people into long-term contracts, can't order people to build power plants or gas transportation systems. So they have pricing mechanisms that operate like that. So it's very different and, of course, there is a reliability standard, one day in 10 years. It's not as long as on the gas side because you can turn on and off electric load a lot easier. So, you know, the standards get debated, but there is a standard there.

So if I looked, you know, along resources and standards and say how well aligned are they? On the Natural Gas Model, it's pretty

well aligned. I mean, you line sight between here's the reliability, here are the resources, here's the performance that we expect and pretty much here's the costs. But you still have competition in that market around the commodity and services. So you can accommodate these different goals in that market. But on the electric markets, you know, I had to put not well aligned and clearly, you know, people could take exception to that with these markets people keep changing them and keep trying to improve them. I don't think anybody thinks that capacity markets are solved. So those issues need to be resolved.

So that's a perspective on two different models of how the business works and some of the things we're trying to do in working with the good folks here at the table in terms of trying to improve service to our customers. I think Paul said New England is the canary in the coal mine being responsible for three and a half million canaries, we don't want to lose any of them, really. So it's quite a challenge. So that's it

for me. Thank you.

MR. D'ANTONIO: Good morning. I'm here on behalf of the New England states but the remarks this morning are mine and should not be attributed to any of those states. And given that folks have already kind of set the table, I'd like to talk about the New England Governors Infrastructure Initiative. I'll start by just offering a couple of perspectives that kind of influence the activity in our region. First is that the reliability challenge is real and it's here now and that to date, the region's response has been both expensive and dirty. And the regional price disparities they are significant the last time I checked the basis futures for Algonquin Citygate are trading at five times Henry Hub, with a Dominion South Point in the Mid-Atlantic.

And the problem's been well analyzed. Several studies have been completed, a couple more are underway. And once you incorporate these experience of this last winter, the situation

looks a whole lot worse. Here you've got the available transportation capacity for the electric generation sector and during the coldest periods of the year, there's just not much space available. Same information here but, you know, as some of our previous panel has talked about, our region's heavily dependent upon gas-fired generation. It's about half of our portfolio. And during those cold periods of the year, roughly, you know, 20 to 40 percent of it is able to get gas and the rest isn't.

And I think that what we primarily have is a mismatch in the markets. I mean, there's a couple of different strategies the generators could pursue and if you assume rationale economic behavior, you got fuel switching or additional infrastructure. And each of them have their kind of own set of issues. You know, fuel oil from the public policy perspective it's pretty dirty. But from a generator's perspective it's probably your least cost solution for meeting your obligations. In terms of LNG, I think Bob mentioned that not

only is it expensive up front, there's a resale risk. If you have to liquidate your LNG, you could lose quite a bit of money if you have to liquidate in the spot market.

Which leads us to pipeline and there's just a mismatch between the two different markets. In the electricity market, we're based on a relatively short-term price signal. If you're an existing generator, you're looking at about one year of price certainty. If you're a new generator, you can get up to seven years of price certainty. But on the gas market side, you know, that's based on long-term contracts and, you know, even if you were able to address some of the incentives around, you know, fuel switching and some of the downside risk there, you still have this term mismatch. And so, you know, why wouldn't the marketers step in? Those financial intermediaries, this is kind of what they do. But I think that you have this problem where whenever you have congestion and you have the opportunity to make arbitrage profits, the second you put in

new infrastructure, the congestion's alleviated and your opportunity to make arbitrage profit goes away. So we really haven't seen the marketers step into this role to provide a solution.

The other entity that maybe could help out would be the producers and we've seen the producers push some infrastructure into other regions, but they haven't come into New England, which makes us believe that there's probably some more attractive opportunities for them elsewhere. And I think that these theses have been borne out by some of the recent permitting filings at FERC where the only entities that are subscribing for firm transportation are rate regulated gas distribution companies.

I think that, you know, this region has been taking about this problem for a very long time and in earnest, for the past couple of years, and it's the state's observation that no other comprehensive long-term solution has come forward to bring in pipeline solutions, which appear to have the right mix of both reliability and

economic price disparity solutions of space.

And keep in mind this is New England, folks, pretty strong commitment to a clean energy. The states are doing a lot of aggressive policy measures to promote resources at the local level. But what we have is truly a regional problem. We're a interconnected grid, an interconnected market, an2 interconnected economy and we're viewing this as needing a regional solution, which brings me to the New England Governors Infrastructure Initiative. These are some of the objectives around which the six New England governors from a very diverse political spectrum were able to coalesce in putting forward a coordinated solution to our issues.

And there's two primary elements to the Infrastructure Initiative which are intrinsically linked. There's a pipeline component and additional electric transmission component. And, now, it's very important to consider that these are integrally linked both in terms of reliability, price disparity, but also in terms of

clean energy policy. I think if you consider them from the emissions perspective, there's a little bit of balance. I think there's also an aspect of comedy in siting considerations and that you've got, you know, regions in the south that want infrastructure that comes through the north, and vice-versa.

So the states have been talking one possible means to expand gas capacity and that's using the electric tariff to be the vehicle for cost recovery to get that pipeline infrastructure developed. And there are some interesting legal issues associated with doing that but I think we'll save those for another time. But I think the important thing to take to consider when you, you know, examine this novel solution of using the electric tariff to pay for gas infrastructure because if it's likely to be the most equitable way to share the costs across the region, you've got some really sticky regulatory issues associated with cross-subsidization and free ridership both across state borders and across

industries. And so using electric tariff in our mind, provides the clearest nexus between the costs associated with the infrastructure and the ultimate beneficiaries, which in our mind would primarily be the electric rate payer.

Now, of course, this notion of having an electric tariff would go through the normal processes and would be subject to FERC approval and there'd be scrutiny in the normal course of business. And I think that the concept would be to have a competitive solicitation for infrastructure projects that could deliver it and we would price them in increments so that we could try to achieve, you know, the right size given our needs and, of course, there would be subsequent cost benefit analyses to make sure that all of this stuff was cost-effective.

The other element of the Governor's Infrastructure Initiative is to expand transmission capacity to capture clean energy resources and the idea here would be to have the transmission piece funded collectively through the

electric tariff. And a subset of the states would be purchasing the power or having their electric distribution companies purchase the clean energy power that would flow over these new transmission lines.

Now keep in mind that these two elements of the Governor's Infrastructure Initiative are part of a broader portfolio of investments that the states are making. You know, the region's commitment to energy efficiency is well known and being from New England, I just had to bring up the slide where we flatten the load curve. And also I think somebody mentioned the strong growth in photovoltaic resources. We've been working with stakeholders in the region to talk about ways that the region's investments in photovoltaic resources could be incorporated into the region's transmission planning and resource adequacy processes. But that's still, you know, a work in progress.

And so to date, try to catch up a little bit, in December the six governors issues a

statement indicating that they were committed to cooperating on a regional set of solutions to this problem. And we followed that up in January by asking ISO New England for technical assistance in implementing these kind of solutions and to their credit, ISO New England has been incredibly helpful throughout the process. And we've had a, you know, pretty robust interaction with our stakeholders in our region. We constituted a group a couple of years ago that we called the gas-electric focus group. It's a cross-industry group of folks. It was formed in response to the FERC technical conferences that really kind of kicked off this issue. And, you know, we went to them and asked them what they thought about the solution space and, you know, what we were proposing to do. And they generally advised us that the quantity of pipeline that we were discussing pursuing was just we were aiming too low and that we should go bigger.

We've had a lot of informal conversations as well as formal conversations

where we've gone through our formal power pool stakeholder process and the technical committees that are associated with that. We held some meetings with each of the individual sectors where we had some pretty robust discussion around, you know, what were we actually trying to solve here reliability or economics? What's the appropriate role of our neutral market administrator ISO New England? And whether there were other ways to try and achieve some of the states' objectives.

You know, we've put out lots of solicitations for comment on different concepts and different ways to approach the situation and to drill a little bit deeper, I think James did a big favor by showing you that graphic whereby the mechanics of one different kind of proposal would work. But I think if you start from the perspective that contracts are still necessary to get pipeline both permitted as well as funded and financed, the question becomes who signs the contract and then once they sign the contract and they've got that capacity, how do you get it into

the hands of folks that meet the public policy objectives of having the electric rate payers, you know, bring down costs and have a reliable system? So we've soliciting comments on how to do that. We've got a bunch of proposals that folks put in. You know, we also went in to explore whether there were market reforms that could alleviate the need to do this. But as I mentioned before, we've seen a lot of market reforms and so far the region's response is both expensive and dirty and I think that, you know, I think that it's time for the states to consider what they should be doing going forward.

So what we had been doing and I'll give you the current status here in just a minute. But what we had been doing was moving through the stakeholder process whereby, you know, if we're going to put an electric tariff in place at FERC, you need to work through the stakeholders first. And we had begun that process. We had brought some proposed tariff language to the techno committees for consideration and consultation.

And we had projected that we would be moving towards a stakeholder vote in September. That's a prerequisite for us. And then that stakeholder vote in September would be followed by a filing at FERC to try and get the tariff approved.

You know, we also have been working an RPF for the electric transmission and how that would work trying to identify both clean energy resources that are domestic as well as imported. You know and really we wanted to get as much public comment as we could on all these things and so as I mentioned, you know, we've had a whole lot of that and that's all on our website.

And the current status, you know, I mentioned before that the two elements are inextricably linked, pipeline and transmission. And I had mentioned that the pipeline and transmission would be funded through the electric tariffs and that the power that would flow over the transmission lines would be paid for through power purchase agreements at our distribution utilities that some of our states would enter

into. And that was all contingent upon Massachusetts, which is approximately half of our load in New England that the governor had put forward a clean energy resources bill through the Massachusetts legislature that would authorize our distribution utilities to purchase that power. Well, the legislature convened for the remainder of the year without acting on the governors' bill. It never even made it out of committee. So as I mentioned, those two elements were inextricably linked so without the authority to purchase power over lines, NESCOE requested that we suspend the calendar that we had been working on where we had been bringing the tariff provisions through the stakeholder process with identifying the potential September vote. We've indefinitely, you know, postponed moving forward with that. And at this point in time, the states are continuing to talk about ways to move forward and what our options are and Massachusetts is doing some additional studies around, you know, their clean energy policies and trying to take a fresh look at the

need. I think that's it. I look forward to your questions and the panel discussion. Thanks.

MR. ROBERTI: Thank you all. Before I open up for questions, I was hoping just to ask two questions for Bob and New England situation, a long-term perspective and then the short-term. First the long-term, with the changes in the product definitions and the addition of a demand curve, I don't know if you're a betting man, but what's your gut say about generators particularly given that in the cue you've got gas-fired generators for the most part to fill the void of the retirements. What do you think is likely to happen in terms of procurement of pipeline capacity? Do you think with the seven-year compensation period in the capacity market coupled with these other changes that this will drive that type of contracting by generators?

MR. ETHIER: I actually don't think it will and the reason is maybe not quite what you're expecting. It's not that the market couldn't support it, it's that additional pipeline capacity

is almost certainly not the most economic way to meet our reliability needs. So the market's going to signal to folks or drive folks to do the least expensive solution to meet the ISO's needs. In New England, it's almost certainly dual fuel capability. We've run the numbers. We've had a consultant run the numbers and adding dual fuel capability to combined cycle units is almost certainly less expensive than building new pipeline capability.

MR. ROBERTI: And let me ask you the short-term question, slides you showed nuclear going from 30 to 33 percent. Looking forward to the immediate winters, there's three things that strike me. One, you have a major nuclear outage or you have an extended cold snap like we did in 2004, or you have freezing of the waterways in which the distillate fuel can't make it up say into the ports of Providence like we did in the year 2000. If any one or a couple of those things happen in the winter, tell us what you see happening.

MR. ETHIER: Well, if any one happens, you know, my understanding of the studies is we'll be okay. If we have many of those things happen piled on top of each other, then it gets a lot dicier. Certainly reduce nuclear capability is going to be problematic. We're losing Vermont Yankee. As we speak it's powering down I believe. So going into this winter, we already know we're going to have less nuclear capability than we've had in the past. And that's going to put more the burden of producing on our existing coal and oil fleet. That's exactly why we have the interim winter programs that I discussed is to make sure that those oil units have enough oil in tanks so that we can run them more to sort of backfill for this nuclear capability. And that's also why we're running the program for this winter that's going to encourage additional LNG capability. And at this point, that's pretty much what we're able to do in terms of, you know, in the long run our market reforms are aimed at getting more infrastructure. In the short run in some ways the

best we can do is ensure that we use the existing infrastructure as best we can as efficiently as we can.

MR. ROBERTI: Okay, thanks. And, Ben, I wanted to ask you a question. I forgot to mention, Ben D'Antonio, as you could tell from his presentation he's not only a lawyer, he's an economist also and he has an extensive background in New England energy issues having come from the Mass Department of Public Utilities. Ben, you talked about what happened with the Massachusetts legislation and also about the procurement model using the EDC procurement model in the question of FERC's jurisdiction under the Federal Power Act. I think most of us can glean that there is an alliance between environmentalists and generators who actually thrive on the volatility that's happened in the last two winters that led to Massachusetts not passing that legislation. I don't think it's unreasonable to anticipate that those forces would converge on the question of whether or not FERC has or can utilize that

authority under the Federal Power Act to employ the EDC model that NESCOE is pursuing. And given that, is there and maybe this question goes to James too, is there an opportunity for the states to do this outside of FERC and still be able to develop cost allocation methodologies that we can employ at the state level? Is that possible or feasible in the event that there are problems with FERC helping us on that front?

MR. D'ANTONIO: Well, that's quite a question. I'm not really clear exactly what happened in Massachusetts and I don't know if there's, you know, any kind of alliance that you mentioned there. I think that any time, you know, you pick one particular resource type, there's going to be winners and losers and, you know, we've had folks threaten to, you know, sue us all the way to the Supreme Court if we try to do something like this. But I think that kind of just goes with the territory.

In terms of, you know, alternative means to try and get additional pipeline financed, there

may be, I mean, we have one state that has some authority to order its distribution utilities. But they're less than 10 percent of the load. And, you know, like I mentioned, there's some really sticky cross-subsidization issues. And if you use the regional tariff and, you know, afford some flexibility for, you know, what you expect the beneficiaries to be or what classes of beneficiaries you expect to have and you adjust your cost allocation accordingly but use the regional tariff to be the mechanism to do that. With or without state authority to move forward, it's just the best means to try and allocate those costs in an equitable manner. So, you know, that's a big reason why we've been focused on the federal tariff. And, you know, as far as the legal issues go, you know, I think that should we move forward with that kind of solution, you know, those issues will have their light of day.

MR. ROBERTI: James, do you want to comment on that?

MR. DALY: If I could just comment on

that. I mean, I agree with Ben, if you could do it through a FERC tariff that would be the cleanest way to do it because you could allocate it to all load and who are the beneficiaries of it. But it is precedent setting to allocate gas pipeline capacity to electric load through a FERC tariff. The alternative would be to do it state by state so that the states themselves would say, okay, electric distribution company, you have this contract for gas capacity, we think it benefits electric customers and, yeah, there are some free riders, but they're always are when you add infrastructure into a region. So we say the states could allocate through their local distribution, local transmission rates and have that collected in retail rates. They could do it. And I guess the question is that if we decide to go down the FERC route and that runs into a lot of legal problems and we still have these pretty serious supply situations continuing in New England. Will the states say we'll take it on and do it? And, you know, FERC would quite rightly

ask the states why don't you solve this problem if you have a way to do it besides bringing it down here so we have a big fight about it. So, you know, I think those questions will be asked and people will have to make a decision at some point. So I think they'll probably all get tested out in the end.

MR. ROBERTI: It may follow precisely what may have to happen with demand response after the D.C. Circuit decision if that's not overturned. So the destiny may lay in the states hands. But let me open it up to other questions. Granger, go ahead.

MR. MORGAN: So when I first heard about this issue a couple of years ago at an EPSA meeting and I guess my reaction at that time was that there wasn't any fundamental issue here that it was just a big argument over who pays to solve the problem. And unless I've misheard, I've heard the same thing this morning. I do have a question and that is I can store fuel for coal plants and oil plants onsite. How carefully has anybody

looked at the prospect of storing gas onsite and reimbursing through capacity markets for firm gas because it's sitting right next to my facilities?

MR. DALY: That's an excellent question. I mean, that's certainly part of the solution here that needs to be looked at. So I think for power generation, we don't need gas transportation, you know, 365 days a year for power generation. This problem exists. There's adequate gas supply most of the year. It gets confusing because people say, hey, we have a lot of cheap gas in New England, and then you say we have a gas shortage. It only occurs on certain days in cold weather and those days can be supplemented by LNG and its economic LNG if it's liquefied off North American pipes versus the international market, which is much more expensive. So there is a solution space there that has some LNG, some pipeline expansion, and, you know, the studies to determine it are it's really, really how does a market price each of those and what combination of them are you going to need? That's definitely the solution

space.

MR. ETHIER: I'll agree with James that I think that's part of the solution. If you look at it on a plant- specific basis, it's probably prohibitively expensive to put in storage for a specific facility that's dedicated to just meeting gas demand a dozen days a year. But certainly there is existing storage in New England that could be better utilized or in the Maritimes in Canada that could be better utilized. And one of the things that we expect out of the market reforms is we're going to see a lot more contracting there. And in a lot of ways we imagine that would be a lot more efficient because then you're combining the need to mini power generators in one facility so you have sort of economies of scale and you have the ability to sort of balance different withdrawal rates with a bigger facility versus if you have just one dedicated facility to one generator. So we certainly see that happening. Some of it will be contractual, some of it will be new

infrastructure. But I think most of it honestly is probably contractual with existing infrastructure.

MR. MORGAN: Are there any contractual arrangements where if I've got a large combined cycle facility and I decide I want to put in some storage, I can get reimbursed through capacity markets for doing that or is that simply not in the cards at the moment?

MR. ETHIER: Well, certainly our capacity market allows you to offer in, you know, the whole point is so you reflect your cost of providing capacity. So you have the ability to say to provide capacity in a reliable manner, I need to make these investments. And we actually even have provisions whereby if your investment is large enough, you can lock in your capacity payment for up to seven years, which was specifically designed to encourage investment in infrastructure like that.

MR. ROBERTI: Richard?

CHAIRMAN COWART: I think my question is

similar. It seems to me that in hearing about the capacity market reforms, pay-for-performance is a big improvement. And it used to be the case that, you know, we struggled with the question of how could we give capacity payments to a gas generator who didn't have firm gas? And so how it possible to give capacity payments to a gas generator that doesn't have firm transportation?

MR. OTT: Again, I think you have power generators who bump behind Citygate's, meaning in the LDC, the distribution gas. You have them along interstate pipelines. Some of them in our case are sourced right at the wellhead right into our cells right off. So they have extremely firm supply, but they don't have firm transport because they don't need it. So the point is I think what you need to articulate is a general definition of product because there's so many flavors including again even in some cases for us we have generators with onsite storage because of where they're located. They happen to be located right next to a place that can create LNG. So I think the

flavor is out there, the key is you need to have firm gas delivered to the site and whether it's firm transport, firm commodity, storage, whatever it is, I think there's a better generic definition and the market will deliver at least cost.

MR. ETHIER: And, you know, just to sort of, I agree with what Andy just said. You know, the trick if you will when we were designing our capacity market reforms is we had the realization that going down the path of defining what was doing enough to be available is a loser's game. Trying to define when a resource had done enough to be available, we were never going to be successful in doing that because there'd always be something we hadn't thought of. Instead, what we sort of flipped it around and said what we want to pay for is delivery of energy. We don't care how you do it just the electrons on the wires and that's the cleanest way from our perspective and it accommodates all those complications that Andy just talked about. We're never going to be able to assess an individual gas generator's situation

better than they can assess it. They make the decision how to be reliable. We just make sure they get paid if they're reliable and don't get paid if they're not.

MR. MORGAN: Rob, it sounds to me like the flip side is big penalty if I can't deliver.

MR. DALY: Well, the economics of delivery of contracting for that capacity is that, you know, the challenge is the same for generators since we deregulated the market is that they don't have a good way to recover those costs. So if they enter into contracts and incur significant costs all year round for their gas capacity, it's now in the market, everybody else can avail of it as well. So they don't have a way except in really extreme cold weather conditions to extract the full value of what it is. And the rest of the year they're losing money on it because the market is surplus anyway. So there's a very difficult incentive for them to enter into those contracts and try to recover those costs. So that's a structural problem with the marketplace and how

those generators are trying to solve their fuel adequacy problem.

MR. D'ANTONIO: I'll just add that FERC recently clarified the tariff obligation associated with being available such that you're not allowed to take an economic outage, which I think has the inference that you're supposed to have some firmness to your fuel supply. So hopefully we'll get some help there. But I think that, you know, Bob's point earlier, that we're likely to get more dual fuel makes sense. It makes economic sense from the generators' perspective from the market participants' perspective. But what's most cost-effective for society I think there's a split incentive problem and I think that cost-effectiveness of different solutions is a function of how much time or what the extent and duration of your congestion is. And, you know, if you've got a peaking problem, you have a peaking solution is most cost-effective. The more you have a longer term and longer duration problem or congestion, you

move into the base load situation being more cost-effective. And I think that that's where we are. I think that that point of inflection's right around 30 days. And we've had several studies come out and say that this problem is greater than 30 days now. And so if pipeline under that kind of rubric is the most cost-effective from a societal perspective, but the generators are only interested in their own bottom line and their own obligation and their most cost-effective way to achieve their obligation is to, you know, do dual fuel. Is that structure providing what's least cost for society is just an open question I think.

MR. ROBERTI: Okay, Sonny?

MR. POPOWSKY: Thanks and thanks to all the presenters for just a terrific panel. I just wanted to pick up on something that James said sort of casually. At one point you said, well, you know, we have this potential solution, but it's really not in the interest of the generators' nuclear goal because they're relying or they want

with the single market clearing price, they want higher prices. You said that casually, but from a consumer perspective, that's sort of the big question. If we're looking for market solutions, can we rely on the sort of the market process, the market participants to produce those solutions? And I guess for Ben, are you saying that the governors of New England have concluded, no, we can't. We need to put our thumb on the scale and say, no, we're going to come in with an out of market solution because we're just not going to wait any longer for this problem to be solved.

MR. DALY: Well, just to reiterate. It's not a casual observation. It is pretty factual. I mean, if you own a nongas-fired generator and it's fueled by nuclear or hydro, you're going to lose money if more gas comes into the region than the clearing prices. And gas prices, which in New England is the clearing price, fire is the clearing price 90 percent of the time. So you have 90 percent of the clearing prices driven by gas and if gas prices drop so

does your LNP prices. It's a very factual observation but it's worth it to keep in mind when you hear the objections of people who say, hey, don't add natural gas transportation. You're favoring one fuel versus another. I don't get a subsidy for my coal transportation. I don't get a subsidy for my nuclear fuel. Why would you subsidize them? Just understand that those arguments are pretty valid, but if you look who's making the argument, it's somebody who's going to be on the wrong end of the incentive for adding that.

So we have it on our transmission lines that would import hydropower from Canada. The same people come and say, you know, this is an out of market solution we shouldn't have this. Really they're protecting their own investments and it's understandable, but just to understand where those arguments are coming from.

So, I mean, the last part of your question then, you know, I think before any solution would arrive here, we're 20 years into

deregulated markets in New England. Twenty years is a long time and there has been no real capacity added into the gas transportation capacity added into that market in 20 years. So I think the New England governors are at the point is that, hey, if we're 20 years in and the solution hasn't arrived, are we going to wait another 20 years or are we going to try and do something? And I think what you're seeing is their response to try and solve the problem. And, you know, in this process, we've been interested in since we put up a solution that the electric distribution company says we can do this, well, what do people think of it and Ben's organization solicited comments on it. And, you know, nobody came along with a better one. So we said, hey, it would be interesting to see if the generators come up with a solution and, of course, among them it's very difficult because they would be providing low gas to lower their LNP price to disadvantage their other assets. They're not all gas-fired. They're not all nuclear fired. They have combinations of

assets. So it's a difficult calculus for them to actually bring forward solutions. It just isn't in their interest largely. And, you know, if ISO New England can get a sufficient incentive for them to have fuel that's an interesting proposition. But I think as Bob says, it may not be sufficient. It probably in our view it isn't sufficient for them to actually enter into a 20-year contract. It would be easier for them to increase their bid into the capacity market to cover any penalties that they might get. So they'll drive up the capacity payments and say to hell with it and we'll pay the penalties into New England rather than enter into a 20-year contract for gas transportation. That's the calculus that's going to occur in that capacity market and pay-for-performance.

MR. OTT: But don't forget, what you need in power is, you know, a limited number of hours where you have a utilization of that power plant during times of cold weather. So building gas pipeline structures 8760 is not the least cost

solution. The least cost solution is building a fuel tank and so the point is the market's not going to deliver an interstate pipeline because that's not the cheapest thing to do. If somebody decides they want to do that for another reason, it's similar to other types of policy decisions you'll get it to happen. But there's no way a market's going to deliver an interstate pipe because you don't need 8760. I mean, it's just as simple as that. I don't call that market power. I call that essentially effectively a product that you're looking for is peak power not base power.

MR. D'ANTONIO: I just wanted to respond to your question by saying not explicitly. They've not explicitly said it's time to put our thumb on the scale. What the six New England governors did was they committed to cooperation on regional issues and there were two elements to that strategy. So you can't forget that dynamic there. But I think it's a fair observation to say that the governors have reached a point where they feel like something needs to happen and they're,

you know, willing to work with the stakeholders in the region and the federal agencies on what that solution space might look like.

You know, otherwise, you know, the states have tried to solicit comments on ways that they could effectuate their objectives with the least amount of impact on the market paradigm. I mean, we're in this for the long haul with the market and, you know, we're in the process of trying to reconvene our cross-industry stakeholder group to discuss, you know, continuing to discuss other ways that we can enhance the markets to try and achieve the kind of solutions that our public policy objectives have. So I think it's a fair observation to say that the governors have said it's time to do something. But I don't know if they've explicitly said what you've characterized.

MR. ROBERTI: I see one more question. Do we have time for one more?

CHAIRMAN COWART: Maybe one more question then we need to wrap it up.

MR. ROBERTI: Okay, Tim.

MR. MOUNT: Thank you. I wanted to raise a different subject but first all I'd like to say I'm very encouraged by the movement towards pay-for-performance makes a lot of sense to me. A number of slides mentioned the importance of moving to a low carbon economy, but nobody really talked about using gas efficiently. The presentations treat space heating and electricity generation as essentially competed uses of gas, which of course they are. But clearly combined heat and power is a lot more efficient way of using gas. Combined heat and power is really much more important in Europe than it is here. A lot of the gas coming from biogas sources. Cornell has just put in 30 megawatts of turbines. We had unfortunately a steam heating system for the university. But it is a sort step in the right direction and it also addresses an issue that's very important is that you're also talking about building stuff for these unusually cold days and how to we get our money back, you know, but, hey, look if I've got combined heat and power, I can

put in storage as well for heat or hot water storage. I can now provide flexibility. I've got a smart grid. I'm going to sit there with my lights on where all the rest of you are in the dark. Hey, no, I'm going to have something that sort of, you know, generates value for a whole year. And I think these are things that we should, you know, take much more seriously particularly with these governors making these big decisions.

MR. ETHIER: Well, there's no doubt that CHP would probably line up better with our low profile than solar for example. Somebody pointed out that the solar was coming off just as our winter peak's coming on. CHP would line up much better with that. You know, I can't really speak to why the states are choosing to subsidize what they're choosing to subsidize, but, you know, I take your point.

MR. OTT: I absolutely agree and the resiliency issue of as you say the type of infrastructure you're talking about there has a

lot more benefit. And again, the State of Ohio is headed there as their subsidies. Instead of subsidizing renewables, they're headed for CHP. And I think you are seeing that around the footprint. But we have a high availability of gas in our geography.

MR. DALY: And there are very significant incentives for onsite generation in New England. It's been a high price market for a long, long time. So a lot of the combined heat and power opportunities have been tapped into, but as prices rise more and more become economic. So people are chasing that market and the incentives are very, very significant. So, you know, I expect to see more of that.

MR. D'ANTONIO: I'll just agree with everybody else, but also point out that, you know, your point is well- taken. But our region is heavily dependent for space heating on fuel oil and a lot of the policy priorities are trying to transition folks off of fuel oil onto natural gas or renewable thermal. And that can exacerbate

some of the issues that we're facing.

MR. ROBERTI: All right, well, would you please join me in thanking the panel for excellent presentations.

CHAIRMAN COWART: Thanks very much everybody. I have a request for members of the committee because we have some votes ahead of us on the agenda after the break, but I want to make sure that we'll still have a quorum present at the time we need to take those votes. Right now we have a quorum. Is there anyone who is planning to leave early? All right, I'm looking at you all intently. I look forward to seeing you right after the break. We've got a short break here actually according to the agenda if you want to stay even remotely on time, 10 minutes at the most.

(Recess)

CHAIRMAN COWART: Merwin, I believe you're up.

MR. BROWN: Thank you. This is a report of the Energy Storage Subcommittee. I'm Merwin

Brown, the new chairman. So far I'm still calling myself new, although I've had a trial by fire in the last three months or so. And I'll tell you in the next slide here what I plan on covering, if I push the right button.

Yes, the topics I'd like to cover this morning are these: One, a discussion of the Storage Testing and Safety paper. A discussion -- I'm not sure we'll need a discussion on this, but I left it open. If you want to discuss it you can, but I think you'll see in a moment, we got bigger fish to fry here. Then the status of the Biannual Storage Program Assessment. This is a discussion about what will be requested of this group, and that's why a quorum was needed to remain in the room, why we do this.

Then I'll talk about the Energy Storage Subcommittee plans for 2015. So those are the main discussion points that I'd like to do today. The discussion of the distributed Storage Testing Safety paper, some background on this. Ralph, who was the prior chairman of this subcommittee had

been drafting a letter for a distributed Storage Testing and Safety Initiative. He left the committee before it got done. He said he was going to work on it, and I have talked to him. And he still is working on it. But it dawned on us in the subcommittee, at least some of us who talked about this, that considering that we're also working jointly with the Smart Grid Subcommittee on the -- and I've used an old title here that it will probably change, but I call it the National Strategy for Distributed Energy Storage in the Electric Grid, which is following the pattern of an earlier report the subcommittee put out on utility scale storage.

But nonetheless, it's a white paper that's being led by Carlos Coe, and the idea was, was that rather than keep pressure on Ralph who's no longer part of this group to produce something, that we instead integrate this discussion into this white paper, because it fits. And it just seemed to be a natural. If Ralph still produces something, then fine, we can integrate it into the

report. If he doesn't, then we'll write the material.

Also I'm going to say that the urgency of this issue I think has somewhat quieted since it first got brought up into the subcommittee. And the DOE has done a lot of activity in this area now, particularly at the national labs. And so it's kind of reduced somewhat on the, as I said, urgency and the concern about it being addressed, because I would say it is being addressed quite a bit at this stage.

So this is what we're proposing to do, and I'm not suggesting we need to take a formal vote on this. It's just if you have any objections, let me know. But this is going forward what I think we should do. This is the one that's going to require time here, the status of the Biannual Storage Program Assessment. This program review -- whoops, what's happening? How did I -- there, let's see if it sticks.

This 2014 Biannual Storage Program Review Report fulfills Title Six, Section such and

such. The bottom line, this is required by legislation for this committee, the EAC, and the subcommittee has been given that assignment on the behalf of the EAC to do this Biannual Energy Storage Assessment. And so that was one of the motivations for doing this, and this is just more of the legal languages it involved.

But in this particular case, we're focused on the two year review. There's another one that's a five year process. Sorry, I don't know what's going on. There's a five year process, which we -- the subcommittee did a report on that roughly -- not quite a year ago. And so this is why we're bringing this to you, and this is why we will need a vote on this. And it is due sometime this year, and this particular committee, the EAC, is -- this meeting is really our only opportunity to meet as a full committee and vote for it before the end of the year.

I might add, by moving up the time to September, it even took up some of our time available to work on this. So it did cramp our

style a bit. And so as you can see on that one bullet there, we're asking for, at this meeting, to get an approval of this report or amendments, one or the other.

At a prior meeting, and this is a little out of date on this particular slide, because we did take it to an EAC leadership meeting. But we also, at the last June meeting of the full EAC, we discussed the nature of the report that we wanted to produce. And one of them of course is, it's assessing the DOE Storage Program and the committee's recommendations based on that assessment. And that one thing we were breaking, so to speak, tradition in this report, was to not go into a lot of detail about energy storage technology status per se. Prior reports tend to have the litany of the various storage technologies and what their status was. And we felt that that's been done a lot and too it's referenced elsewhere.

And so in order to keep the report more focused and shorter, that we didn't go into that.

And whether you remember or not, you didn't object to that. So that you will see in the nature of this report.

Continuing on the status, the assessment was conducted and reported by a working group, a subcommittee with assistance from external experts. And I guess maybe very quickly I'd like to thank the subcommittee for all their help on this, and there were a few exemplary ones who wrote a lot of it, Anjan Bose, Carlos Coe, Clark Gellings, Paul Roberti, Chris Shelton, Gordon van Welie, Ramtin Shoshani, I can never say his last name, Tom Sloan, Carl Zichella. And then Ryan Franks helped with contributing some material from NEMA, the National Electric Manufacturer's Association. And I also got some help from ESA, the Energy Storage Association, as some of the external experts.

And then I also want to thank ICF staff members, Samir and Maureen. They were also a really big help in helping us keep organized and get this all put together and hold meetings on it,

because we did have a marathon. We worked very fast and very hard on this, and we were writing up to the last moment before this had to go out. And therefore I'm going to also make an apology and an excuse at the same time at this moment, to say, this report has really not had the full vetting as far as craftsmanship and wording that I would have liked. I think it has some rough spots in it. But by the same token, I think it's a diamond in the rough. That I think the recommendations are there, and I believe they're supported by the text in this document.

So I feel comfortable in going ahead and bringing it to a vote in the sense from a practical point of view, it's a quite adequate report, even though it wouldn't have the polish it would have if we'd had another month or two to write on it.

The preliminary draft report was completed and submitted on September 3rd and sent to the Energy Storage Subcommittee and the Smart Grid Subcommittee for comments. Then it was

circulated to this committee on the 10th of September. The next step is to present it here at this meeting and have a vote for acceptance, so the actual annual report -- or biannual report.

First of all, it was based largely on DOE's December 13th report, the Grid Energy Storage. That was a very timely and helpful report, and it also had some new features to it that changed the nature of our assessment based on prior assessments. One, this particular DOE report had a broadened agency department and scope. Of course continue to have the Office of Electricity and Delivery -- Electricity Delivery and Energy reliability, OE, which has always been the mainstay of the Energy Storage Program for us to review. But this time it added DOE Offices of Science, Energy Efficiency Renewable Energy, EERE, and Advanced Research Projects/Energy, ARPA-E. And it also added some other federal agencies, such as Department of Defence.

First of all, we want to say that we applaud this broader look at the DOE perspective

on what's going on and what is planned to go on in energy storage within DOE. As a result, we tried to expand our assessment accordingly.

The DOE overall energy storage, this report, the DOE report, provided us with information on the overall energy storage strategy and department level strategies for the Department of Energy on energy storage. But also we based -- the assessment was based on individual and institutional observations and the experience of the working group in addition to that. I might add though, getting all of that, I'm pretty sure we didn't have all the resources we needed to capture and know everything that DOE has done or plans to do. And so we may have some gaps or we may make, for example, some recommendations that we didn't realize DOE is already doing. I'll talk more about that later if it comes up as a subject.

The overall findings of our assessment are this: One, the Federal Energy Storage Program Strategies and Activities are comprehensive and largely responsible to the needs of the US

industry and public agencies. However, since the prior EAC's assessment and even since the period in which DOE was formulating their DOE 2013 report, which this assessment was largely based, there has been, in the US energy industry and policy expectations and strategies for the development deployment of energy storage devices and systems have changed. In other words, it's been a very rapidly changing landscape, which we took into consideration in this assessment.

And the recent emergence of market transformations, public policy developments, technology trends related to US energy storage industry and the global market trends more generally, have began to shift the energy storage landscape.

So the EAC offers recommendations where programs and initiatives could be amended, refocused, augmented or scaled back in order to better meet the objective of the department and the strategic goals that are listed in the 2013 DOE report, in the context of there have been

changes that have taken place fairly recently that would warrant some of these changes.

But it's really more a matter of degree. DOE has pretty much covered the waterfront, but because of these changes in the landscape, we're going to be making recommendations more along the lines of degrees of focus and resources and attention and those kinds of things. So that's sort of a general summary of what we've found and recommend.

Now we have 11 recommendations and I guess maybe the process is to go through each one of these, maybe discuss each one. What would you recommend Rich?

CHAIRMAN COWART: I think you should put each one up and see whether there is discussion, because there may not be.

MR. BROWN: Good point. Okay, one of -- oh, and I tried to put these roughly in the order of sort of going from, here are some assessments and recommendations that sort of approached the program structure at DOE. And then as we go

through this, it will turn more and more the focus and attention more and more to programmatic kinds of things. In other words, what are the contents of the activities that DOE is working on energy storage? So it's not totally smooth that way. It just wasn't laid out exactly that way.

So our first assessment I want to talk about is the DOE goals are tied to grid related applications. But the Office of Science and the National Science Foundation focused on basic science and component technologies, which is not too surprising given their missions. But we would recommend that where it's possible, that there be more grid focused research support is needed in these venues if you want to reach the goals in the context of grid related applications.

So again, this is a matter of degree. I'm not asking to change the stripes of OS or NSF, but to have it more transparent and concentrated or obvious focus on the grid focused application of energy storage research.

MR. MORGAN: I'm not going to propose a

change, but I just want it understood in the room that this is not an argument there should be less fundamental research. Just an argument that DOE should -- I mean, if I'm understanding correctly, just an argument that DOE should retain or perhaps strengthen a grid related focus.

MR. BROWN: Yes, yes. And if it's, so to speak, already sort of hidden in there, then at least make it transparent and obvious how it relates to grid related. Okay, I'm going to go on. The second one, the assessment was -- DOE focused on reliability and safety issues rather heavily and their objectives and goals. Recommendation is to consider a broadened focus to include some additional issues that energy storage might address, such as increasing grid asset utilization and operations, economic optimization. The main reason for this is that it would open up additional opportunities for capturing the multiple benefits of energy storage devices, which is one of the sort of general strategies that's being used to get energy storage accepted into the

marketplace and to start being deployed. So that's really what that was meant for.

I see no tents going up. We'll go on. I don't know whether it's just the projector's delaying or I'm not pressing hard enough. Okay, number three, assessment. This one's actually already been addressed in this meeting now quite a bit, but I'll state it again since it's in our report. The ARRA demonstrations are important to DOE's strategy. But it's not clear there is capacity to continue at ARR levels. In other words, there was a lot of money, a bubble came through. And so now going forward, what's going to happen in this area of demonstrations?

The recommendations are -- there's actually two parts to this recommendation related to ARR. One, similar demonstration levels continued with funding from coordinated public. Federal and state and private resources might help DOE to be able to continue at a level higher than their ongoing resources might allow. So the recommendation is to encourage developing those

relationships. I say that in the context, knowing you've already tried to do some of those and are attempting to do it. But we want to go on the record that we think this is an important thing to do because it would help raise -- leverage the resources that you have to get these demonstrations going. And I know, for example, coming from California, there's going to be I think a lot of opportunity to do that just because of the deployment programs in California for energy storage.

A lot of money is going to be spent there on getting things on the ground. Secondly, it relates to the national labs. National laboratories are heavily involved in storage research. So perhaps encouraging more public/private partnerships to help leverage research synergies. Again, I know it's already ongoing. But perhaps a look at how would you elevate the sort of -- the marketing, the visibility of this process to encourage more of that to go on, might help, again, get the

resources needed to keep these kinds of high level of demonstrations, field testing, etcetera, activities going forward.

Yes, Chris?

MR. SHELTON: Yes, Merwin on 3.1, based on the conversation we had yesterday around -- when the ARRA projects were presented, I raised here and I heard from folks at dinner last night, that they agreed and we can -- if anyone disagrees, please say so now. But the report outs from those projects were going to do cost/benefit analysis. So I think we have an opportunity here under 3.1 to formalize and I would recommend that we formalize the concept that the demonstrations should do cost -- or should do benefit/cost analysis versus sort of market cost and not just on the cost of the demonstration project. Because a lot of times demonstration projects have overhead in them that you wouldn't have in a real project. So something to highlight, because one of the things we've seen is, DOE's numbers being used in public proceedings by the utilities to

argue that storage is not economic. But those aren't real market numbers. These are demonstration projects. They have a completely different profile.

MR. MORGAN: If I could just offer an amendment to that, which is, these out to be parametric analyses. That is one should not simply do a benefit/cost analysis for the particular realized cost in a particular realized market. One should do some sensitivity analysis to see the space in which the technology might or might not make sense.

MR. SHELTON: Right, and I would add also that a lot of times their scale is not consistent with the scale of, like, a power plant, for instance. So if you're comparing them to power plants, and they're small, if they're, like, 3 megawatts and a power plant's 100 megawatts, there are other cost loading issues on small projects that need to be recognized.

MR. BROWN: Okay, two things strike me about your recommendation or your comment at this

point. One of them is, you said that you thought in yesterday's presentation, you were comfortable that that was going to be the case. That DOE would look at the cost benefit parametric. Is that what you said?

MR. SHELTON: There was a recognition that that would be valuable. But this seems like there's an opportunity for us to formalize that recommendation. That's all.

MR. BROWN: Okay, then the other thing is, it sounds to me maybe it's a third one to add to this because it doesn't exactly fit with these others. I guess based on -- let me offer a suggestion and see if anyone else on the committee has a reaction, positive or negative. Would you mind drafting a sentence to that end to put in here, that we can get to our editor in the back? And I assume it would be along the lines of, we recommend that DOE conduct a cost benefit analysis on a parametric basis on the ARRA demonstration project results or something. Something along those lines? Okay, so if the rest of the

committee would agree that that language in general is the way to go, we trust these gentlemen -- or maybe I guess it could be -- did you happen to capture it?

MR. SHELTON: You said (inaudible).

MR. BROWN: Okay, so that would be an amendment, and it would be a third sub-recommendation under this particular assessment. Okay, I'm going to --

CHAIRMAN COWART: I see no objection, so we'll continue on that basis.

MR. BROWN: Okay, I'm going to go on then. Assessment number four, offices in DOE seem to collaborate and understand each other's projects. But it's not clear how research results are transferred among them. Recommendation is, augment and strengthen interagency coordination around energy storage research results transfer and make it more transparent, that we can tell that it's happening. So that's pretty much it in a nutshell. In some ways you did kind of touch on a new approach to a collaboration effort through

your modern grid program. It didn't directly address the subject of tech transfer among these agencies. But I could see it in there.

MR. MORGAN: Do you mean inter or intra?

MR. BROWN: Intra, what did I say?

MR. MORGAN: It says inter up there, but it probably ought to be intra.

MR. BROWN: Oh, yeah, I get mixed up. Yeah, well, it could be inter because some of the agencies are actually --

MR. MORGAN: But the assessment above is DOE specific.

MR. BROWN: Yeah, I --

MR. MORGAN: It can say inter and intra.

MR. BROWN: Yes, yeah.

MS. HOFFMAN: It might be interesting at some point in time for the EAC, there is a tech transfer effort within the Department of Energy. And it would be -- it might be nice at some point in time to do a specific briefing on that topic so the EAC is aware of the activities that are going across the department. We actually have a tech

transfer coordinator that's really pulling out, and we used our energy storage program as the example for the tech transfer group at the department.

MR. BROWN: Okay, are you, by saying that, suggesting that we don't need this recommendation? It shouldn't be in here? Or just leave it? Okay. I'm going to suggest in the interest of -- that one, we leave it in and two, I'm going to suggest that we -- unless you have a real heartburn with it, let's leave it as interagency at the moment, because it's actually both. So if you don't mind, I'm going to leave it alone and consider that a minor weakness in the report.

Let's -- okay, I'm going to go on then. Assessment five, while some of DOE's research is applicable generally to both utility and distributed scale energy storage, particularly that it's a highly technical component level, such as on lithium ion batteries or something. Research focus on applications has emphasized the

utility scale quite a bit. And so the recommendation is, because distributed energy storage applications have recently increased, and by the way, that is a focus and a driver for this white paper that we're working on between the two subcommittees I mentioned earlier. And exhibits some unique grid interactions to distributed in contrast to a central station or a utility scale, an increased research focus on energy storage interconnection at the electric distribution level is needed going forward.

Any reactions to that? Not seeing any tent going flying up, so I'll go on.

SPEAKER: Yeah, it's a good observation and keep going.

MR. BROWN: Okay, assessment six, that many recent energy storage demonstrations at utility and distributed scale, have revealed inadequacies in the availability of tools, especially those based on non-deterministic models that can, for example, count for the effects of market, resource and system uncertainties. That

was an observation that our committee made, or the working group made. Well, then the committee agreed with it, subcommittee.

Recommendations, the development of such tools could lead to improved energy storage operation, resource assessment, decision making. Furthermore, given the evolution and generation mixes, especially for high penetrations of central and distributed variable renewable generation, the strategy for storage deployment development must be broad enough to cover any possible generation mix of the future. Yes, that had kind of two recommendations in it. Bottom line though is, is that it's calling for tools that tend to take in a probabilistic approach to fit the modern world of complexity and uncertainty, to help with energy storage, operation, resource assessment decision making, etcetera.

And because of the growth of variable renewable generation, solar and wind, it becomes pretty important to make sure that those tools can handle that kind of complexity and uncertainty.

I'm seeing no tents go up. I'm going to go on. And if I go too fast, you can always make me go back.

Assessment seven, recent energy storage demonstrations have also revealed a lack of validated reliability and safety codes and standards. DOE's impartial views on energy storage industry and of proposals submitted to code bodies. And a role as a neutral arbitrar to make clear the rationale behind specific proposals are a very high value in this process. So the recommendation is one of continue doing it. In other words, DOE should continue to convene planning activities and provide technical support to standard codes and bodies. And I think one prior example, that one that gets a lot of references and is the one held at Sandia National Labs a few months ago. I see no tents going up.

Assessment eight, pumped hydro and compressed air energy storage are routinely projected to have high levels of deployment in studies of high renewable penetration scenarios.

For example, a number of NREL studies on the penetration of renewables in the United States or in certain regions of the United States, have assumed the availability of such storage devices.

A recommendation is, given that that is behind a lot of these studies, that new -- we need some new work done on these two energy resources, storage resources, technology assessments, to be conducted to reflect changes in the resource and technology characterizations, to improve the assumptions used in capacity expansion models for scenario analysis. In other words, let's take some of the assumptions out of these studies and put a little more realism and reality to them as to what really these two resources can do.

I think some of this has been spawned or spurred or encouraged by some of the experiences that happened in the Northwest, with trying to use hydro facilities to mitigate wind and things like this. So anyway, that's the recommendation. I'm not seeing tents go up.

Number nine, assessment. The knowledge

DOE provides regarding energy storage technology costs and systems is a viable resource. Therefore recommendations, DOE should continue and expand the development of resources like the 2013 EPRI DOE Storage Handbook and the DOE Energy Storage Database. Note, due to a lack of information, a time series of power electronic costs and learning rates would be of value. In other words, this is a specific recommendation of, if DOE has or can get this information, it could be very helpful for energy storage deployment, particularly distributed, but in general, to know more about the history of power electronics and how it's progressed and things like that.

MR. MORGAN: Yeah, I want to simply reinforce that one. I mean, I cannot find such an account, and I really think a lot of people could find it very useful.

MR. BROWN: Okay, since that's a comment not to do anything to it, the tenth one, assessment. Today's restructured electric system, reliant on a mix of competitive and traditional

costs of service regulation market designs, can create inefficiencies for storage assets that can provide multiple services that straddle the two market classifications. A recommendation, this will sound familiar after yesterday. Conduct comprehensive studies of competitive and regulated market designs and their effects on storage, to assess technology developers, device and system vendors, utilities and market managers and regulators.

I think this is in line pretty much with some of the things you heard yesterday on things doing with market, both regulated and competitive markets. So I'm not seeing the -- oh, you have a tent up. I'm sorry Mary.

MS. RALLS: Mary Ann Ralls for NARCA. I'm pinch hitting for Pam Silverstein. Merwin, I don't have any comments to the recommendation on the screen. I do have some concerns with some of the language in the report that sort of elaborates on the recommendation. I also have just some proposals to just two sentences, to tweak that or

to offer that up. I don't know if this is the appropriate time or you want me to wait.

CHAIRMAN COWART: It's the appropriate time.

MR. BROWN: I think -- well, the only hesitation I have is, do we need to look at a projected version of the report to see the sentences? If that's the case, we might want to wait till we're done with this and then go back.

CHAIRMAN COWART: Before we vote, we should be able to see those recommended changes.

MR. BROWN: I agree. By the way, I met with Mary prior to coming up here, and I agree with her recommended changes. And they're I think relatively minor. But it is a tone that is a bit inadequate. Okay, so let's see, on this one, please remind me if I forget to go back. I've only got one more here to do anyway, so -- and that is number 11. The integration a grid connected renewables generation at both a transmission and distribution level is a major value proposition for energy storage. The

recommendation is, DOE conduct comprehensive studies of the implications of different competitive market and regulatory mechanisms on efficiency, signalling the value of these generation services so that the full value of energy storage can be considered.

This is similar again to the prior one and is similar to some of the things that I think we heard yesterday. It's basically to investigate what we can learn from field studies, demonstrations, etcetera, that could help shed some light on -- particularly for regulators, market designers, etcetera, and as well as business case studies. Yes, Rich?

CHAIRMAN COWART: Merwin, is it understood in reading these words that the full value of energy storage, the phrase "energy storage" here, includes thermal storage?

MR. BROWN: Let's see, if I remember right, we -- did we -- help me, we talked about it. We ended up not including thermal storage in this report I believe. Isn't that right? Help

me.

CHAIRMAN COWART: Yes, it's right.

MR. BROWN: Yes. So no, it does not include thermal storage. It wasn't really explicitly left out, but we just felt it wasn't within our scope to handle that.

MR. MORGAN: But Rich, it could easily be fixed if you wanted it to say energy storage of all kinds.

CHAIRMAN COWART: Yeah, but we got to add a lot more detail to the report itself than that. We've addressed this before when we did the five year report, and we felt it would be unduly complicating the effort here and didn't really have a good idea what overall DOE's work was in the area. So it's pretty hard to characterize a recommendation. Now if we want to do that, I would strongly recommend we not mess this thing up. That we perhaps adopt for ourselves a separate task. It's not in what Congress has told us to do.

MR. BROWN: Anyone else have any comment

on this? Yes?

MS. HOFFMAN: My only comment is that I agree with Clark. In some ways we can capture that in a separate report and then do a deep dive and a focus on that.

MR. SHELTON: Is this exclusionary language? I mean, I'm not understanding, is there a particular concern? Because this would -- wouldn't this language encompass thermal storage?

CHAIRMAN COWART: Well, that's why I asked the question because the full value of energy storage as a phrase could include thermal as well as electric power storage and/or storage of energy to produce electricity. But I recognize that the charge of the subcommittee was the latter, not the former. And I recognize that the report focuses on the more narrow definition of storage. That's something I understand. I just think that the reader of the report should somehow be alerted to the fact that we have narrowly targeted this assessment to a subset of all storage resources.

So if that's stated clearly, then that's fine. Because I've just been in so many meetings where people talk about storage and then they forget the huge sort of resource base of thermal storage that we know is going to be needed to accomplish the goals that we've all been talking about.

MR. BROWN: That's right. And one -- I'll have to re-read it because I think it was in there, where we did say we didn't cover thermal storage. But that may be because I'm thinking about the earlier report that we did, because I know we said it in it.

So what I propose that we -- how we handle this, and I'll get -- do you have a comment on this particular subject? Oh, Carl?

MR. ZICHELLA: Yeah, there's of course different flavors of thermal storage too at generation and on a distributed grid as well. But it seems like -- I take the point that maybe we should do additional work on this. But I guess my question is, should we have a recommendation that

we do that? We could simply add a recommendation that we look into this further and integrate it more into the overall picture of energy storage.

MR. BROWN: Let me suggest one of the -- who are you recommending do this?

MR. ZICHELLA: I guess it would be the EAC.

MR. BROWN: That's why I asked the question because this is a report to DOE that's making recommendations to them. If it's a recommendation to EAC, I think you just made it on the public record here. I don't think it goes into this --

MR. ZICHELLA: Well, let the record reflect that Pat was nodding and giving me the thumbs up. (laughter) Thank you Merwin.

MR. BROWN: Is that right Rich? I don't think it belongs in this report.

CHAIRMAN COWART: I think this is fine. I just wanted to flag this topic for the full committee because we know this is important. We've said this from the beginning, and this

report serves a different purpose. It's fine.

MS. HOFFMAN: And this is Pat and Pat had stated earlier with Clark that we should do it. Would recommend that we do a separate report focusing on thermal storage. That would be valuable to the industry (inaudible).

MR. BROWN: Tim was next and then you Chris. Tim?

MR. MOUNT: So I strongly support treating this as a separate issue, and I would like to broaden it beyond thermal storage. That the whole concept of flexible demand, controlling water pumps, da, da, da, da, that should be a major focus.

MR. GELLINGS: That's really a separate issue though. I mean, we can --

MR. BROWN: Demand response.

MR. GELLINGS: Demand response is really a very separate topic. And yes, they come together in some sense, but I wouldn't want to mix that in with a report on thermal storage.

MR. MOUNT: But they do cover the same

purpose. That you can provide flexibility to the system from the demand side.

MR. GELLINGS: The characteristic of that flexibility is quite different.

MR. BROWN: We'll take your comment. I don't believe it affects this report per se. And so I suggest it's on record now and you have a good point, but let's go on please. Chris?

MR. SHELTON: Two comments related to this topic. I think for the record, many of the things that are recommended here for storage apply generally to also include thermal storage. That's why I'm saying a lot of these recommendations are not exclusionary. And it's particularly for this paper. And in the strategy recommendation paper that we did last year, we had a whole section that was focused on the taxonomy of need. And that the focus at DOE and in research should be framed into need and characteristics, not technologies. So the point that was just made about thermal storage playing a flexible demand role, is a characteristic aspect of thermal storage and

demand response. So I think we should continue. We've made those recommendations in the past. We've recognized that, but this is not meant to exclude thermal storage and most of it doesn't.

MR. BROWN: That's correct. But to Rich's point, the subcommittee informing these recommendations did not have an overt focus on thermal storage.

MR. SHELTON: And I don't disagree with the focus, but I applaud the focus on the characteristic of what you're trying to get out of the technology, rather than just the technology itself.

MR. BROWN: Okay, thank you. And the answer I think is, I think it's in there. It was at one time, at least in our discussions. We'll check to see if there's a comment in there that makes the distinction. If it's not there, we'll put something in, make sure the reader understands that the thermal storage was not covered. But these are not -- that doesn't mean these don't apply to thermal storage. That's up to the reader

to decide that. Okay, yes? I'm sorry, I --

MR. BOSE: I think that this has been an ongoing issue for the Storage Committee, because outside of the storage community, people seem to interpret storage to mean many different things. And that's why there is confusion between whether -- when I let my power company use my thermostat, control my thermostat, are they using it as storage? Or are they using it as demand control? Or what is it? So I think the definition -- we need to be careful about the definition, and we'll just have to go back and check on that.

MR. BROWN: That is correct. So the point raised, and we'll see to it that --

CHAIRMAN COWART: It may just require checking to see if there's a sentence in the introduction or even a footnote could be dropped early in the report that makes the point that the focus of this report is on a certain form of storage. And that there are a lot of other resources that the committee is looking at in other reports.

MR. BROWN: Right, and what I'm thinking, if it's not in there, and I was thinking it was, but now having re- read it on the way out, I don't remember seeing it there. But I may have just read it --

CHAIRMAN COWART: I didn't see it either the last time I read the report.

MR. BROWN: Yeah, so we'll put a sentence in there. Probably just take one from the prior report to address the same issue. If that's okay. So I guess we need now to go back. This is the end of the recommended assessments, and discuss Mary's question. And so can we project -- yeah, you're working on it.

MS. RALLS: It's page 17. It's the last paragraph on the page. Okay, as I said, I don't have any problem certainly with the recommendation. However, if you go down to the bottom of the paragraph that begins with, "The importance of renewable integration," the last sentence reads -- at least the version that I have. I understand there were a couple of

different versions coming out. "Based on the results of this research, the department should make recommendations to the ISO and RTO communities, state regulators and FERC on appropriate market design and regulatory improvements in this arena." Certainly the research is necessary. Certainly sharing that research is necessary.

We have some concerns about language, describing DOE's role as making recommendations to regulators and markets on what is appropriate. So I would propose that that sentence basically be changed, and I'll read it in full and then go back. "Based on the results of this research, the department should make that research available and strike 'make recommendations.' To the ISO and RTO communities, state regulators and FERC, which they may consider in assessing, delete "on" and then continue the rest of the sentence.

So it would read "Based on the results of this research, the department should make that research available to the ISO and RTO communities,

state regulators and FERC, which they may consider in assessing appropriate market designs and regulatory improvements in this arena."

And I'm going to trust the house that you've got it up there because my eyesight is so poor I can't see.

MR. BROWN: Pardon?

MS. RALLS: I'm going to trust the house that you've got it up there because my eyesight is so poor I can't see the screen.

MR. BOSE: Oh. It's up there. Have you - yes, going to ask a question?

CHAIRMAN COWART: I guess I have no objection to the change, but I wasn't getting the subtlety here. The subtle difference. So maybe the difference as I understand it is the difference between the department directly making recommendations to the - for policy adoptions to the ISOs or whoever, versus making the research available showing the options and letting those decision makers make their decisions. And I understand that this language is fine with the

department.

MR. BOSE: Yeah, I think recommendations implies a prioritization which says, we've done this study and here's what we think are the main takeaways or the things you should --

MR. BROWN: Yes, we would need - what I was trying to reconcile is we make recommendations on a regular basis. Why is this different? Why is this recommendation different?

MS. RALLS: These are recommendations that DOE would be making, as opposed to recommendations from the EAC. Now like I said at the beginning, the overall recommendation makes sense. It talks about the study. The language here goes into what happens with that study or that research after that?

MR. BROWN: Is that captured? Can you see it there? Okay, did you have any other --

MS. RALLS: Nope, that's it.

MR. BROWN: Okay. Well, based upon this change and other changes that we discuss orally here, I hear a call for -- make a motion please.

SPEAKER: I'll move to approve this report with the changes as recommended in the discussion.

MR. MORGAN: Second.

CHAIRMAN COWART: Any further discussion? All in favor say aye. Any opposed? Right, the report is adopted with these changes as discussed.

MR. BROWN: Thank you.

CHAIRMAN COWART: Thanks very much. Thanks Merwin.

MR. BROWN: If we have time, I have one last slide, but it's not that critical to cover.

CHAIRMAN COWART: Whether -- how dense it is.

MR. BROWN: It's not very dense. Actually I'm sorry, I had two. I just wanted to -- one of them was -- summarized the real nature of this report. One, what we found was the Federal Energy Storage Program is comprehensive and largely responsive to US needs. But recent trends in markets, public policies, technologies

related to energy storage are shifting the energy storage landscape, revealing institutional barriers especially. So in that context, EAC offers recommendations for DOE Energy Storage Program in order to better meet the strategic goals enumerated in the 2013 DOE report, which call for program changes that are generally a matter of degree.

So the meat of this is a summary of the report and the message that was in it.

CHAIRMAN COWART: Thank you very much.

MR. BROWN: Okay, and we did that and then the plans for 2015 I'll go through quickly. One we've already talked about. This white paper that's jointly being done between the storage -- the Smart Grid Subcommittee is the lead in Energy Storage Subcommittee on distributed energy storage. Also I'd like to -- it's been mentioned by our subcommittee, we haven't adopted it yet totally, but look at the role of electric vehicles as grid storage as an initiative area we'd look at. And another one is the role of grid storage

and grid asset utilization in economic efficiencies.

And I think that was it. I'm sorry, I shouldn't -- I didn't know it'd go blank on me. But anyway, unless you want me to bring -- oh, there you go. Those are kind of -- I haven't vetted this with all the committee members yet because we just haven't had an opportunity. But this is what we're going to look at going forward, at least at the moment.

CHAIRMAN COWART: I just have one quick reaction Merwin, that there's an overlap between number two and number three. And I think it's fine actually to have a focus on electric vehicles. But electric vehicles serve the asset utilization and economic efficiency goals as well as what I think you meant by grid storage, which would be electricity in, electricity out. And it seems to me that number two would be a stronger product for the subcommittee if it focused on all the values that electric vehicle storage might deliver.

MR. BROWN: I didn't follow that. I'm sorry. All of the values of --

CHAIRMAN COWART: In other words, instead of -- conversations about the use of EVs, sometimes focus purely on using the battery as a bidirectional sync and source for electricity or for VARs or for other electric -- purely electric purposes. But the other benefits of sort of smart charging of vehicles in response to market conditions, for example, or charging them in low demand periods, that kind of thing. Or high renewable availability periods. Those other advantages have to do with the displacement of the use of petroleum as much as with the -- and using the grid, your point in number three, grid asset utilization, taking advantage of available generation. Taking advantage of available transmission and distribution capacity when it's freely available.

So in other words, your number two study is tightly linked to your number three objective. It makes sense to take -- if you're going to talk

about electric vehicles, talk about them more comprehensively.

MR. BROWN: So another way to put it is to embody number two in number three.

CHAIRMAN COWART: No, I'm just -- I think it's -- something that focuses just on vehicles might be very smart and focused enough and concrete enough to be a good committee work product. It's just that I wouldn't want to limit that paper to a subset of the vehicle's contribution.

MR. BROWN: Oh, okay. I think I understand now, and I don't believe that was an intent here. It was my quick note taking of suggestions from the subcommittee members. We'll have to discuss it more thoroughly. But your point is taken. Yes Pat?

MS. HOFFMAN: Merwin, I have one request, and it's some feedback that I've had with respect to conversations when I go around the country and I do the presentations. And I'd like the committee to think about -- and it goes back

to I think Chris's comment and some of the conversations here is, how do we get more standard -- I don't know if standardization is the right word, from utilization or a use case point of view for energy storage so that everything is not uniquely designed? How do we get some of that complexity around the use case, which means the utilities and the users have to start putting system requirements out or defining the best case use scenarios in which energy -- where the product developers are developing a product for a need defined by the industry.

And I don't know how we sometimes flip that conversation of what capabilities we're looking for, so the product can be developed to meet those capabilities. But think about that as you move forward. I ask the committee to think about that.

MR. BROWN: Okay, I think I know where you're going with this. And for those of you in the subcommittee here, I wrote it down to help remind me to look at that. I guess we're done for

the subcommittee.

CHAIRMAN COWART: Thanks very much Merwin. All right, we are out of order and we're somewhat behind time. So we're going to have to be very timely in our -- I think we have Karen Wayland who's now here. Sorry David. So please --

MS. WAYLAND: Well, thank you for accommodating my dentist appointment this morning, and I can be quick because while I was in the dentist chair, the secretary asked for something by noon. So I spent the time between getting to the office and getting here doing that instead of spending a lot of time writing something for you. But I do have an update on the QER, and I asked Carl Pechman to come along because I think one of the technical workshops that we've been doing as an aside to the stakeholder meetings, I think you'll find very interesting.

So let me give you a quick rundown on where we stand on the QER. We are winding down the sort of very formal stakeholder meetings

component. We have one more stakeholder meeting in New York City on finance on October 6th. The public comment period closes on October 10th, and then at some point before we release the final report, we'll do a wrap up meeting in Washington DC.

We're going to continue to do sort of informal stakeholder engagement and we'll likely, as we start to come out with interim products and results of analyses, be sitting down with stakeholders to sort of socialize some of the results that we're seeing and make sure that we're on the right track.

In addition, we have done -- in addition to the formal stakeholder meetings, we've done some technical workshops that allow for us to sit down with experts and kind of roll up our sleeves and go through some of the data that exists already. We have done one on resilience metrics that was convened by Sandia. We have done one on alternative fueling infrastructure, and the conversation you just had about the electric

vehicles as storage was interesting to us because we spent a lot of time in the beginning of the scope of the QER trying to figure out how to deal with electric vehicles. Because as you know, they are sort of a storage capacity, but there is potentially so much more that they can add to the grid.

But it also could be in next year's QER, which is end use, end generation and supply. So what we decided to do are, for some of these issues that cross over, both this year's, which is purely transmission storage and distribution, wires, pipes, rail barge, truck transport, intermediary processing facilities, that would be the bulk of the report. And as these cross cutting issues pop up, we're going to cover that in kind of sidebar boxes.

So definitely kind of the role of EV and then alternative fuelling infrastructure, of which we did a very comprehensive technical workshop, that will be in this one, but covered much more in depth in the next version of the QER.

We are -- Carl's going to talk about the grid architecture workshops that they've been doing. And we likely will have one more on IT interdependencies, with a heavy focus on electricity. And that -- stay tuned for that. We hope to get that done in the next month or so.

We are deep in the analytical phase. We have contracts with many of the national labs to do analyses on liquid fuels, electricity and natural gas space. A lot of work being done on the interdependencies among those groups. We are also working with some outside consulting firms, as well as doing analyses ourselves in the form of white papers and other kind of visualization and modelling work.

A lot of -- some of the most interesting things I think that just came out were a way of looking at all of the literature that's out there, the current studies, because we certainly don't want to duplicate efforts. For example, the inner -- the studies that are being done through the DOE and our connection funding are just ripe with

information and recommendations that we want to be able to incorporate.

So one of our teams has been working with a national lab to create a searchable database that actually allows you to pick out metrics and predictive relationships that have been identified in the research and pull those out. So it is a really interesting way for me to have seen a literature review done, which I have not seen before. And that tool will become available after the -- when the report is done.

Some of the work streams that we're doing with the national labs, with our internal papers, with RAND, and incorporating the subject matter of the QER meetings within the electricity space, are tackling questions like grid reliability and resiliency. What are the likely issues in bulk power systems, the distribution, the whole reliability through 2030? Again, we are -- these are the questions that we're posing in the analyses, and the results will be forthcoming in the next few months.

What's the appropriate level of resilience? What are the resilience metrics that we might use? What are current methods for paying the cost of improving resilience? What's the role of smart grid? These are all things that you're grappling with. So there's no surprise that these are things we're talking about, at least in a distribution system. How quickly can the current regulatory system respond to new external forces and incorporate technology innovation? So again, we're not just looking at sort of a technology realm. We're also looking at sort of the regulatory and institutional environment.

How does the transfer of assets and services from regulated mechanisms to market based mechanisms change the ability of a utility to obtain financing? Again, that would a subject for the October 6th meeting. Greenhouse gas reductions and other drivers of grid change. Some of the questions would be, how well can the transmission storage and distribution system adapt to the changing portfolio generation that are

needed to support greenhouse gas reductions yet maintain reliability and affordability? Obviously a lot of people are looking at that.

So we will be trying to incorporate work outside of the current stream that we've got labs doing. What are limiting physical and cost factors in integrating intermittent zero emitting renewables in DG and the operation of the system? So again, you would be familiar with the questions that we're grappling with.

So when it comes to the stakeholder meetings, we've held 12 out of the 14 that we plan. So far we've heard from over 180 panelists, from industry NGOs, some people around here have been some of our panellists, state officials. You can look at the meetings. We transcribed every single one of the meetings, and we also have meeting summaries. And the meeting summaries are large font. So they're 16 point font and end up being 20 pages long with a lot of space. So they're actually quite readable. They summarize the panels and give an overall assessment of the

meetings.

Those are all on our website Energy.gov/QER. So the meeting transcripts, the meeting summaries, a briefing memo that I've mentioned before for each of these meetings, as well as all of the statements from the panellists. So there's kind of a trove of information that we are now currently going through the transcripts and the summaries, as well as all the comments that we've started to receive and pulling out key industry insights and recommendations.

Surprisingly, we're getting far more industry insights from the stakeholder meetings than we are specific recommendations. But we're getting great recommendations that are coming in, in the written comments. So we're really -- in the next couple of weeks we'll be diving into those to pull out those insights and recommendations.

Some of the ones that you might be most interested in hearing from us about are, if you want to take a look on the website too, are the --

we had a June 19th San Francisco Energy Water Nexus meeting. And it's slightly tangential to energy transmission storage and distribution, but obviously there is some link there. We had a fabulous meeting, and I think two of the best meetings that we've had have been the electricity meetings. One in the west, in Portland on July 11th and one just recently in Newark, New Jersey, which was a fabulous location let me tell you, on September 8th.

Some of the things -- one of the things -- we intuitively know some things, but then when you actually hear an industry executive or somebody actually spell out very explicitly how something is being affected, it sort of hits you and you realize you really -- that is something that we're going to have to address. And one of the things we heard over and over again, but really quite clearly in the Portland meeting, was the huge problems that exist now between the timeline for permitting and approvals at the federal level when used to build transmission to

connect to nuclear or coal plants that also took 8 to 10 years to approve and build. That sort of long federal approval process became less of a problem than when you're trying to get approval to connect to renewables that can come online within two years from the planning to turning the switch.

So that mismatch in the timing of the federal process has become a real bottleneck in the system that we're going to look to -- there's an ongoing process. So that is not something that we're going to tackle sort of from ground zero. But that is something that we're going to be looking at very closely in terms of how we incorporate recommendations.

I think I'm going to stop there because we don't have much time and let Carl talk a little bit about the workshop he's been doing and we stand ready for questions.

MR. PECHMAN: It's nice seeing you all again. Last time I was here, I discussed the prospect of a great architecture project. We've now engaged Pacific Northwest National Labs to

work with us on developing a high level grid architecture. The objective of the project is to really start laying out what a future grid architecture might look like and to sort of stress test and evaluate the use of the grid architecture as a tool for evaluating policy.

So to a large extent, what we're most interested in with respect to grid architecture is how the grid architecture could reveal policy questions. We know that there are a lot of other uses for grid architecture. For example, looking at communications lengths and standards, electric flows, interactions of certain components and things of that sort.

This has been a very short-term project. The entire project from beginning to end will be 10 or 11 weeks. In that time we've held a preliminary workshop where we discussed potential use cases. For example, the use of -- basically relating to the IEEE 1547, the use of advanced electronics for photovoltaics, to mapping of issues. One of the issues that we had mapped was

the impact of the recent federal courts ruling on FERC's Order 745 to look at how demand response, what parts of the market would be affected by that ruling in terms of eliminating certain forms of demand response.

We held our second workshop two days ago here in Washington DC. By the way, these workshops have been very well attended, both by staff of OE, EERE and EPSA. But also other agencies, like NIST and a wide variety of stakeholders. We've had EEI. We've had EPRI attend. We've had vendors like AVB attend, utilities, Con Edison, ISOs, California ISO has been in attendance for both workshops.

And we're trying to reach out as part of this process to explain what it is that we're trying to do and to get feedback. So this second workshop was a presentation, a preliminary result of mappings, of case studies and things of that sort. For example, one of the things that we're beginning to look at and we hope to look at are how -- are the relationship between different

kinds of electric technologies, their impact on the system and whether or not the appropriate pricing mechanisms are in place as a tool for identifying pricing that needs to be further investigated. Costing methods and things of that sort. Sort of following on the FERC's issuances 755 where they looked at frequency regulation.

So in a nutshell, we will have our draft report on October 3rd. We are happy to share it with members of the EAC, especially the Smart Grid Subcommittee. We'd be overjoyed to have your response and comments and to incorporate that into the report. And we look at this as the start of a longer process. Not necessarily within EPSA, but by the department to investigate different configurations of the power industry, the role of distribution. How distribution system operators might fit into a larger bulk power system, microgrids, things of that sort.

So it's been a very exciting process. We look forward to your participation as we go forward, and with that, thank you.

CHAIRMAN COWART: Any comments or questions from the committee on QER? Chris?

MR. SHELTON: Thank you for the update. Chris Shelton from AES. I had heard through a couple of different channels that you all were wanting to get an update on energy storage. I just saw something come through electrical -- or grid related storage. I saw something come through from ESA that there's a meeting set up with the team. Do you need any more input on that? And are you covering that here with storage? Or are you going to cover storage next year with generation and load?

MS. WAYLAND: I think both. But I think it is -- I mean, transmission, storage and distribution is within the -- is definitely there. So yes, I mean, we can talk afterwards. And I can go back and make sure that I know what the invitation list is for that meeting and then get back to you. So yes. In fact we had -- so if you look at the briefing memos, the briefing memo for the electricity west was updated to include some

information on business models, because that was the -- one of the panel's topics in the east meeting. But that briefing memo has a set of questions in the back, and some of them deal with storage.

So if you're interested in submitting individual comments, you can look at that and see where we're going. But happy to talk to you afterwards about that and follow up.

MR. SHELTON: Thanks.

CHAIRMAN COWART: Anything further? All right, thank you very much. David, I think we're ready for your report.

MR. TILL: Thank you. I'm ready also. Let me just make an announcement while Maureen is getting the recommendations for the expanding and modernizing the electricity power delivery system for the 21st century paper. We're beginning our initial descent. Tray tables and seats in their upright positions please. We'll be landing momentarily. Just want to set the right mood.

First, we'll start by going over the

recommendations for our white paper. It was an aggressive schedule to get it here to you today. You have in your inboxes at 8:42 a.m. this morning final version of this, because we believe in just in time delivery. There's a balancing that has to occur on the power system when you're dealing with AC power.

And so we're going to cover the recommendations, and then we'll go to the appendices and then we'll step back to a little bit of change in the text from what you've seen. The changes that we'll be talking about have been taken during our meeting and have been good changes that we felt like should be incorporated into the paper. So we'll present that fully to you and then talk about where we have discussed going from here with a 2015 work plan. There's only a couple of items that we'll talk about.

I would be remiss while we're getting to page 17 or so if I didn't thank not only the Power Delivery Subcommittee members that made such a huge contribution to this paper. Carl Zichella

led that. Clark Gellings and Pam Silberstein and Sonny and Paul Hudson and others contributed greatly. I hate them -- I know I left somebody out. Mark Lauby, Mark Lauby begged me, "David, don't ruin this by writing something yourself. Let me write the transmission section." (laughter) I said, "I agree. I hold the same esteem for myself that you do."

So it's a very good report, and then your comments have made it that much better. So we have in each category -- we have a category and then a recommendation under it as we get into the recommendations. And the first category is, develop future grid operating systems. The recommendation that goes with that is, work with the industry to define the architecture of the next generation EMS and DMS and create standards that drive the implementation of an open systems architecture.

This is -- I don't believe this is a controversial or new recommendation to this esteemed group. Seeing no tents, I'll go to the

next. Improve power flow control. The DOE recommendation is fund a demonstration project that illustrates the efficiency gains from deployment of advanced power flow control technologies. The next is, create smarter, more resilience distribution systems. The recommendation that we had and still retain is, research and report on strategies to harden and make more resilient grid assets in response to credible potential threats, both natural and manmade, or other federal agencies to inventory and characterize vulnerabilities and lessons learned from microgrid development projects, such as those being established by the Department of Defence.

Now yesterday we added a new recommendation under the more resilient distribution systems. And that is a wise recommendation, identify and assess other strategies to assure the continued provision of critical social services when grid power is disrupted. This is a recognition which is

widespread in the resiliency community, that in the same way that my utility assumes that our communications have been compromised when we plan our responses. That we recognize that there are times when the grid simply will not be available, and there should be measures to push critical social services off onto other means of being accomplished.

Moving on, under integrate multiple systems and technologies, the DOE recommendation is continue to prioritize and provide funding for research and development on variable resource integration and energy storage applications. Collaborate with industry and university research efforts to identify, evaluate and promote the development of technology advancements and operational enhancements needed to lead toward the integrated grid.

And then we have a reference, see companion R&D paper, which will be distributed after this meeting in draft form for more specific recommendations. At this point I should point out

that this paper sets up the reasons why the grid needs to change, is a bit more of a policy paper leading to the Smart Grid Subcommittee paper authored by Clark Gellings and Billy Ball primarily I think, to get more specific on that. And then as we'll share with you, we're going to take off a bit from this paper also with our 2015 plans as envisioned right now.

Under design and plan the future grid, several recommendations. As previously recommended by the DOE, EAC, the department should continue to work with regional and interconnection wide planning and reliability entities such as RTOs, the Western Electricity Coordinating Council, peak reliability and the Eastern Interconnection Planning collaborative to take advantage of DOE research and development products as these entities develop planning tools and methods needed to reliably expand and modernize the 21st century grid.

Then direction and process. Coordinate with above mentioned entities, archive and FERC

regional planning entities to ensure that emergent technology grid coordination and operational advancements are included in the regional and inter-regional planning efforts as required under FERC Order 1000, non-wires alternatives analysis and consideration.

Work with industry to develop interconnection standards, macro and micro level, both communications and full grid interactionability of any device connected to the grid. And finally, study greater efficiencies with conversions of other forms of energy use to electricity.

CHAIRMAN COWART: Can I just ask a question, what's meant with -- in that last bullet? Are you talking about generation efficiency, or are you actually talking about fuel switching at the end use from, say gasoline to electric cars or something like that?

MR. TILL: I think that we're talking about fuel switching at the end use. But let me look around and see if any members of the

subcommittee would like to correct me on that.

MR. GELLINGS: Yes, it follows from the following: That in order to meet any of the targets for CO2 reduction that I talked about in the long-term, you're going to have to electrify. So it doesn't necessarily speak to the urgency or the priority of which end uses, but in general it's talking about electrification.

MR. TILL: Other questions? Other comments?

CHAIRMAN COWART: I agree with the recommendation. I just think that the sentence is unclear. So I wonder if we can just have an agreement to clarify the sentence.

MR. TILL: Sure, would you like to make a recommendation Rich?

CHAIRMAN COWART: I will do so after we get done with this conversation.

MR. TILL: All right, that's good. We had significant discussion about the appendices, this document. And while we included all of the appendices for you to help us make a decision

here, I think that our current direction would be to eliminate both Appendix A and Appendix B. Are there any discussion on that?

CHAIRMAN COWART: You might say why? Yeah, so really all of these issues are being pulled into the draft R&D paper. And to have sort of two different lists doesn't seem like it makes a lot of sense. So a suggestion is that in this paper we refer to the sort of companion, although I don't know those are the exact words, the companion R&D paper. And we will cover all of this within the R&D paper and therefore not be constrained with having to worry about the two lists being the same and being more inclusive and so on.

MR. ZICHELLA: If I may just add also. I mean, these appendices were to help shorten the text. There were -- all of the contributors were pretty much on the same page. But as we've seen numerous times, nomenclature's often not exactly precisely the same, etcetera. And because we were going to go into such detail, as Clark just said,

this was a parking place for things that were probably going to find their way somewhere else. Just so we could keep track of them and if necessary, have them available. But I agree with Clark, that we don't really need these. It actually makes the job of reconciling the two documents a little more difficult perhaps.

MR. BOSE: I noticed in several things there were some standards in the recommendations. And they look like standards that clearly falls under NERC's area. And so I was wondering what was the thought there.

MR. TILL: Direct me to which standards we're talking about Anjan. Which recommendation?

MR. BOSE: Interconnection standards, macro, micro, communications and full grid interactionability. I wondered if that's sort of -- I mean, I understand the need for the standards. I just wasn't sure whether it's DOE's part or it's somebody else's.

MR. TILL: Why don't we ignore it here because we're going to strike that appendix.

Let's go back to the recommendation.

CHAIRMAN COWART: It's the next to last recommendation. Same language.

MR. TILL: Yes, work with industry to develop interconnection standards, macro and micro level, both communications and full grid interactionability of any device connected to the grid. So I don't think that that's really going to so much fall under NERC and the reliability standards, as much as it's going to fall under IEEE and other standards where device makers and purchasers agree on an open-ended -- yes?

CHAIRMAN COWART: A suggestion, because I might have -- it might be my fault that that looks the way it does at the moment.

MR. TILL: I know it's not mine.

(laughter)

MR. GELLINGS: We're not -- I think we don't want to say DOE developed standards. But what's really needed and the example of 1547A is a good one. The industry needs help, perhaps I could call them guidelines on how to utilize those

standards effectively. So maybe a word or two changed there would take care of --

MR. MORGAN: Yeah, well, I mean, one thing you could do would say, work with industry and others to support the -- or to provide the support for or something. I mean, it's not so much that DOE's going to develop the standard. But they are presumably going to play a role in developing the support that's needed for someone to create the standards.

MR. ZICHELLA: I think that's pretty much what we meant anyway.

MR. MORGAN: So if you just say what you meant, that'll be fine.

MR. TILL: Did you catch that language Maureen? Do you --

MR. MORGAN: The develop of (inaudible)--

CHAIRMAN COWART: To support the development of, you might want to use your mic Granger.

MR. TILL: That's doable. Would you

like changes? All good? Good. Okay, thank you Anjan. And we decided we would eliminate Appendices A and B. And then on C, I'd like to propose a change to the title Maureen. Strike planning and insert policies and criteria, and then we'll throw that open to comment. It was suggested that this would be a more accurate title of what follows.

Looks like there's no discussion of that change. I assume that means support. So let me see if we can get by with my just reading something as far as a change in the body. We had several changes in the body that were not substantive at all, but improved the language. And one of those started on page 11 where we said, "The higher cost per mile or per piece of transmission equipment has historically led to greater attention to transmission system reliability." Everything was fine until there.

And then we said, "Through hardening the distribution system in flood prone areas, though hardening the distribution in flood prone areas

has gained new urgency." And it was suggested that we change that to read, "Though hardening and speeding restoration of the distribution system in storm and flood prone areas has gained new urgency." I don't think that should be controversial, but scanning the room I find you don't think so either. Thank you.

Are there any other areas within the recommendations or the content that you feel need discussion before we ask for a recommendation to vote on this document? Tray tables are up. Would anybody like to make a recommendation?

MR. REDER: I'll move to approve with the amendments as discussed.

MR. GELLINGS: Second.

CHAIRMAN COWART: Any further discussion? Hearing none, all in favor?

MR. BROWN: (inaudible) about that last sentence before you vote.

SPEAKER: I'm sorry, which last?

CHAIRMAN COWART: Well, I'm just going to -- I thought I had license to change

(inaudible). I'm almost done. I think we should vote now (inaudible) and then you can tell me (inaudible). All in favor of approving the report with the changes discussed. Any opposed? All right, consider it approved. And I will read you a final sentence and we can discuss it if we need to. Otherwise it will stay the way it is.

MR. TILL: While you're finishing that, I'll go ahead just briefly and talk about where we go in 2015. This paper mentions very wisely the importance of -- to a particular community especially, but to all of us, that non- wires alternatives be considered so that people can be assured that we didn't have blinders on when we planned the grid. The way it was put that I thought was very well several years ago, I heard a PSE chairman say, "We trust transmission planners. They're very smart people. We trust them to plan the best transmission possible. What we don't necessarily trust them to do is to recognize if the best solution isn't transmission."

And so this paper points out that the

non-wires alternatives need to be considered before transmission is proposed as a best solution. But going forward from this paper, much of -- we talk generally about technical things. We talk about regulatory issues, and this paper refers to the regulatory paper that the Smart Grid Subcommittee put before us and we approved in this meeting.

But much of what holds up transmission where transmission is really required, is not so much in people being able to see a technical need. But in the organizations that would provide the finding not being financial institutions providing speculative funding. But being the utilities and the RTO arrangements and so forth that provide funding. There is a need to establish the worth of several things, and one of those is the VAR that provides voltage support.

In the TVA system, for every three megawatts that we move across our system, we need a mega VAR somewhere to keep the system from collapsing while that transaction takes place

across our system. And the issue is that when you go to a financial person with a project and they want to know, well, what's the benefit? And it's very difficult -- it's a very difficult question to answer because it depends on where in the system you are, what the configuration is at the time, what the threat to the system at that point is.

If we're in a situation where a Memphis or a Nashville or an Atlanta or a Phoenix or some Southern California city, or going across the world in Egypt, anywhere where there are huge concentrations of low inertia air conditioner compressor motors, there is a possibility for a voltage collapse under certain conditions. And if you have those conditions and you're in one of those locations, the worth of that VAR is much different than if you're out in Podunk and the lights on the chicken coop need to stay lit.

And so establishing the worth of that voltage support and establishing the worth of moving to a system that is actively controlled for

load flows instead of passively controlled, those two things, the worth of a VAR, the worth of active control, we have discussed as areas that we'd like to move into. Because a lot of the barriers are not technical barriers. They're barriers to getting money cut loose.

So I put that before you and ask you for your comments on that as a direction for the Power Delivery Subcommittee in 2015.

CHAIRMAN COWART: Any discussion? Comments on that?

MR. VAN WELIE: I guess I just support the proposal.

CHAIRMAN COWART: I think we need a vote. I just think this is time for a committee discussion. Any other comments on the committee report?

MR. GELLINGS: An outstanding report.

MR. TILL: Thank you Clark. Let's land now.

CHAIRMAN COWART: All right, I've been asked to recommend the sentence for the final

bullet there concerning electrification of end uses. And I'm trying to be succinct, but I do have a sentence which would read as follows: As the modernized grid will be needed to support greater integration of renewable generation and national environmental and economic goals, DOE should study the means to improve efficiency and reliability through strategic electrification of end uses, including thermal and transportation uses."

MR. BROWN: Rich, your scribe hasn't kept up with you. You're going to have to repeat.

CHAIRMAN COWART: Yeah, well, I can give her the text.

MR. BROWN: So Mel, it's twice as many words as were needed, but the words are fine. (laughter)

CHAIRMAN COWART: Well, as is often said, I didn't have time to write a shorter one. All right, so I can help you. Are you doing it now? All right, all the wordsmiths in the room, I agree with Granger that it could be improved. But

it's clear in its intent anyway.

MR. GELLINGS: Good job.

CHAIRMAN COWART: Any suggested modifications? I think we've agreed that --

MR. MORGAN: Given the climate is part of environmental, (inaudible).

CHAIRMAN COWART: Yeah, well, thank you. All right. Hearing no objection, I take it that this language is included in a former motion and the amendment becomes part of the approved document. Anything further on this? All right. Thank you. That concludes this part of the agenda. We have -- we're early in the wrap-up stage here. We have one announcement from Samir concerning the proposal to create a cyber security working group. Is -- Samir, you here?

MR. SUCCAR: Yes.

CHAIRMAN COWART: Okay. You want to go to the podium, or do you want to speak from there?

MR. SUCCAR: (inaudible).

SPEAKER: Can't hear.

CHAIRMAN COWART: We can't hear you.

MR. SUCCAR: So unfortunately Chris Peters had to leave the meeting a little bit early. So I just wanted to convey to the committee that Chris had proposed creation of a new working group, similar to the Workforce Working Group, focused on the topic of cyber security. The concept would be a working group that would focus on areas around cyber or the C2M2 maturity model and consist of both existing EAC members and outside expertise, drawing on utilities, trade organizations and utility vendors. The idea would be to organize the group with a liaison from DOE and prepare work products similar to the ones that have been described today and expanding on the scope of what was undertaken in the context of the EAC work product on cyber governance. Which was approved earlier this year.

The idea would be to leverage EAC diversity and specific industry expertise. Keep the working group small, moving quickly to provide actionable recommendations, while ensuring that it is not a redundant initiative. So this has been

proposed. An email will go out to the full group to gauge interest and to start a conversation on whether the working group make sense. If so, what the scope and charge would be and what next steps might move forward. But without Chris's presence at the meeting, we've -- sorry, Rich has moved to move that conversation from this meeting to emails.

And so look for that message and Rich, back to you.

CHAIRMAN COWART: With that, thank you Samir. In view of the fact that Chris isn't here to make the proposal and we're short of a number of members right now anyway, I thought it would be better if the invitation to create a cyber security working group were circulated to everybody. And we can all communicate in between now and the next meeting. Granger?

MR. MORGAN: Yes, I'll say this in the email. But I would -- if we do this, I just urge that we figure out something substantive we can actually do. There's so much, pardon my English,

but baloney, I would use a stronger word, in this space, that we don't want to just produce pabulum or other useless stuff.

CHAIRMAN COWART: All right, Anjan.

MR. BOSE: Different sub -- just a question. I thought I heard Pat say in the grid modernization part, that she was requesting the EAC to have some sort of an oversight or reaction to that. And I don't know if the EAC wants to take that up as a request. But well, Pat, you're here, so I don't want to put words in your mouth.

MS. HOFFMAN: I think we can actually handle that offline with the other committees. But what I would recommend is either it's part of the EAC meetings or part of a subcommittee where we're reviewing different programmatic areas of the department's program. For example, we did a lot of the institutional issues in yesterday's meeting as part of having LBL here to continue to do that as part of the topical areas of the EAC or as well, some of the subgroups. You can use the existing subgroups.

But to find a mechanism or a way to incorporate a more formal review of the program as part of the EAC. I think that exactly how we should do it, we should come up with a plan of action and then have the EAC go through approval of that.

MR. BOSE: I guess my question Pat is, how quick -- it seems to me things are moving quickly on that front, at least in terms of your budgeting process and all of that. So I don't know what the time constraints are.

MS. HOFFMAN: I would say as you well know, we move quickly, but we seem to move quite slowly at the same time.

CHAIRMAN COWART: All right, I think we're in the -- definitely in the wrap up phase of this meeting, and I know Pat had some closing comments.

MS. HOFFMAN: Just in closing, I guess number one, I'd like to thank everybody who's here for participating in the EAC meetings. I appreciate your participation. I'm here because I

feel this is a valuable contribution to my thinking, and where the department's heading and the issues that we need to have addressed.

I'm constantly trying to figure out how do we gain more value out of the reports and the recommendations that the EAC brings up? Because I think it's spot on to what policy makers need to hear. And so it's something to think about, how we can continue to utilize the products that the EAC has produced. Not only that we post them on the website, but how do we really get the message across to the folks that need to hear some of these recommendations and these strategic directions?

I do want to take a moment, sometimes I'm remiss in not doing a very good job, but to thank David, Matt and the ICF team for all -- and the leadership of the EAC, Rich and Sonny, for all their hard work in pulling the meetings together. Because the discussions are quire valuable and quite informative.

And so I really appreciate all the hard

work that everybody does on that. In the future we are going to be continuing to look at, how do we want to structure the department's activities and really try to pull it together. We've already talked about in the meeting the grid modernization efforts. But I really appreciate the last paper and some of the synergies in which the EAC recommendations are affirming. But also providing great insight of what you all are looking at in including what the department's looking at.

One of the things that probably will lead into the physical and cyber issue is, in some ways I feel like I'm being asked on a regular basis of, what is the strategy to -- in tackling risks to the system? Whether we're talking physical risks, cyber risk, aging infrastructure, climate risks, and I'd like to be able to probably brainstorm with the EAC on strategy elements. I know there are some discussions from a security side regarding the vulnerability of transformers and what we should be doing in that area.

And I'd like to bring some of those --

I'd like the opportunity to bring some of those conversations into the EAC discussions to get your feedback as we move forward. So that's one of the things that I'd like to make a request out of. And then ultimately, I just -- I appreciate your input and one of the things is investment in the future is going to be critical. And I'm not sure we've totally figured out how we're going to pay for all those investments.

And not that that's a role of the EAC. But I know there's different groups in the department that are looking at alternative financing and financing mechanisms. And that's something that the EAC may be interested in looking at and having feedback. So from my perspective, it's probably more ideas and I'm giving you guys more work to think about. But I think the topics are quite relevant, and we need to have the discussion.

And so it's a very valuable discussion. So I just wanted to thank everybody for their participation and engagement in that.

CHAIRMAN COWART: All right, thank you Pat and I would echo strongly the thank yous to the ICF team and to the department support team. You guys are terrific. And I've been so impressed by the support that the committee has gotten. And then of course it goes without saying, it's pretty obvious, that the work of this group occurs in the subcommittees, and the individual members and leaders of those subcommittees deserve a lot of thanks and credit for everything that happens.

We just approved at this meeting quite a series of weighty documents, with quite a number of recommendations for -- Pat should implement without adequate funding. But we just actually accomplished quite a lot and should pause for a moment and ask ourselves, are we going to be able to keep it up until March? We'll see. But between now and March, I hope the -- and expect that the subcommittees will be plowing ahead on their new topics.

MS. HOFFMAN: One last thing, keeping up with work. I did want to let everybody know that

we do have three vacancies on the street for senior executive positions at the department. They're on OPM.gov website. If you know anybody that's interested in coming to Washington and being a wonderful civil servant, please have them go to OPM and look at some of the vacancies that are available.

CHAIRMAN COWART: Well, in fact let me ask if it's possible Pat for you to circulate, either to me or to the entire committee. I mean, if it's important that you share them with me and then I share them with the committee, or you share them with the committee directly. I think it would be good to have that information in the hands of the committee members in more detail. Is that okay?

MS. HOFFMAN: Um hum.

CHAIRMAN COWART: Thank you.

MR. BROWN: A different subject and back to the QER. I understand in public meetings the secretary is saying that the QER will be available for public comment by January 31. And I'm sure

the committee will want to take that document and respond to it. So that's to be noted on the list of things to think about.

CHAIRMAN COWART: Will it be important for us to do so before the March meeting or could we -- what would be the timeframe for comments on that? Do you know? Thirty days, yeah, in which case when it's available, if the committee wishes to comment, we would have to either comment individually. Or we'd have to convene a conference call to do it. Perhaps we should just -- people should have in mind that we might be trying to convene then a web-based meeting of the committee in order to do that. Or we might decide simply to give each -- give the members of the committee the opportunity to comment individually. Clark?

MR. GELLINGS: It's a different subject, but I just -- for those who are not aware, back to the comment made about productivity. I had reason to look over some of the work that's done by some of the other advisory committees to DOE. And I

was amazed to find that most of them do very little, and even when they do it, DOE doesn't respond to them. Their suggestions or recommendations get no response. So my compliments Pat to you and your staff for truly making use of this group.

CHAIRMAN COWART: Good comment.

MR. POPOWSKY: I think Karen in her remarks suggested that she would share a draft with the committee on October 3rd of the QER.

MR. BROWN: No, that's a draft of a product that PNNL is producing as input to the QER process. And it's a very -- what I've seen of it so far, it's a very interesting study about grid architecture. But it's only a small component of the QER itself.

MR. SHELTON: I appreciate Pat's comments as well, and I appreciate the challenge of dealing with all of the recommendations on different themes as they're coming out of this committee. I think there's one common element to what we've seen over the past two days and

probably most of the work product. And that is the sort of next general architecture. Sort of the mega theme. It screams out of kind of every paper. It's in the discussions that we had on the regulatory changes that are happening in distribution companies in New York and in other markets.

So a place where I think the agency -- you know, the federal role in defining architectures and standards and vision and for future systems, has been quite helpful in other areas like telecom. So I think you could probably look at the reports from the EAC and see themes in each paper that could develop into kind of a mega theme recommendation on -- that could turn into a single set of efforts that could all be organized.

MR. ZICHELLA: Yeah, if I could add one thing. It seems like the recurring themes that I heard that need attention, go to things like eliminating inefficiencies in the system. We tend to look at the electricity system as an "it," and it's not an it. There are many ways in which we

inefficiently use the assets that we have. It leads us to build things we don't need. Leads us to run into financing hassles. How are we going to pay for what we actually do need?

And it seems like having DOE as sort of that uninterested overview of everything, being able to put a finger on where inefficiencies do exist, where we could change the way we think about making investments. Where we're not just thinking for the next 3 to 5 years, but we're looking out over 50 years of an asset and how we might want to be able to maybe spend a little more at the beginning to get more out of an asset 20 or 30 years down the road. Making it scaleable, those kinds of things.

These are I think ways we're going to have to head. We can't build rights of ways everywhere. We have technologies we've talked about. David talked about some of the non-wires approaches to dealing with controlling load, diminishing a need for some of the investment.

The extent that we can make the case for

the investments we need to make, I think the funding will be there for it. But if we look like we're silver plating or gold plating the need, that's where we're going to be getting into a lot of trouble. And people will understand and support some of the shifts. I mean, all the polls show it, about concern about climate, about wanting to modernize the system, having the quality of the resources that we talked about yesterday.

It's all there, and we can do what we need to do a lot more efficiently if we can get the most out of, and operate what we have better. And plan not just for the short to medium term, but for that intermediate to long- term. Our climate goals are 80 percent by the middle of the century reductions from 1990 levels, greenhouse gas emissions.

Well, we have a 30, 40 year time horizon to begin planning and thinking about how to do that. I think DOE plays -- through its labs and, by the way, they're doing spectacular work on some

of these very topics. I work with them all the time, and I just think it's really amazing what they're contributing. But putting our finger on the inefficiencies and trying to help people organize themselves around getting rid of them, would be a huge benefit that DOE could do and maybe this committee could help with.

CHAIRMAN COWART: Anything further before we adjourn? All right. I'm happy to note that we're five minutes ahead of schedule, and we are adjourned. Thank you all.

(Whereupon, the PROCEEDINGS were adjourned.)

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CERTIFICATE OF NOTARY PUBLIC

COMMONWEALTH OF VIRGINIA

I, Carleton J. Anderson, III, notary public in and for the Commonwealth of Virginia, do hereby certify that the forgoing PROCEEDING was duly recorded and thereafter reduced to print under my direction; that the witnesses were sworn to tell the truth under penalty of perjury; that said transcript is a true record of the testimony given by witnesses; that I am neither counsel for, related to, nor employed by any of the parties to the action in which this proceeding was called; and, furthermore, that I am not a relative or employee of any attorney or counsel employed by the parties hereto, nor financially or otherwise interested in the outcome of this action.

(Signature and Seal on File)

Notary Public, in and for the Commonwealth of Virginia

My Commission Expires: November 30, 2016

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