UNITED STATES DEPARTMENT OF ENERGY

ELECTRICITY ADVISORY COMMITTEE MEETING

Arlington, Virginia

Tuesday, June 17, 2014

PARTICIPANTS:

RICHARD COWART, Chair
Electricity Advisory Committee

BRIAN PLESSER
Attorney Advisor
DOE Office of General Counsel

MERWIN BROWN
Energy Storage Subcommittee Chair

WILLEM FADRHONC
STEM

TOM WEAVER
AEP

MELICIA CHARLES
CPUC

TOM BIALEK
SDG&E

REED HARVEY
EPA

SUE TIERNEY
Analysis Group

KEN COLBURN
RAP

KAREN OBENSHAIN
EEI

WANDA REDER
EAC Smart Grid Subcommittee Chair

CARLOS COE
Distributed Storage Paper

PARTICIPANTS (CONT'D):

PAUL CENTOLELLA
Regulatory Policy Tools Paper

CLARK GELLINGS
Research and Development Paper

* * * * *

P R O C E E D I N G S

MR. COWART: Good morning, everyone. Good morning folks. Please be seated. We begin with an ethics briefing from Brian Plesser, from the Office of General Counsel.

MR. PLESSER: Thank you. Okay, so this should be fairly quick, but this will take care of your annual ethics briefing. The reason you have been asked to listen to me this morning is, you have been appointed as special government employees, and as such, the federal ethics laws apply to you, as well as the regulations. Samir is kind enough to pass out -- what he's passing out, is the 14 principles of ethical conduct for federal employees. This was signed into executive order by the first President Bush, and essentially these caution employees to endeavor to avoid any action creating the appearance that they are violating the law or any ethical standards. I'm sure you all have seen these already in the past. This is a common handout that we provide to people. Hold on one sec. Okay.

Financial conflicts of interest are probably most important, and that's why we ask you for financial disclosure reports. I know that they are a hassle, but they're helpful for us to analyze whether or not a conflict exists. Absent a specific waiver or regulatory exemption, a criminal statute bars your participation in your government capacity, in any particular matter, if you or any of the following individuals or entities, whose interests are imputed to you, have financial interest in the outcome. And those entities or individuals would be your spouse or minor child, a business partner, an organization with which you are employed or affiliated as an officer, director, trustee, or general partner, an organization with which you are negotiating for employment, or have an arrangement for future employment. Now we've taken a look at your financial disclosure reports, and we have talked to the management team of the committee, and it doesn't appear that the work that you're doing here becomes specific enough that you are talking

about particular entities. But if that arises, please let David or Matt know, and they will contact me, and we will talk. You may be recused from working on a particular matter that the group is discussing. That does not mean you have to leave the room, but it just simply means, if you could please refrain from discussion at that point.

There are also regulations that restrict your participation in matters affecting specified parties. And those would include relatives or members of your household, individuals or entities with whom you have, or seek a financial relationship with. Entities your spouse, parents, or dependent children work for. Entities you have served as an employee or officer, director, trustee, consultant, within the last 12 months, and organizations in which you are an active participant. What we have here is the appearance of a conflict. So this is a regulatory conflict, and the test here is whether a reasonable person with all the facts, would question your

impartiality, working on a matter. So, for example, if your spouse is employed with the Ohio State University, for example, and you are discussing a matter that -- a contractor grant that you would be making a decision that would affect the Ohio State University specifically, which I don't think you do, but if you did, you would have the appearance of a conflict in that instance because your spouse works for Ohio State.

So, we're going to move on to misuse of position. Simply put, do not use or disclose non-public government information. Information that you learned of because of your association with a committee, should not be shared with the public, if it is non-public information. You should also not use public information for private gain, whether your own or someone else's. Do not use your official position or advisory committee title for any purpose, other than in connection with the duties of the advisory committee. You all have associations and titles at other institutions, home entities that you could use in

lieu of. Representations -- you have to be aware that there is a criminal that provides you must not represent someone else before the government, including DOE, on any specific party matter on which you have participated as a committee member. This law also bars you from accepting fees, such as representation done by others. So, if you are working on a matter for the committee, you cannot turn around for your home institution or in a consultancy role and represent somebody on that same matter, back to DOE or the federal government. Seems to make sense, but that does not preclude you in your other capacity, contacting DOE or other federal agencies on matters that are not specific party matters. So, if there's a grant out there, that you're interested in obtaining, contract -- so long as this committee has not taken up action on that matter, you are free and clear to pursue that. There are restrictions for STE's that work more than 60 days, in a 365-day calendar period. I don't know that you all would get to 60 days in

the aggregate. And if you do work 60 days, you know, God bless you for doing that.

There is another law that bars you as serving as an agent of a foreign principal, as defined the Foreign Agents' Registration Act. So, if you have a consultancy or a relationship with a foreign government or entity, please make sure that you contact me, and give me the facts on that.

And then finally, I just want to talk about the gift rule, and then I will let you go for the year. The basic rule is we do not solicit or accept gifts and favors from any prohibited sources, or if a gift is given, because of your official DOE position. A prohibited source is anyone who is doing business with the department, ceased to do business with the department, is regulated by DOE, has interests that would be substantially affected by the performance of your official duties, or is an organization, the majority of whose members are described above -- what I just said. There are a number of

exceptions for the gift rules. And this is gifts that you would receive, obviously, in your advisory committee capacity, which I'm sure you receive many more opportunities for gifts in your other capacity, your non-committee capacity. But some gifts that you could certainly -- exceptions and gifts you could accept would be benefits resulting from your non-DOE business, which I would assume would be most of the offers that come to you. Gifts clearly motivated by family relationships or personal relationships. So, if your spouse is offered a gift by General Electric, because she does work that would affect it, you're permitted to accept that gift. You're permitted to go along with her in the event that they're throwing, and it would not be a problem. And then there's the $20 gift exception. So if you're offered a gift of $20 or less, you're permitted to accept that, $50 or less in the aggregate for a year, from any one entity or individual. If you have questions throughout the year, you can certainly contact David or Matt or me. My phone

number is 202-586-1346. Again, it's 202-586-1346, and my email address is brian.plesser@hq.doe.gov. If you guys have any questions, I'd be happy to -- yes.

MR. LAUBY:: I don't know if it's in the handout version of the 14 principles, but item three that says employees shall engage in financial transactions -- it's actually telling me to do that, as well as 6 saying, employees shall knowingly, basically, make unauthorized commitments. I believe the two should be not, according to what I see on the web. So three should say, employees shall not engage in. Six should say, employees shall not knowingly. The one that you sent out in the email did not.

MR. PLESSER: Oh, it did not, okay. I guess you have legal cover to do that, huh? I didn't realize that that one did not, so that's conversation number one, I'll have with Susan Bier this morning. I will resend all those. As lawyers, usually the answer is, no, you can't do that, to the client. But we will resend that,

obviously, you can trash it. You can bin it. So it should be -- the one that we handed out today is obviously, shall not engage in financial transactions in number three, and shall not knowingly make unauthorized commitments, number six. I apologize. I don't know if somebody was playing a joke. I don't know why that would -- makes no sense. Okay, does anybody have any other questions? No. Okay, great. Thank you for your service, and if anything pops up throughout the year, just drop me a line. Thanks.

MR. COWART: And in the category of not accepting gifts, I'm reminded to let you know that, the nice array of drinks and what have you, out in the hallway, was not intended for us. (Laughter). And a special request from Mike Heyeck.

MR. HEYECK: Thank you. I said to the chair, that I'll only take a minute. He says, you can take all the time you want. That's very dangerous for an elected official. Give Mike a mike, and I'll take an hour.

Last night, after the win and a couple of beers, I had time to think more about what Sonny asked yesterday about the future of transmission. And I gave you my answer yesterday. I just wanted to provide a little bit more on that. We tend to look at transmission from the top down, in all our discussions about central station power, wind farms, nuclear, and things like that -- RTO's and big markets. But I think in the future space, we need to look at it from the bottom up. Actually, transmission from the bottom up, actually enables the competitive choices that customers can choose. Whether it's micro grid storage, PV panels, or whatnot, I think transmission provides you the law of large numbers, so that you have resiliency, reliability, and things like that. If we're all connected, a customer could reach to a Wyoming energy provider. If we're not connected, they can only go down their next subdivision for the battery that's hooked up to Merwin's house. So you look at transmission as an enabler of transparent markets,

and an enabler of choices for customers. So, as I encourage you to go forward, not just thinking about this at the top down, but also thinking about this from the bottom up.

Lastly, I'd like you to -- if the committee could take a read of what we wrote six years ago, in keeping the lights on in a new world. This was before the shale gas revolution, and it just shows you how quickly items become outdated. It's a long report, but I think you could look at the highlights to see, that whatever we create, you never know what the discontinuities are ahead. But given the inertia of customers, and given the inertia of assets, I think that transmission and distribution together will have a space. But create that different space with a bottom-up customer choice, so that they could reach the markets they choose, and create the transparency that's desired, that will create the marketplace, that will yield the lower prices they want. So, I really am honored to serve on this committee, and I'd talked to somebody that served

with the DOE some years ago, and he put it in the right sense, and that is, you are serving your country. This is an honor to serve your country, and what you do in this committee, will actually have some influence of what will happen in the department for the next 20 or 30 years. So, I thank you for the opportunity, Mr. Chairman.

MR. COWART: And we thank you. You said you were going to be leaving early this morning?

MR. HEYECK: Yes.

MR. COWART: Okay, all right. Thanks very much, Mike. On to present business. We have a report from the storage subcommittee, and I think Merwin is ready to lead that.

MR. BROWN: Yes, I guess this is the second time I've been up here as the chairman. The first time was rather quickly, because I got the title the same day I had to stand up and give a report. Filling Ralph's shoes, is rather difficult, frankly. But I'll give it a whirl here at this report. I don't think it's going to be particularly long. We'll see how it goes with

discussion.

The topics I want to talk about this morning on the activities and the plans of the energy storage sub- committee of this full committee, is -- I got a few loose ends to tie up about the national grid energy storage strategy report, that was recently published. A little bit of discussion about distributed storage testing and safety initiative letter, discussion about the National Strategy for Distributed Energy Storage in the Electric Grid white paper -- got very little to say about that, and you'll see why in a minute. And then probably most of the time will be spent on the last item, the biennial -- I'm never sure how to pronounce that word correctly - the biennial storage review report.

The first item -- you'll recall that this subcommittee put out what we call the national grid energy storage strategy report, was issued February of this year -- was finalized by this committee at a teleconference meeting on January 24th of this year. And it contained 11

recommendations to DOE in four phases, more or less by periods of time -- how far out the recommendation extended. And DOE now has responded to those recommendations in writing in a report that I think all of you have probably received by now. I'm not going to go through all of those, but I would say, that from my reading of it, DOE basically accepted all the recommendations, and maybe one of the reasons why is that DOE has largely began efforts or completed projects that are consistent with these recommendations. So DOE has already started down the path in each one of these recommended areas.

The third point I wanted to make is that the Energy Storage Association, ESA, submitted comments to the EAC on March 13th at that public meeting. And it made some recommendations. I summarized them here, as basically recommended that DOE funding efforts be actionable by states and utilities in policy planning and procurement. And secondly, they were suggesting more coordination among the DOE offices. And that

already had been discussed before this full committee, even as of yesterday. And also in that letter, ESA offered their help as a resource in our work here, which was nice. This letter was actually delivered to the full committee and was broader in scope than just this particular strategy paper, but it did reference it, and that's one of the reasons why I put it up here. It was also probably the only place it would show up in our discussion in these two days. So I put it in here. Are there any questions or comments on this, because I'm going to leave this topic.

Distributed energy storage -- in distributed energy storage testing and safety, the subcommittee started off on a fairly -- I would call, I guess, intensive, or wanted to do sort of an in-depth look at this subject, but then as time went on, and we looked into it, it was decided by the group, that DOE actually was quite a way down the path on this subject too. So we thought maybe it would be better to just write a shorter letter of our views on this matter, that would mostly be

in support of what DOE was doing in this case. And so Ralph, our prior chairman of this subcommittee, has agreed to, and is drafting a letter that would cover this subject matter. In talking to Ralph, he hasn't had time to start it yet, so that's where we are right now. And so we await that letter from him.

The second point under the area of distributed energy storage is the National Strategy for Distributed Energy Storage in the Electric Grid white paper. I mention that because the subcommittee is a part ownership, if you will, of this activity. But it's being managed and led under the smart grid subcommittee, so I'm not going to cover it any more here, other than to give you a heads up, that right after we get done talking about this subcommittee, there will be a panel that will contribute to this topic of distributed energy storage.

Now the Biennial Storage Program Review Report -- this is an activity that the subcommittee is asked to perform, and in some

ways, I guess, told to perform by law, that every two years there is to be an assessment of the DOE program with respect to how it's meeting its goals and things like that. The most recent one of these was actually combined with a broader paper last year, that looked at a five-year strategy that came out last year. We worked on them, the subcommittee, for over a year. But this year, we're going to look at just the two-year review and won't have much of a strategic focus, although we will probably have some recommendations and suggestions, if we find any gaps or anything like that, that we think are in the current DOE activities and plans.

We're shooting for an approval in the October 2014 EAC, and -- is that the right date? Is it October is the next one? Or is it September? For some reason -- when is the next EAC? Okay, September -- that's what I thought. That's a typo. And we're going to try and make that. It's a short time to put this all together and get a committee organized around these

matters, but that's our target -- is to reach that. If we should fail, we may request -- and maybe we ought to prepare for this at least, to perhaps tackle this report by a video webcast conference, like we did the strategic plan in February of this year.

The nature of the report that we're looking at so far, and we discussed this with the EAC leadership team in a meeting on April 8th of this year, will focus on assessing the DOE storage program, and the committee's recommendations, if any, of substance out of that. And it will not focus so much on the energy storage technology, per se, that can be referenced elsewhere. And what I'm referring to is that it's gotten so that these reports that are put out on energy storage, typically have a huge volume of information that is a litany of all the energy storage technologies, their status, and how they work, and this kind of thing. And that seemed to us, working on this, that it was getting in the way of really getting to the message. And so, since it

had been put in and is easily referenced, don't look for that kind of material in this report. We'll reference it. If we need some specific material regarding the technology, we'll put it in here, if needed. But other than that, we plan to focus on the DOE activities, plans, and our recommendations to keep this as a slim report.

We've had three meetings of the subcommittee since the March meeting of this committee, and so far an outline has been drafted, and it was distributed to this full committee, prior to your coming here. Some document resources have been identified to use as reference materials, and then there's a menu of candidate activities developed by the subcommittee to guide subcommittee comments. And those are also listed at the end of the outline that was sent to you. This is how far we've gotten. Our next steps are that we have a meeting scheduled for lunch today, and Samir, I don't know where that is going to be. Somehow we'll find a place to meet at lunch today, and try to take some steps forward, in working on

this report. And then we have also a meeting scheduled -- our usual, regular monthly meeting scheduled, coming up. We hope to be able to finalize an outline this month yet. And based upon the offer from ESA, we would like to get some high-level feedback from them in particular. Probably early on, ask them to look at the outline, before we get too far down the path. And we may go to some other external resources as we feel we need to. And we now need to also make writing assignments from that outline, and it's probably something we need to discuss today at lunchtime, if we get that opportunity.

So that concludes my remarks, and are there any questions or comments anyone would like to make? Yes.

MR. MORGAN: It may or may not be appropriate for your report, but over the last six months, I've been looking for time series data on the cost per watt of power electronics and the efficiency of power electronics. And obviously, power electronics is critical to getting into and

out of storage. I've talked with the senior guy leading power electronics at ARPA-E. I've talked with folks at Argonne, and at Oak Ridge. I've looked for things like, you know, proceedings of the IEEE summary. I cannot find anything. Now, you know, people can tell me individual bits and pieces, and I've had a few other things, but some comprehensive look of the sort that DOE routinely put out, in areas like LED's, would be awfully useful. Maybe it exists, and I've just been unsuccessful in finding it, but it strikes me as a good recommendation, if in fact you folks don't find it.

MR. BROWN: Okay, thank you. Maybe that could even come up on our panel, following this particular session, if any of our panel members have some experience in that. That could help answer your question, but thank you. Are there any other questions or comments? And by the way, I'll make the same plea that David made yesterday. If there are any of the new members, or any other members for that matter, that would like to, even

if you don't even like to, but if you would, please join the subcommittee. We need people to help put intellectual content to it, as well as put pen to paper, or fingertips to your keyboard. We need someone to help write this material as well. So, I see no other tents in the vertical position, so I guess that concludes it.

MR. COWART: I guess that does. Thank you very much, Merwin, and thank you in your second appearance, as chair of the subcommittee. Any further conversation on the storage arena? We're pleasantly ahead of schedule here.

MS. HOFFMAN: No, I guess I would just like to emphasize -- this is Pat -- I'd like to emphasize -- I think it was very synergistic with where we were heading with the program and looking at safety standards, looking at new technologies with respect to how do we move energy storage forward. And I think the collection of reports are a solid background for anybody that's going after, or looking at energy storage. What we probably need are some very tailored specific

recommendations that we should go forward on, on the next steps with respect to energy storage. I'd also like the committee to keep in mind what's going on in California with some of the energy storage mandates, and how that continues to evolve. I think those are good opportunities to take lessons learned and have that debate and discussion around. The power electronics contribution was really important, as we move forward, looking at power electronics.

MR. COWART: Wanda, is your panel ready? Is everybody here? Fortunately for the committee, Wanda has two chunks of the agenda, so we're asking her to switch and take the afternoon bit now. And then we'll see how the day progresses. Maybe we will finish earlier than planned.

MS. REDER: There's actually three pieces of work going on within the smart grid committee right now. One is the distributed storage paper, which Merwin actually talked about. There is an outline that was distributed. So the intent of this panel is to give us input to that

activity and, you know, looking forward to having that occur. We're going to do our best to have something in writing for the next meeting. I'm not sure it will be prepared well enough to have a vote on it, but we're going to strive for that as our goal. So certainly we would take input to that outline. I think the comment that Mike made from a bottom-up perspective, is very much the one that we're looking at, from the distributed storage side. We know that every other year the storage report has been done from a macro perspective, and the bottom-up look of what storage can provide locally, is really the intent of that work. So that's where we're headed here, and of course the insights from our panelists will help us do exactly that to develop this national strategy for distributed energy storage white paper. Paul Centolella actually provided a really good update in our February meeting on the regulatory report. So that continues to evolve in terms of outline and PowerPoint, and now there's some good dates established to get that in written

form. So I have high confidence that that will be a work product that we will actually be voting on at our next meeting. And then the last one, of course, is the research and development paper that Clark has been leading. Billy Ball's been involved, as many others. There's been good text that's been circulated. A full-court press has been put on to get additional comments, because it's been in written form for a while. So maybe since Clark is here -- no, Clark's not here. I'm really missing a lot of the folks here, but Billy do you want to add anything to -- nope, that's where we are. Okay. I will say there's 28 pages of text there, so it's not for lack of words. I think it's more an issue of, are we saying the right things. And some of the thoughts that I had, in kind of previewing holistically coming in to this meeting is, are we doing enough on the data, the tools, the overall architecture for inoperability, because a lot of the smart-grid pieces have been just that -- kind of switches and volt-VAR and meters, and how do we look at this

thing from more of an overall architecture perspective to get more seamless in our operability. And I'm not sure that part kind of pops enough in the R&D paper, but I think through iterations, we'll continue to work on that as well.

What has been working quite well -- we have monthly meetings, and that has provided us an opportunity to do some webinar work, which has been great to provide interim experts. Laney Brown with Iberdrola, actually gave us some good insight to her regulatory experience, which I think is helping Paul formulate some of the regulatory comments in his white paper. And we will continue to showcase, kind of the latest pieces that will incrementally evolve our thinking. I think it's a good way to have milestone updates and bring in outside folks that have made some good work appear, so that we can more systematically, work that into our work product.

The other thing that we did, Joe

Palladino was involved with creating a smart-grid system's report, so a handful of us got involved with providing comments to him. And, of course, that happened -- before it was submitted to Congress there was a regular periodicity that that has to be written, and it needed some review. So we provided that, and the recommendations were that the report would include the R&D and technology advancement recommendations, in addition to the current focus in the smart grid adoption, i.e. drivers, barriers, and market transformation. So that's really where we are on the smart grid committee work. This is coming into the five- year run of those ARA projects, so right now a lot of the detailed attention is buttoning up. Where are those projects? How do you showcase the lessons learned? How do we scale from here? So that is kind of the bridge into the future of where we are right now. Are there questions, comments?

MR. COWART: I'm interested in that last bit about the ARA projects. Can you say a few

words about what you think is coming out of the analysis of all of those projects? What are the leading lessons, that are in your head?

MS. REDER: Wow, there's so much there. I think, first of all, it's a portfolio of projects. Some of them have tremendously positive outcomes, and some of them, not so much. And I think it's incumbent upon us to kind of encapsulate that and get the word out, so that we can continue to scale and evolve from all of the good work that's been put in place. And we're really at that point of trying to get the lessons and the comments encapsulated in a form that's meaningful to folks. The volume is so huge. That's really the tricky part, is getting the transfer of knowledge in a way that's meaningful. And I think that there's a lot of data, and a lot of lessons. If I was going to kind of pull it up and say, where were we, I think now we're at a point where this inoperability, the architecture, how do we use the data, is the next frontier. It's kind of like me and my I-phone. I have this

gadget that I use every day for some fundamental functionality, but there's so behind that, that I don't use. I think there's a lot parallels to the technologies that have been deployed, where, you know, from an industry perspective, there's ways to leverage the data, and tools that are (inaudible) so that we can be much more efficient with what we already have in place. So, we're kind of at that juncture.

MR. COWART: Rebecca.

MS. WAGNER: I just wanted to add on, because Paul Centolella had to leave. He was going to do a little bit more this afternoon, and he may, but I just wanted to add on -- just on the regulatory policy tools paper that we're working on, we are desperately seeking new recruits. I am a new commissioner. And anybody who wants to join in our effort -- we've lost several members of our writing team, or about to lose them. And also, just wanted to highlight that we will be having a panel in September. And this morning we had a brief little meeting about trying to figure out

who we're going to include, different perspectives, both regionally and just, you know, every state and entity is searching for different ways to tackle different but similar problems. So that's kind of where we're at. And Paul, I didn't know if you wanted to add on anything from that?

MR. HUDSON: A different set of comments, actually. I'm not sure this is a question for Pat, or if it's a question at all, but an observation. Yesterday, Larry, and I forget the other gentleman's name, Carl, spoke a little bit about wanting to have more input. And Pam actually discussed the analog with telecommunications companies. Two overriding comments -- one, I find that the DOE generally puts out an incredible amount of information. But I think that a lot of the information that it puts out is under consumed by those that could most benefit from it. And in particular, over breakfast, we had several former, and one current regulator together, and the workload incumbent on those folks really makes it prohibitive to absorb

the universe of information.

The second set of comments is about our dialogue with ourselves, which is to say, I think we do a great job talking amongst ourselves as an industry, but we do very little to reach across industries and draw in, say the Mackenzie's or the Deloitte's, or others that have extraordinary expertise across multiple sectors, and can speak to the types of analogs that Pam brought up yesterday. And so I'm wondering if you have any thoughts, Pat, about how to both increase the ability of the DOE to communicate with the members of the community, I think most liked to have increased communication with. And then, how does the DOE think about drawing in from the non-traditional voices that have experiences outside of the dialogue that this industry tends to have with itself.

MS. HOFFMAN: Those are very good comments and something I struggle with to be honest, because there's just not enough hours in the day and not enough resources. And how do you

prioritize getting the message out? One of the things that I think was important with the smart grid program was saying, okay, let's -- I think some of the difficult decisions is, we have a lot of technologies. But how do we prioritize some of those investment strategies. And so the conversation with Iberdrola, and I think some of those conversations, has aided in that. With respect to the states, you know, we've been trying to do a specific outreach on a state-by-state basis through the technical assistance. If they request looking at, where do they want to do grid modernization, we've been trying to say, all right, we'll go up, and we'll share the lessons learned. But it's very much hands-on in trying to say, okay, how does this relate to where your state is, with respect to its grid structure, its capabilities, whether it's interested in meters or not, or additional capabilities. What aspects are the commissions interested in, and that becomes very much a state-by-state conversation. And so it's a lot of conversations that have to occur.

And I don't have a good answer to say that's it's more time and resources to get out there. We've been trying to reach out through talking to ourselves. We've done a good job in reaching out to IEEE and TND, and getting some of the success stories and some of the lessons learned, as part of the engineering magazines. But maybe we have to think about now -- I agree with you. How do go beyond the talking to ourselves group, and start reaching out to the next level? I don't have a prioritization. If you have recommendations, I don't necessarily know where I would prioritize, where I would start, and I'll have to think about that.

MR. COWART: Bob and then Merwin.

MR. CURRY: Apropos what Paul said. As many of you know, New York State is engaged in taking a new and different look at the regulation of utilities. The essential premise that the staff and the commission articulated was, the utilities aren't going to do it themselves, so we are going to make them do it. There is publicity

to that effect in Massachusetts, about utility of the future being something that you have to bring in with your rate case submission. I don't know. I don't know how Massachusetts works. I do know that New York is going to be a very interesting example of -- can you really drag people kicking and screaming into the next century, because with the very limited time frame involved, there are likely to be some very well articulated principles that are supposed to guide rate cases downstream. And then the proof in the pudding will be the staff's ability to elicit from the utilities, procedures and also weight-related activity, so that the dividend stays intact. I didn't circulate it to many of you all, but you may have noted that Barclays downgraded the entire electric credit sector, because of the uncertainty. And Wall Street hates uncertainty, more than it hates disaster. It hates it more than anything else at all. So, part of looking outside, is also the lessons to be learned from what went on in Arizona, on that metering, how effectively the

insurgents simply said, don't tax the sun, and all of a sudden, some back-of-the-envelope figures that the Public Service Services of Arizona threw out, is what the cost of integrating that meter would be. We're disturbed by their lack of transparency, shall we say? So, I think that the industry itself is grudgingly moving in the direction that Rebecca and Paul were talking about, in looking to the outside more. I do now know that the Consolidated Edison of New York, now uses a Democratic pollster to do its focus group sessions, and not somebody's cousin, who was bound to get the right result. So, you know, there's also a virtue in having pollsters do your work in a given state, if you're primarily Republican, or primarily Democratic. You pay the pollster to do it, and then all the guys are trying to get elected, and gals trying to get elected, will per force get that information. But I think the outward looking aspect, which is really hard to do. It's really hard to take people who are focused on advancing the cause of reliable and

effective electric delivery, and get them to get into this other space. But I think that's one area where I think we might hopefully be able to make a contribution.

MR. COWART: Merwin.

MR. BROWN: Merwin Brown, CIEE. My remarks are sort of going to, I hope, tie together comments about the ARRA efforts, and the developing new regulatory models for the 21st century. And they go back to what I see as an issue, a gap, which is a lack of monitoring of the distribution system. Transmission is pretty well instrumented, and we know quite a bit about it. But I would say that distribution systems are pretty much in the dark. ARRA gave us some opportunities for some targeted instrumentation; for example, a photovoltaic power plant may have been installed, and it was heavily instrumented down to one second data, kinds of things. But for the most part -- and another thing I would add to that is, unlike transmission, it's very difficult to pick relatively few samples and monitor it, and

then extrapolate it to others. In distribution, almost every feeder is its own individual feeder, which makes it even more difficult to know how it's going to behave. And so, I guess what my message is, is that we ought to be thinking about a way of encouraging and expanding fairly rapidly, the monitoring of distribution systems to know what is going on out there. Are there things going on we don't know about, and if we were to monitor them, that up until now it didn't matter. But as we start reducing the inertia on the distribution system, and we start networking, as Billy said was happening, and I think it is already. There's networking happening just by tying some feeders together for emergency situations. So, that's my comment. What my point is, is that as we try to develop regulation responses to what needs to be happening, a lot of that, I'm concerned, is going to be done without understanding the ramifications, because we don't know how the distribution system is going to behave. I might add also the modeling, per se, is

in its infancy, I believe, for distribution, and we're going to need the data for that purpose too, to develop the new models for distribution.

MR. COWART: Carlos?

MR. COE: Yeah, I would like to do this same as before, and say that we lost some key members of our writing team. Distributing energy storage is a fascinating topic. A lot of people are concerned there are not experts in that area. It doesn't matter. Good writers are good writers. I think we have plenty of technical experts. We just need some good writers. We also lost our regulatory folks on that side, so again, I'd like to call out for anybody interested in that category, to see Wanda or Merwin or me, to kind of throw your name in that hat.

MS. REDER: Maybe we could send a sheet of paper around with these different opportunities, and do some recruitment by folks signing up.

MR. COWART: I encourage you to write the piece of paper in a really inviting way,

before we circulate it. Any other comments, questions on this topic?

MS. REDER: All right, thank you.

MR. COWART: I'll just add one thing. I think I'm repeating what's already been noted, but it seems like one of the challenges that we're going to be facing, is in valuing what distributed energy storage technologies can provide in certain circumstances. You know, this question of what's it worth, or what are we willing to pay? What should we be willing to pay, and who should pay, is present in this topic, as well as in the distributed generation topic, that we discussed yesterday. So, to the extent that the working group can point people to valuation studies or help even frame what evaluation study we'd have to look at, that would actually be a good contribution. I think the folks who are struggling with how to pay and who should pay, need to understand better, and we need to learn as we go, I guess.

MS. REDER: Yeah, I think this value of

service, when we look at the customer part of the equation, is an aspect that we really haven't had an easy way to incorporate it into our decision-making. And that was one of the unique pieces that Laney brought to the table, is using the ICE model and a filing, to help prioritize their incremental investment decisions. And that being said, there is certainly an opportunity for improvement. So in the ICE model, I know DOE is working along those lines. Certainly one aspect of that is the emergency facet, but, you know, there's a lot of incremental work, I think, in terms of location specific and residential versus commercial, criticality of loads. They can take that a lot of different directions, but at the highest level, the essence is, how are we incorporating the customer's perspective into our decision-making, as it comes to the infrastructure and using that infrastructure to propel us into the next century, especially given the digital dependency that we have on it. So, you know, I agree. This is a tremendous opportunity right

now, especially in the regulatory paper, to try and change our paradigm a bit, because how we've been doing it, looking in the past, certainly isn't the methodology that we need to springboard into the future. Good point.

MR. COWART: Granger, and then Carl.

MR. MORGAN: On the valuation issue, I mean a further complication, of course, if you just ask consumers questions about willingness to pay, it's really hard to get them into the mindset of suddenly I've had a widespread blackout. There's a lot of consumer surplus associated with those first few kilowatt hours, and people typically don't think very much about that. I mean, we pay in excess of $100 a kilowatt hour for D cells for flashlights. So, the problem of valuation in contingency situations is a really tough one.

MR. COWART: Carl.

MR. ZICHELLA: Yeah, one thing that -- in talking about distributed storage, and more generally, yesterday there was quite a bit of

conversation about how impossible it is to really predict the future and things that will change, the paradigms. That's happening in this space, probably as much as anywhere in our business. And it occurs to me that the work that we're doing right now, to provide some recommendations about the technologies we know about, are really -- it's solid work. And it's a good analysis. But the thing I think we might want to start to try to put our finger on a little bit more, are the emerging technologies that aren't in that bundle, that aren't seeing recommendations. There's really incredible work being done out there at major universities, new chemistries, mechanical applications. You know, compressed air and hybrid storage solutions that we're not really looking at. I'm not saying that we should right now, because they're not quite practical. They're not being commercialized. They're not in the mix yet, but we should begin to put our finger on some of these things that could be the thing that changes electricity storage. And we saw a number of

factors drive photovoltaic prices down 60 percent in three years, changing the entire industry. You know, unconventional gas -- these things happen very fast, and I just have a sense that storage is moving forward on so many fronts, that it may be good for us to start thinking -- this is maybe, perhaps for Pat to think about too, is basically a survey of the merging technologies and what's out there. They have MIT and Harvard working on new chemistries. It just seems to me that this can change very quickly, and economics could change very quickly, if some of those things pan out. So, I just offer that up as something I don't think we've put our finger on quite enough.

MR. COWART: Chris.

MR. SHELTON: Chris Shelton, AES. I think I want to reflect the comments I was making yesterday, and maybe make an example, that I think relates to several of the previous comments. But I think we have an opportunity, and I think it's incumbent upon us to think about the high level aspects of these systems in a very abstract way.

It's the only way to design a system that has to have so many different specific outcomes, right? You have all these different regulatory constraints, as I mentioned yesterday. And I mention them as constraints, not to have the negative connotation, but to have it as, you know, when you're designing something, you usually need to know what the constraints are of your design. So to have a good design outcome, you need to know what your constraints are. And one of the constraints we have -- several subindustries have, is they're trying to deliver resources in a distributed fashion, be they solar or demand response or storage, or combinations of all of those, is they do have different regulatory environments that they have to serve in. And they have different technology evolutions that need to happen while they're serving in all those different regulatory environments. So, I think we really do need to encourage a system design that anticipates that, and that can evolve independently of technology and regulatory

environment. And it might seem impossible, but some incredibly visionary people in the sixties, designed a thing called TCPIP for the internet. It's a transmission control protocol and internet protocol. It had many different regulatory environments since the sixties, and every phone in this room uses that exact same protocol that was designed fifty years ago. So, I think we have the opportunity in the electricity realm, to do something similar. Obviously, DOE is the place to make that evolve and grow at this point. So, I think we have an opportunity as advising that, to do something similar in this realm. It won't be exactly the same. It won't be completely analogous, but we have a similar body of constraints, that they were designing for specific outcomes. And a lot of their design imperative was similar to what we're looking for. They wanted to design a national, global system that was impenetrable, resilient, you know, something that could evolve and expand on its own. And they were incredibly successful in doing that. And

we're all benefiting from the work that they did. And the work that they did, actually enabled and inspired regulatory change as well. So, it's a function. So that design, I think, became a function of change that happened in the nineties in the telecom industry, where we had a lot of regulatory change in telecom.

One last thing I wanted to add is, you know, if you think in that abstract way, then you can allow for evolutions in the regulatory environment. There can be a diversity of regulatory environment and structures and rates. Ultimately, it's incumbent upon a regulated monopoly. We tend to use that term, regulated monopoly, but I think the other way to look at it is that those companies, and their investors, have a franchise. And, you know, have an obligation to serve. And they have an obligation to serve in the future, not just in the past. And their regulators and their investors can help them figure out how to serve in these different futures that are going to come. So, I think a lot of

times we don't always realize and think about it. You know, the utilities and the regulators in each state have an obligation to serve, because they've set up franchises and monopolies to do so, and they have protections to deal with these evolutions. Thanks.

MS. REDER: Any other comments? Okay, good. I appreciate your feedback.

MR. COWART: I'm going to ask a question. In addition, it is not as thought provoking as TCPIP for distributed resources. By the way, I love the analogy and I am really taken by having to think about that. And that goes to the question, following up on Granger's point, about what these resources are really worth to end-use customers. And what we would learn if the value of distributed resources to end-use customers could be revealed more clearly. And the question that comes to mind is the ability of end-use customers to use either storage or self generation, something besides a Honda generator, say a PV panel during an outage. We have these

rules in place that basically require all those panels, all the rooftop systems to be shut off as soon as the grid is not supplying adequate support. And to my knowledge, there's not an option. I'm not aware of a regulatory option somewhere that says to the customer -- oh, there's a different option here. You can disconnect your system from the grid and then self supply. And it seems to me that if customers could disconnect and self supply, during periods when the grid is down, that that value would dramatically increase the number of customers who actually would say, hey, I'd really like to have that installation because that's a serious added value to me. So, am I wrong in that point, and is that a topic that is relevant to the smart grid subcommittee's work, particularly in the regulatory policy part of it.

MR. BALL: Billy Ball, Southern Company. I'm not really sure what keeps a customer from doing that. It's a switch. I mean, customers who have back-up generators that you can buy from Home Depot, Lowes, anywhere, they do that all the time.

It's just a switch. When the power goes out for safety of the electrical workers, the switch throws the generator cranks, and just like the commercial on TV, they keep vacuuming, and grandpa keeps dancing, and (laughter), so I really don't know. I mean that happens today. It may not happen with regularity with other types of self-generating devices, but I don't know why it couldn't. I'm not sure there's anything missing there, any work to be done.

MR. COWART: That would be terrific if it were widely known, but I've been told that in lots of jurisdictions, the interconnection requirements for net metering customers do not allow it.

MR. SLOAN: Tom Sloan. I was going to pursue the same line of comment that Billy just did, because we're already doing it, particularly for the larger customers with interruptible rates and such. But the underlying question you're asking about -- what is the value to the customer, I think can be expanded. What is the value to the

utility, if that customer can self-generate. And I'm thinking of some things that are going on -- discussions at least, that are going on in my state, where the National Guard is looking at putting rooftop solar on their armories. Their peak load is on the weekend, which is non-traditional for the utilities. But allowing the utility to manage their output, Monday through Friday, which would provide a benefit to the utility in meeting both its peak load, and its renewable demands and such. So, I think that there's some customer benefits there. Some utility benefits that should be captured as we look at this stuff. Beyond that, I don't know whether we can get at the value of a micro-grid impact on customers who cannot take advantage of it -- the low-income folks, or people my age, who aren't going to make that investment, because we have to pay for our nursing home rooms coming up. But is there a value for storage that indirectly impacts those of us who don't directly participate.

MR. ROBERTI: Paul Roberti from the Rhode Island Public Utilities Commission. So this is an area where -- to me it's in the center of that new frontier, trying to triangulate on exactly what makes the most sense, bringing economics and what resources are available. So, I always back up and say, what would I do as a customer? Tropical storm Irene had the longest outage for a week. And reflecting back on that, in the event that that outage would occur with the next, we call it the next storm of the century, because that seems to be the lingo we use these days. And as Jim said, all I have to do is write a $4,000 check to have the generator put in, and have that power supply, without any capacity factors, without any voltage issues. And as I probed in this issue, I was out in the Sandia National Laboratories a few months ago, and went into their solar facility, and was pressing all these questions. And there's these engineering issues that crop up when you look at the distributed renewable generation, as opposed to

more conventional type of back-up generation. And one gentleman finally said at the end of the day, it's not going to kick on your compressor. We saw some data on that yesterday. You're not going to run your central air-conditioning. You may not get your furnace started to get hot water. You may keep your refrigerator going. So there's all these engineering issues that, I think when you factor in, where do you really want to be when that next storm comes in, I wrestle with that issue. You know, maybe one week without electricity isn't so bad, and all the NERC standards, there is this built-in consequence of not guaranteeing 100 percent electricity all of the time, even outside of the storm context. So, you'll find out that these are my first comments on this committee, but you'll find out that I'm more of a pragmatist on some of these elements. And I don't know the answer to it, but I certainly think about this question often.

MR. COWART: Let's go around this way, Barry, and then (inaudible).

MR. LAWSON: I just wanted to -- I believe clarify something. Having a back-up generator, is not the same thing as net metering. We seem to be equating the two. Having a back-up generator as Billy discussed, involves opening the line between you and the utility to protect the line crews during an outage. Net metering is selling back into the system. That's not what most people are interested in doing. They're just interested in having their lights, their refrigerator running, during some sort of event, whatever the event is. So, I think we need to be careful not to try to mix up net metering and back-up generation too much. Even if we didn't intend to do that, I think we can confuse a lot of people. It's not rocket science to have back-up generation put in. People in my neighborhood have it now. I don't. I work for the industry. I'm trying to remain strong. (Laughter).

(Inaudible), but let's try not to confuse those terms. Thanks.

MR. COWART: Just to be clear, I wasn't

confusing those terms. I was trying to raise a question about an additional value that could be offered to net metering customers, without having to go out and buy a Honda generator.

MR. CURRY: Just about a minute-and-a-half on the economics of a company like Solar City -- the net metering portion is the last one in. The first is the tax benefits that accrue from investment tax credit. The second is the accelerated depreciation that only a corporation can take with the kind of breadth that a major solar distributor can work with, which is roughly 15 percent of total. That's from tax credit (inaudible). The net metering portion is what puts it over the top in many states, and permits the offer to be, no money down. So, while net metering -- and I take the point that Barry made in terms of confusing things, but when you look to the spread of this, and the economic justification for it, that metering is a very significant component of the business case for rooftop solar.

MR. COWART: We take the rest of these comments, and then we'll turn to the panel.

MR. BROWN: Merwin Brown, CIEE -- maybe to add to the confusion -- I think the issue was not an issue of confusing the terms of net metering versus emergency power. The difference is to me, the issue of using your photovoltaic system that is tied to the grid, and you are net metering, to use it as an emergency supply, there's a distinct difference with the emergency generator in two factors. One, that's already been mentioned is that the emergency generator, the Honda generator, has storage built in, in the sense of its fuel, and as Sandia says, without something like that, it's difficult to get things like HVC started, and it's also difficult to maintain any kind of high level of power use, if you've got your supply going up and down, and up and down, which photovoltaics tend to do.

The second issue, that I think isn't a big one, is it's one thing to be able to develop a system where -- if the power goes down, and you

want to put an emergency generator on it, it can easily be isolated from the grid for sure. But if your photovoltaic system is already on the grid and running when the power goes down, I think it's doable, but I think there's a lot more concern about, can you isolate it and make sure it's isolated, while it's purifying your emergency. So I think there's the issue. And I think the technology needs to be able to convince the regulatory bodies and the safety people that that's safe. So, to me, that's the distinction.

MR. BOSE: I think Merwin pretty much stated, what I was going to say. And it goes back to what Granger said. That the value to the customer during a contingency condition, is much higher than the value to the customer of just paying the time-of-day rates. You know, the story that comes to my mind is that when India had the blackout with 600 million people out of power, the actual numbers of people that felt it, were much less. That's because about 300 million of those didn't have electrical connections anyway. And

the people who lived in the big apartment building in Delhi and Mumbai never felt it, because they thought it was just a usual rotation of their blackouts. And their diesel generators kicked in, and they were just fine. So, to calculate the value to the consumer, you know, you can do the engineering analysis, and come up with the dollar numbers, but it really will not have any connection to what will actually happen. But as people are going to get diesel generators, you're going to live on an overhead distribution feeder out in the country. I mean, that's just sort of standard. But I wanted to make a point about the internet, and the value of R&D. You know, being an academic, one needs to do R&D that will lead to paradigm shifts. But it doesn't help to look back and see which are indeed efforts that got us into paradigm shifts. Because there were whole bunches of others that we did R&D on, that didn't get (inaudible). And in fact, there are still lots of technologies we've been working on for decades, which is still 20 years in the future, and after

billions of dollars spent on it. That doesn't mean we shouldn't be spending money on it, we have to also do R&D, which says, what would happen if that paradigm shift didn't take place, and we still have to live without storage devices that are not in the $500 range. That is, what is the penetration of PV going to be that we can handle, if the storage solution doesn't come about in that timely manner.

MR. COWART: All right, thank you.

MS. REDER: A great lead in to our panel.

MR. COWART: Back to the panel. Thanks very much.

MS. REDER: All right, I'm feeling better, now that I have four of four panelists here. So we can get started on this distributed energy storage panel. As I mentioned earlier, this is a contribution to the white paper that's in development. Carlos Coe is actually chairing that white paper, and welcomes your incremental authorship, I am sure. But anyway, this is a

joint effort between the smart grid and the storage subcommittees. This team was assembled because they've all kind of had their hands into doing it. We're well beyond the pilot stage, and we've been asking them, what are the lessons. What are you going through, and where do you anticipate going from here? And with that being said, what are the gaps, and what can DOE do to help facilitate moving through those gaps? So, pulling out of the DOE database, just to give you some sense of where we are from a storage perspective, there's actually 233 storage projects that have already been installed globally, of that, 368 megawatts of battery storage or 746 megawatt hours. Those are global numbers, but I thought it gives you a perspective, that there are actually a lot of installations out there, as well as here. So, we're not in a situation of trying to figure out how? It's more kind of figuring out what the future might hold and store.

I guess a little bit on the conversation around value propositions -- sometimes I like to

step back and think about our distribution asset base and kind of question. We put in a lot of distribution infrastructure, underground cable, lines, transformers and the like, that fundamentally are there to serve peak conditions, that happen very rarely, less than one percent of the time. So, if you think about it, it gets back to Tom Sloane's comment on, what is the value on the utility side to increase the utilization. You know, to actually think about, how do you use the infrastructure, so the utilization is higher than what it is today. We have a lot of vulnerability in those peak conditions, as you well know. So, I think these kinds of questions get us into a different mind-set than our traditional design. And I really like Chris' comment about, what can we do in order to think about this infrastructure like the internet, where there's so much flexibility that we don't have to go through all of these hoops, in order to facilitate this local interconnection. That's the kind of thinking that I believe helps us facilitate where energy storage

has a play in this marketplace, is actually trying to transform the grid, so it can be an interconnection type, like the internet. Certainly we had many references yesterday, that storage could help us manage through the duck curve, and I know that both Mel and Tom Bialek will have their various perspectives, both on the regulatory side and the implementation side, of how energy storage has been doing that in California, and the visions going forward. From my vantage point at S&C, we've certainly been involved in a lot of these installations throughout the country, and actually globally. And I think some of the topic that come to mind, more from the supplier side and the services side, are topics like, how do we integrate and control to meet the needs, i.e. protection, interconnection, demand side, micro-grids. Where are we at in terms of standardization requirements? It's just right for figuring out, you know, where we go in the standardization front. You know, there's life expectancy

conversations here on the power electronics' aspect, and how that dovetails in, to what we've grown up from a power system's perspective, so that kind of alignment, we need some work on. I think, you know, obviously the market and the policies, i.e. jurisdiction, incentives, rate recovery, asset classification, all ripe for conversation, right? Certainly this grid friendly aspect, and how do we make this stuff really user-friendly is a piece. And then I think it was Merwin, that talked about monitoring aspect. You know, there's a lot of work that still needs to be done on the monitoring, the condition-based maintenance, foolproofing this stuff, if you will, and taking advantage of, not only the functionality, but also being able to give us visibility to better manage going forward.

So those are kind of my high-level comments, to kick off the panelists here, of which we have four very esteemed folks. I'm certainly glad you made the time to be here. Thank you very much. I know it takes effort to do that. Will

Fadrhonc is actually with STEM. He'll be our first speaker. And he's the manager of Grid Solutions there. This is actually a situation where there's a commercial application, using storage and figuring out from a market perspective, how to be an aggregator. Will has experience in distributed storage. As a resource in the broader power systems, focuses on market development, policy, and utility relationships, especially as it relates to distributed power. And also, you know, a lot of his background came from time in Ahlsten, when he was involved in wind power there. So Will will be our first speaker.

He'll be followed up by Tom Weaver. Tom is at AEP, where he's had most of his career. Currently the manager of distribution system planning at AEP. AEP put in a lot of the early storage systems, so Tom will be talking about that. He's had a long experience with system planning, network planning, and engineering fundamentally in distribution systems there at AEP. Our paths have crossed many times at IEEE,

where he's been very active (inaudible) as well.

And then Melicia Charles, or Mel, is actually with the California Energy Commission. She is an energy advisor, and of course, a lot of our front running policy is coming out of California. So, we'll hear the thinking around, can the mandate for storage in California, and where that's headed. In terms of her experience, she's had a lot of background developing policies and programs related to solar, and also to distributed generation and energy storage, and has served on a consultant on evaluating programs. And also supervised the California PUC's customer generating programs, which oversees the California Solar Initiative, self-generation incentive program, and the net energy metering policies. And we talked a little bit about net metering earlier, so we can quiz her more on that. Get ready.

And then Tom Bialek, who's actually been with the EAC in prior panels is back again. So, thank you, Tom. Tom is the chief engineer at San

Diego Gas and Electric Company, and as you know, SDG&E has put in a lot of technologies in the smart grid space, and Tom has been in the middle of, not only thinking about the road mapping, but also the implementation thereof. He's got a lot of experience with smart-risk strategy and policy. He's been a principal investigator for micro-grid projects, and actually did some peer review work for DOE on the micro- grid projects. His background, of course, is in electric utility design, planning, operations, and has done numerous papers in this area. So anyway, I welcome the panelists. Thank you so much for being here. We'll just get started. Will, are you ready? Okay.

MR. FADRHONC: Thank you all. Thank you for having me here. It's great to be here. As Wanda mentioned, I'm with STEM. My name is Will Fadrhonc. STEM is a customer side energy storage and data analytics company, based in the San Francisco Bay area. We have an office right next to San Francisco Airport, if any of you guys are

ever coming through. We love to have people into the office. We can show you some of the hardware, some of the software demonstrations.

A little bit more color on STEM. We install energy storage systems behind the customer meter, primarily our go-to market is to operate as a peak reduction product for those customers. Commercial and industrial customers get charged, not only for the kilowatt hours that they use, but also the peak kilowatts that they use, over the course of a year. We tried to identify those peaks in advance, using data analytics. And as we see them coming, discharged out of our batteries, through the utility meter and the distribution system, seeing a lower peak demand on it. The result to that is savings to the customer on their bill. We can also aggregate these systems, as we install in a geographic area, and operate them as a network fleet, essentially created a virtual power plant, a demand response resource, or whatever you want to call it. We've got about 30 systems installed around the State of California.

A nine megawatt backlog, a pretty aggressive sales team, so that number is probably out of date by now. We've developed a storage finance product, similar to the solar PPA, which has gotten a lot of traction in the industry, because a lot of the smaller commercial and industrial customers don't want to lay the capital up front to actually purchase the system outright. This allows them to pay as they save. In addition, we've got a UL certified product, that you see here. These silver boxes, each tower we call them, is about the size of a gym locker. It's 18 kilowatts, 30 kilowatt hours, so you're looking at 54 kilowatts, 90 kilowatt hours of storage there, that's full AC to AC. It's about 1 1/2 square feet by 6 feet tall. So it's a very compact unit, and depending on how large the customer is, we can install more or less. So we can go down to 18, or we can stack up as many as you'd like.

There was a question earlier about standards and process. We rely very heavily on the standards' organizations like UL and IEEE.

It's the fundamental way to build trust between us and the distribution utility, in order to prove that can install and interconnect safely, in accordance with prudent electric practices, and that in the event of contingencies, our systems are going to operate accordingly, disconnect when we need to, stay connected otherwise. So there was another question earlier, I think, about the drop of the cost of solar over the last three years, going down by some 60 percent. We also find that standards are a great driver of that. Internally, we have an expression that we're building products, not projects. We don't like to get into large engineering projects, where you're designing things from scratch every time, and you've got a huge amount of switch gear, and you're pouring pads and cement. We just want a nice simple product that's going to fit behind a 50 amp breaker with a disconnect, and you can put that everywhere else. So the three-year drop in PV prices, it wasn't because we developed a new solar panel or a new chemistry, or a more

efficient panel, it's because we had a product, and we let the manufacturing world go out and, you know, and hammer on it and hammer on it and get the cost down. At STEM we've done the same. We've been able to pull about 40 percent of the cost out of our product in the last year, just since our certification.

So, I guess just to sort of (inaudible) a little bit, I think there's -- why we've been asked to come here, is that we sit in a slightly different spot on the system than a lot of energy storage. You can put it at a grid scale. You could be a pumped hydro facility that's sort of transmission connected. You could be in a substation. You could be on a pad, off the distribution feeder. We install behind the customer's meter, really at the last mile, behind -- on the secondary side of the transformer. So we are a low voltage product. We'll do anything 480 on down.

The reason that we've developed behind the meter product is really kind of threefold.

The first is from a power system perspective. The end of the system is really where you're getting the most value, in terms of resource development. So we're installing what's effectively a capacity resource in a customer's basement. And if you have access to that via web protocols through our cloud architecture, you can discharge those systems very quickly very responsively, and you're going to see load come off in the hardest to reach areas of the entire power system. We find that it's also cheaper, faster, and safer to be behind the meter. It's cheaper because we're a low-voltage product, so you don't need highly trained installers to go into a substation and shut everything down, try to pull something from 69 KV down to 480. All power electronics needs to operate at low voltage anyway, so we're actually just piggybacking off of the distribution transformers that are already out there. So instead of building more grid, we're just using the ones that are out there, a little bit more effectively.

Additionally, since we discharge into the customer load, we never net meter or export onto the system. We're just offsetting customer load. You don't get into the situation where you actually do need to build out more grid, upgrade a substation, upgrade transformers. Those get to be very, I guess expensive. And probably more concerning is uncertain projects, in that you don't necessarily know how expensive a substation upgrade is going to be, until it's fully done, and everybody's been on site and left. And so if we can avoid doing that, we're glad to do it. It makes it a financeable product, which is important to us, and important to our customers.

And then lastly, we think it's a great way to get customer participation, even if just financial participation in the power system, without avoiding (inaudible). So that's, I think, one of the biggest concerns that people hear about net metering, is that solar is a volatile resource, fuel cells come one and come off, and all sorts of distributor gen has those same

problems. If you're spinning the meter backwards and you're injecting current on the distribution system, that has an associated cost with it, that the system was designed and is operated to be run safely with current flowing one direction, we think we can do all of the utility use cases that we see, without spinning the meter backwards; and therefore, without shifting costs from a customer that has storage to a customer that doesn't. We also avoid circuit saturation issues in that way, in that we don't get into 15 percent penetration -- only 15 percent of customers on a feeder can have storage. If you're not net metering, that's no longer an issue.

As I mentioned, our primary go-to market here is offsetting customers' peak demand. What you see here is a graph of a disaggregated utility bill, or actually the summation of the three investor-run utilities in California over the last ten years. We looked at ten different rate tariffs that the utilities offer to commercial customers. We broke it down between demand

charges and KWA charges, and we overlaid customer-load profiles to see, how was their bill changing over time. And when you aggregate it up, it's probably only one or two or three percent growth per year, but what we see is all that growth is coming from the demand side. Things like cheap natural gas, you know, the second kilowatt hour of storage is pretty cheap. Those are driving the energy costs down, but meeting peak and having a power resource has actually increased pretty dramatically over time. So that's where we see the energy storage being the most valuable is in, you know, at least currently being operated as a power resource. So this is just an example of the particular use case. This is a customer -- we installed -- right there, that's, I think December 12th, and we've been operating at that customer site since clipping peaks here and lowering their system. So again, you'll see that we're not pushing power pack to the system, but we're manipulating the customer load, according to the tariff. So this is -- from

a regulatory and a utility perspective, if we think of the tariff, not just as the rate recovery vehicle, or the way that we collect the money back that we're owed, but rather as the economic signal that we're sending to all of our customers, hopefully to have them respond to -- we see that, you know, this is the outcome that we found for customers, or for commercial industrial customers. So this is just a blown-up view of that.

As a utility resource, once we install our systems in a given geographic region, we can aggregate them. We have very high level telemetry down to the box, in sort of a subsecond response time. Actually, just last week we qualified our resource in San Francisco at a couple of different customer sites with the California ISO. We've been participating, bidding in the day-ahead energy market there. And so we're actually now doing it. We're using distributed storage to provide wholesale value, in that we've had a very fast responding, local capacity resource. Again, no upgrades to the transmission system. And

there's a lot of other things that can go. If we have a partnership with a utility or even just an energy trader, we can provide a lot of hedging against volatile swings in the five-minute imbalance market, and the hour-ahead market, all the way up to that -- because we're getting this very quick response, highly localized resource. There's a lot you can do with that, from a trading, risk-management perspective that we're pursuing.

As I mentioned, we're a California company. We're there for a couple of reasons. Thanks to Mel and Tom for their work and the organizations they represent. But we like California, because it's -- we have incentive structure, so there are programs like the self-generation incentive program, which was a program that was born really out of the California energy crisis in 2002, 2003, where they realized that having distributed generation, improves system reliability a great deal, because you're N minus one, N minus two criteria really diminishes

a great deal as you get a very robust distributed network of systems. So the result of that was this incentive program called the Self Generation Incentive Program, which as of about two years ago, has included energy storage as part of that.

We have very progressive utilities. Utilities who have been on the forefront of things like solar interconnection. So there -- on the distribution side, they're professional at installing, distributed power electronics based resources, primarily solar and fuel cells. But now they're starting to see a lot more storage, and because we don't have to fight a lot of the same fights around UL or standards, we've been able to interconnect very rapidly in all three of the investor-run utilities in California. It's California; we have an early adapter culture. We're in the heart of Silicon Valley, STEM is. So there's a lot of early adapter customers. For us from a talent perspective, the lion's share of our technology is on the software side. We really think that energy storage is a software problem,

not necessarily a hardware problem. So our technology team is full of people that should be working at Facebook and Google and Amazon, but as our VP of technology says, they wanted to come work for us, instead of selling more socks. We love California for a lot of reasons. That said, there's certainly a couple of changes that we think could help push distributed storage, distributed resources, really the distributed grid, because we do see -- that being the case, in terms from a contracting perspective, from a reliability perspective, there's a lot of value to a robust distributed network.

I'll focus on this last bullet here, which is -- I think that's what will make this distributed resource industry really explode, is how do we get the utilities on board with this? How do we have them make money? STEM certainly doesn't have the answers for those yet. We've got a resource that looks and acts and contracts a lot like everything else that they've seen. And we've done that purposely. But we need to make sure

that this is good for (inaudible), is good for shareholders, good for the system. So if anybody has thoughts on those, I would love to hear them. I think we'll be glad to take questions at the end of the panel.

MR. WEAVER: Good morning. Thanks for the opportunity to talk about energy storage and what we've done at AEP. We actually have been a leader in applying energy storage, and I'll give you a couple of examples. During the last few years, we've kind of taken a pause. We did a lot with NAS batteries. We started into the community energy storage world. And all of this with the expectation that costs were coming down. They really haven't come down the way that we expected. So, I think the state for us is, we've learned a lot about how to apply storage. We're still learning how to get the full value out of storage. And just recently, we've kind of renewed our interest, somewhat due to customer inquiries, somewhat due to the type of discussions that are taking place here. So I think it's very timely

for me to be talking about storage and hearing some of the developments across the country.

So in the interest of time, I'll just briefly mention a few highlights about AEP. We're no longer the largest distribution company in the country, but we're among the largest. We have 5.3 million customers, and from a distribution aspect, one thing that's really important is we have 5,500 different distribution circuits. And also significant is, we operate in 11 states. So, we get to work with 11 different states. We get to learn a lot from state to state, and that's typically a good thing.

I'll just briefly go through some of the history of energy storage at AEP. We started doing energy storage years ago. We had our first pumped hydro down in Roanoke, Virginia. I don't know the exact date, but I know it dates at least back to the seventies and probably back to the sixties. So we've been in the storage business for years. We were the first to apply sodium sulfur batteries in the United States. I'll tell

you more about that first installation in a minute, but we have four, actually five, installations in place. And we've been working on community energy storage. And we're still learning about that, but we believe that it has a lot of value in the future, and it spreads the benefits across customers and the utility.

So just a little bit about NAS batteries. I'm not going to go through the details of how sodium sulfur batteries work, but they do operate at a high temperature at 300 degrees. And when they're charging or discharging, they still operate at 300 degrees. Now, if for some reason, they get completely discharged, you must maintain that 300 degree temperature. So we have to have heaters in the battery compartments to make sure that if they do get discharged, like if there was a massive outage, and we didn't have local power to keep them charged, then we would have to invoke these heaters, to keep them at 300 degrees. They're pretty efficient for a battery system. Their

round-trip efficiency is, I believe it's like 75 percent, which is pretty efficient for a utility scale battery installation. Our first installation was in Charleston, West Virginia. It was a one megawatt battery. Its main purpose was to help us defer building a new substation. We had a substation that was reaching overload, and we had a new station in plan. We found that we could defer that station at a cost of probably 3 to 4 million dollars. We anticipated we could defer that for four to five years. I think we actually ended up deferring it seven years, so we got a lot of value out of that battery. No even with that value, it didn't fully justify the cost of the battery. So we're still looking for, what's that added value? What else can we do with that battery? Since then, we've put in three, two- megawatt units, one in Ohio, and one in Indiana, and one in West Virginia. We also have a four megawatt battery down in Presidio, Texas.

Here's a picture of a NAS battery installation, and -- here somewhere. I want to

point out a couple of things. The large, tall units you can see, are two, one- megawatt NAS battery compartments. They're pretty big. It's roughly the size of a tractor/trailer and a little taller. In the front you see the label PCS. It's basically the inverter string. That's what takes the DC power to 480 volts. Then there's a transformer that takes it from 480 volts to our primary voltage. You also see a gen set there. That's the generator to power those heaters, in the case that we have a total isolation of this battery location. Part of what I wanted to point out here is the difference between the battery cost and the installed cost. That's one of the realities, I think we need to make sure we're dealing with, when we talk about cost. A lot of people, when they talk about batteries, they just talk about the battery cost. But when we're looking at value, we've got to look at the installed cost of having that battery available.

I won't spend a lot of time on this, but you can see there -- if you look at the top chart,

you see a load graph, hovering around 20 megawatts at peak. If you look at the red line, that's the lowered peak, because the battery was supplying part of the power. And if you look in the next time frame, right here, the peak would have been this much. But because the battery is discharging, the peak is only this much. Our limit was 20 megawatts, and we were able to maintain that limit. Then at night, the battery charged. You can see that it added load at night, but it really didn't hurt anything, so, a very good cycle.

I like to use this slide to point out some of the customer value of the islanding features we can do with these NAS batteries. This is the town of Churubusco, Indiana, population about 1,800. It's got a city office, a fire station, a post office, all those things that a small town has. We can island the whole town. That's pretty cool. Fortunately, since the battery's gone in, we haven't had the opportunity to island the whole town, but we can if we need

to.

Well, let's move on now and talk about the concept of community energy storage. You know, applying these large batteries, basically in a substation type environment, is really good, and you've seen the value of what we can get from that. We think we can distribute that value closer to the customer, by using smaller units. And the first units that we're testing are only 25 KVA, but they would typically be applied in a place where maybe you're serving three to four customers. And they're connected to the secondary. Again, closer to the customer. So, you get unique benefits for the customer, and if a customer has an electric vehicle to charge, it works very well with that. And it can directly interface with customer-owned renewable resources. We could also do demand control through contractual integration with a home area network.

One of the complications that I think the industry is still dealing with is, if you have an outage, and you're going to use these batteries

to restore the customers for a period of time, how do you control who uses what power, and who drains the battery. If one guy's got his television, his beer cooler and everything running, and the other guy is sitting there with one light on and charging his cell phone, is that fair. So, one of the things we have to come up with, is some way to equitably allocate that energy.

Here's the concept that you have multiple CES units, each serving mobile homes. The specifications -- these are available on our website at aeptechcenter.com. We had a lot of help in developing these, but I think we took a leading part in developing those. I know we worked very closely with S&C and EPRI, and those specs -- I'm sure they're being tweaked today, but the basic specs are out there.

Well, a little bit more about the local benefits, back-up power, flicker mitigation, renewable integration. When you look on the utility side, if we have a fleet of these -- if we had 80 of these at 25 KVA, that would be our two

megawatts, similar to what we had in our station deployment. So, with a controlled hub, we could then do load leveling at a substation level, power factor correction, and ancillary services.

I'm not going to go through this slide in detail, but it gives a vision of a layout, that could make a lot of sense. A CES unit and then a DC bus, where customers' energy storage, customers' renewable -- all those things that operate on DC, electric vehicles, could be connected directly to a DC bus. Think about the efficiency we gain here, when we have less inverters in the line. So again, I don't know that anybody is doing this yet, but the concept is there, and I'm sure we'll be doing it soon.

Okay. The drivers for energy storage -- peak load shaving and leveling. This was early main driver. We did some studies of some additional installations, when we were thinking we would put more NAS batteries in. And we found that the peak -- the deferral of capacity projects would get you about 20 to 50 percent of the

justification for putting in a NAS battery. We never found a project that would fully justify a NAS battery, just by deferring a capacity project. So, we've always known that we need to find some additional values. Another value is islanding of a load area. It's very hard to put a dollar factor on this, but it can be done. Just an interesting story about islanding. I told you about Churubusco, and we haven't had the opportunity there. Down in West Virginia, near Milton, we have a battery that has islanded several times. And the most interesting one was during a major snowstorm a couple years ago. Almost all of the feeder was out. The only section that could be restored was the section closest to the battery. And there were only 25 customers in that section. We were able to keep those 25 customers on for two days. Of course, everybody was driving up and down the road, wondering why those customers were on and they were off. But the battery did its job. Smoothing the variability of solar and wind generation,

energy arbitrage -- you can charge at lower cost and discharge at higher value. And ancillary services -- frequency regulation, spinning reserve. We have yet to tap those. We're still trying to figure out how to do that, and we think that's the key, to filling in that gap, between what we can get from the deferral value, and we can close that gap and beyond, we hope, with some of these other values.

Balance and cost of benefits -- energy storage cost is still high. We know it's coming down, but it's still high. Energy density needs to improve. These things take up a lot of room. Utilities need to find the full value of energy storage. I know I've mentioned this several times, but it is really key. T&D referral is the easiest to calculate, but varies greatly. Other values, such as energy arbitrage, frequency, enhancement of variable energy sources, do not have identified dollar values yet. We're working on it, but we're not there yet.

I put this slide in to recognize that

some of the work we've done, has been funded by DOE projects, so we typically put this slide in.

Wanda asked us to mention things, we thought the DOE and this group, could do to help. And after hearing that, I put some down that aren't on the slide. Obviously, one is cost. Help us in the industry find lower cost ways to do this. Not only the battery costs, but the installed costs. Help us identify and capture value. And when we do that, we reduce uncertainty. And we heard just a little while ago, one of the biggest threats for the utilities is continued uncertainty. Anything we can do to reduce the uncertainty around energy storage and these other things, is bound to help.

And lastly, help education the public and the folks who are driving toward a new energy policy. Help educate on the realities. Things like -- we can't just talk about battery cost. We have to talk about installed cost. We can't talk about solar as a 24-hour-a-day source. We can't talk about solar as a source to start your air

conditioner and run your sweeper, unless it's a really, really big solar, with a lot of storage behind it. So, if you can help us with those realities, I think we can really make this work. Thank you.

MS. CHARLES: Hi everyone. I am Melicia Charles. You can call me Mel. Thanks for the opportunity to be here. I actually sat in on some of the meeting yesterday, just to understand what you guys do and understand the conversation, and it was really educational and helpful for me, especially since often I have tunnel vision, because I work from the California perspective. So it's really good to hear the conversation, when it comes to the national perspective and the broader perspective.

I'm here mainly to talk about the storage mandate today. And so I'm going to take a step back and just talk about our procurement target, and some of our thinking behind it, how it works, and where we are now, and where we think we're going. Some terms of the CPUC, long

statement -- we do a lot of things. We regulate the transportation industry, the telecommunications industry somewhat, and the water industry, in addition to energy. When it comes to electricity, our mission at a high level, is to provide safe and reliable electricity at affordable rates.

In terms of who we regulate, we regulate the investor-owned utilities. The large ones being Pacific Gas and Electric, San Diego Gas and Electric Company, and Southern California Edison on the electricity side. We do strive to be a national and international leader when it comes to energy. We have a number of aggressive initiatives when it comes to renewable energy and energy efficiency and now energy storage.

Our decision and our mandate -- so, it all started with state legislation, AB assembly bill 2514, which was authored by Nancy Skinner. It basically directed a CPC to adopt procurement targets for energy storage, if appropriate, and for us to reevaluate our determinations every

three years, and include future RPS plans to comply with the storage decision and mandate. So, once that bill was passed, we actually had a lot of activity that started before the mandate, and that included establishing a framework of storage applications and use cases. It included 21 use cases, end users and seven use cases including voltage support and EV charging. And looking at different types of storage from a policy perspective. We also identified regulatory barriers, including lack of defined interconnections rules, which I've seen is a big part of the discussion yesterday and today, which is great. And lack of a cohesive regulatory process, which we are trying to rectify with this mandate.

In terms of studies, I think somebody mentioned earlier this morning, that they wanted to identify some valuation that's happened. Both EPRE and KEMA did studies for the CPUC on preliminary cost effectiveness, evaluations of storage. And the storage proceeding has relied on

and continues to rely on stakeholders included STEM and other utilities, repair advocates, and non- profits, as we continue to develop our policies. And this has been a key piece for us.

So, last year the CPC approved our decision to establish storage procurement targets and policies for load serving entities. The large investor in utilities have a target of 1,325 megawatts, cumulative. 3/2020 -- the storage must be procured in four biennial solicitations, starting at the end of this year. PG&E and Edison have roughly a little over 500 megawatts and SDG&E, which is a much smaller service territory, has 165 megawatts. And the above targets are divided into what we call grid domains, the interconnection point, and that includes transmission connected, distribution level connected, and also behind the meter. And the non-utility loads of the entities, and that includes community choice advocators and direct access providers, have sort of a more -- it's not less stringent, but sort of a more high- level

target of one percent of their peak load by 2020. And we have basically a lighter, sort of regulatory hand over them.

In terms of the different use cases, I'm not going to go through all of this, but you can kind of have a sense of some of the use cases we identified earlier on, including voltage support, and EV charging, bill management. So you have a sense of the various options that we were looking at for storage to help support our systems. And in terms of procurement targets, again, I'm not going to go through all of it, but you can see it's divided up, not only by terms of targets, but also in terms of grid domain.

On key piece of this -- we realize the storage part market is a (inaudible), and we're one of the first to come out of the gate doing this. And so there's a lot of unknowns for us. And so for us, the flexibility is key. We didn't want to -- we're trying to strike that balance of having a mandate, but also not being overly prescripted, because we don't know what to expect.

So in terms of some of the flexibility we have, after solicitation, a utility may request deferment of up to 80 percent of the target, with an affirmative showing, either unreasonable costs, or an insufficient amount of bids. Deferments -- and then deferments again, will be added back to the next solicitation, and they are on the hook, the utilities to procure by 2020.

More flexibility -- if a utility does over- procure in one year, which would be awesome, it can be applied to the subsequent year. Utility can shift 80 percent of the targets between transmission and distribution grid domains. At this moment in time, we don't allow shifting in and out of the customer-side domain. The thinking behind that, was that we didn't want -- we wanted to protect customer side storage, and we didn't want any shifting out of it. But we have gotten feedback from various parties, that they would like that flexibility there, to allow for higher procurement targets in the storage domain, and allow the utilities to have that freedom. So it's

something that we've heard, and we're definitely considering, as we look to the future in making modifications. And no portion of the procurement targets can be traded amongst the utilities (inaudible). In terms of project eligibility, at a high level, the procurement target has these guiding principles. The first one is with optimization. We obviously want an optimized grid. And then, of course, integration of renewable energy. I heard the duck curve mentioned many times today, and I hear it every day. And grid reliability is a huge, huge, huge piece of this -- a priority for the commission, especially with all of the various policies we have. So, yes, integration of renewable energy, and then reduction of GHG emissions.

And then procurements and other proceedings and programs can be counted towards the target, so I will mention the self-generation incentive program, and the RPS program, and the various other proceedings and programs we have within the commission. If they are procured

within those proceedings, outside of the solicitations, they do get counted with the target.

And on pump storage, which is usually over 500 megawatts, is not eligible, unless it's under 50 megawatts. So, only small pump storage is allowed, and the reason they inclined that is because these targets are 500 megawatts at the most, 580 megawatts at the most for the larger utilities. So one pump storage project could consume a target. And we want to see some diversity in terms of technologies. And then to count against the targets, the projects must be installed and operational after 2010. So, to count towards the targets, all the projects must be installed after 2010, and they must be installed and in operation, no later than 2024. So procured by 2020, installed by 2024.

Some additional directives, basically the utilities were directed to submit their procurement applications by March of this year. And the (inaudible) solicitation I mentioned, is

at the end of this year in December. And basically, the plans did propose different types of storage resources to be procured, including the quantities and operational requirements. And this is not only for the CPC, but also in submitting these plans, it also gives some early guidance to the industry and the stakeholders, in terms of what the utilities are looking for. It also includes proposed procurement details and bid evaluation protocols.

Utilities can own storage, up to 50 percent of the storage across grid domains, and the CPC staff is ordered to conduct a comprehensive evaluation of the program in 2016 and 2019. And that goes back to the legislative directive that we look at the program every three years. And in terms of this piece, going back to your question in terms of what the DOE can do, we are going to have this comprehensive evaluation in three years. We are going to -- in between 2014 and 2016, we are looking at the program. We may make any modifications in the interim. And any

sort of support you guys can provide, in terms of evaluation, would be great. I wholeheartedly second all of the issues Tom mentioned, at the end of his presentation. Another issue for us that is a big one, is any sort of safety standards with regards to storage, and anything related to interconnection. That has been a big issue, which Will also mentioned for us. We're in the process of working through it, but it's not done.

And where we are now, the utilities were very good, and filed their application a day ahead of February 28th. We are looking at the applications. There has been a couple of workshops, stakeholders have filed their responses to the applications, which raised issues in terms of either efficiencies or modifications, or issues they would like to look at. And we are in the process of sort of working through those issues. And basically, we plan to issue a decision in the fall, that will either approve of modifications or deny the applications. And then the first RFO, a request for offer, is going to happen in December

of this year, as I've mentioned many times before. So, there's a lot going on, and we're just in the beginning of the process, but it's been an interesting one.

A couple of other things that I want to mention, in terms of procurement and other proceedings that do relate, is that Southern California Edison issued an RFO, late last year, on their local capacity requirement. A number -- like 500 I think, distributed energy storage bids were received, and Edison is likely going to request approval this summer for their list of winning bids. And we are not only monitoring best practices in this process for our own proceeding in our upcoming RFO, but I did want to mention, because this is about distributed energy storage, Edison did share with us their short list, and it was really interesting to see that -- we expected most of the behind-the-meter storage to be procured just broadly, throughout all proceedings, through the self generation incentive program, and the permanent load-shifting program. And we are

already seeing behind-the-meter storage projects in this RFO, so it will be interesting to see if we see a similar trend in our upcoming RFO (inaudible). And then we also recently adopted a decision on NEM, net energy meter and storage interconnection rules, because this has been a big, major sort of barrier and issue, that has been ongoing for the past few years. And so basically, what it did was establish consistent rules for interconnecting net energy metering projects, allowing certain fee exemptions and streamlining the process. And it's the beginning. I don't think there's more that needs to happen and more we're continuing to work on, but it is the beginning of us looking at storage and interconnection. And I think that is it. So, thank you very much.

MR. BIALEK: So, I'd just like to take the opportunity to thank you for inviting me here to present today. I'd also like to, along with my fellow panelists, talk about what we're trying to do, where we're trying to go. Not surprisingly,

we've been busy. We have a lot of activities, obviously, a lot of it in terms by regulatory policy, but not just from a regulatory perspective as well. We are working on our, as Mel talked about, our RFO for energy storage. December of 2014, RFO will be composed of basically 16 megawatts worth of storage, 10 at the transmission level, and 6 at the distribution level, for which we'll be power quality related at the distribution level. Another two will be basically market- type activities. So really (inaudible) really focused on market activities, with the other four being really useful power quality issues.

Storage is interesting. I'm not going to give you a lot of information here, but I'm going to try to spend a little bit of time -- we've been looking at storage for quite awhile. So we actually have installed units. We did look at all sorts of types, as Tom pointed out. This is Borrego Springs. It's a 500 kilowatt, 59 kilowatt hour lithium land battery that we deployed. The challenge in this particular case

-- we also looked at the sodium sulfur batteries in the desert, which was kind of interesting, because you would think with it really nice and hot in the desert, that would be really good. National power electronics are buried directly below the cells, and they're only good for 40 degrees Celsius, and in the desert, where we are, it's 50 degrees Celsius. So we'd have actually had to put this entire battery in an air-conditioned control room. Think about that. Then you add on top of it as Tom said. You've got to keep it hot, so now you're cooling it to keep it hot. It's really kind of bizarre. We've got some other ones deployed here. These are distributed (inaudible) storage devices that we've deployed as well. So we've deployed a number of them. And here's an additional level of which we are now actually in the process of installing. So, with regards to the targets that were set by the CPUC, effectively, we are, for the first solicitation are actually pretty close to being overprocured and oversupplied because of how the

accounting occurs. We do happen to have one of those lucky little 40 megawatt pumped hydro-storage that meets the 50 megawatt target, kind of unusual. But it's a relatively small reservoir. So these are units that are going in, but you can see here, pretty significant numbers. You can see who had quantities.

To give you a little idea of what these systems look like, this is one of the other alternatives. Sorry Wanda. We've looked at those two. The interesting thing is -- take a lot at -- well I'll just point it out to you here. (Inaudible) over a 50 KV (inaudible) service transformer. And the box standing next to it, is the actual -- in this case 3 KW 72 kilowatt hour in a storage device. So one of the challenges clearly, is for those of you who have never worked in the utility world, everybody says it's easy because we have easements, and the answer is not so easy. These will really get to be pretty big, and we've got a very aggressive undergrounding program in San Diego. We basically take anywhere

between 50 and 60 million dollars a year, converting perfectly good overhead conductors to underground conductors. And then what happens is, these green boxes show up, and nobody likes the green boxes. They thought they were getting a better view, but suddenly a green box shows up. They don't like that. So here's the other alternative. This is an S&C unit. You'll notice here, much more compact. We really sort of like these ones. This is in the desert. The (inaudible) storage unit is actually subsurface. So it does create a much smaller footprint. And so from a utility perspective, an easement perspective, that's actually very nice.

Now I'm going to show you what we have been using these for. Tom talked about PV integrated with (inaudible) and PV smoothing. So, this particular unit demonstrates the fact that you've got -- the red line is actually the load that's being measured at the actual customer facility. And this is a particular unit with a single customer. This is out in the desert. And

you'll see some negative values, and the fact is that he actually has photovoltaics, as well.

What you see here, is now you've got a smoothing out rim, that's actually occurring here. That's the blue line. And you see this now much more smooth, refined curve. So the question becomes at the end of the day, what do you want essential storage units to do? It's pretty clear with the power electronics. They are very, very flexible. They can do a lot of neat and interesting things, much more so than, you know, traditional devices, and in fact, we keep talking about storage is really the ultimate flexible device for utility. It's certainly one of the more expensive devices for utility. But it can act as a load. It can act as a generator. It can act as a capacitor. It can act as a conductor. It can go anywhere in between, if you specify it correctly.

What I was trying to show you here, this is an actual, and Tom says he hasn't had the experience yet. We've actually had the

experience. Again, back in the desert, where these particular devices were installed. We have three customers. This is on a secondary level. One of those customers has a fairly large PV array. If you can make it out here, the light blue is actually the grid power. You can see the CES power is the red, and the low power is the purple, and the CES state of charge is the green. We had a large monsoonal storm blow through, knocked down transmission lines. The lightning basically burst the transmission pole. It fell over, and it fell over in the distribution line. We had a new order of about 21 poles down for about 25 hours. In this particular instance, the actual customers that had this particular facility located with the transformer, actually -- what you should be able to take away from this is they never experienced an outage for that whole 25 hours. So somebody was talking about energy metering. Well, the challenge with energy metering is not that you can't disconnect and have your PV system carry your load. Tom and I were

talking about this. The challenge -- you need to have the right technology. You have to write algorithms, and you can actually go to your meter and actually open the disconnect yourself. But the challenge gets to be the fact -- the PV systems are relatively small and they can't handle the inverse curves that occur when you start bringing in your big loads -- air conditioning load in particular. And so you'll basically stall and a protection will take the system offline. So, can you do it? Yes, you can design for it, yes. But usually that comes at an additional cost. Now it's not to say you can't do that. Usually when we sort of give this type of presentation, what we talk about is, smart grid being an alternative service of the model for allowing customers with technology and with things like electric (inaudible) to actually be able to do that exact thing. There's an energy magnet system, automatically disconnecting from the utility and going on their own power. And then (inaudible) and coming back with utilities there.

So the key here, is you can watch this green state of charge. It was actually sort of sitting up at about 75 percent, dropping down, dropping down, as it provides power to the local homes. It gets to just above the area which it would shut off, and you'll notice the actual purple here, which shows the PV coming back on. The PV starts charging the actual energy storage device. And then finally, the grid comes back.

I've got three slides of this. I'm not going to spend a lot of time on this because I think you could read it as well as I can afterwards. But there are issues. Here are procurement issues, and I've got a laundry list.

Turnkey contracts -- what do they really cover? Vendor financial strength -- what you see is a lot of VC funded start-ups. We're selling energy storage devices, which don't have a financial wherewithal. The question is, will they be around by the time you actually get to installing the units? Turnkey projects -- we're looking for solutions. That's one of the other

challenges. We're not looking for an energy storage device. We're looking for a system. And we need you to provide a system.

Vendors -- some of them don't want to provide quotes. Standard warranties, yes, no. Usable capability of the batteries is actually not a hundred percent. You cannot run these things down. If you run them down, you'll end up with a brick. We actually had a (inaudible) storage device, where the PCS manufacturer was doing (inaudible) upgrades over the internet, and when they actually put those upgrades in, they actually turned on the charge, discharging of the battery. They did discharge that battery all the way to zero. They did end up with a brick.

Design engineering issues -- so we've got a lot of those as well. Models, as in being moved forward in time, and increasingly become important. You know, when you talk about what can DOE do -- models around PCS, models around storage, how these devices operate. Getting them into the public domain. Right now we have to sign

NDA's with every vendor that we talk to, to get their specific control of rhythm, so that we can actually model them. Large heavy units -- these are not small. These are not light. Construction standards -- we've gotten better at that. Cooling requirements are significant. Noise -- it's an interesting little thing. Those inverters make a fairly high-pitched loud noise, and if you're in a quiet urban environment, we've gotten complaints. So you put this in a right-of-way right next to a home, and somebody starts complaining.

And then safety and environmental -- I think one of the keys, particularly around lithium ion -- we actually tried to put lithium ion units in homes, as part of one of our projects, and what response we got back from our legal team was, will these things fail, and could they start a fire. And the answer is, yes, they could fail. They could start a fire. And that we, as a utility, would be liable. Pretty soon, we weren't putting them in homes anymore. Now imagine these are in our easements. You would think that people

wouldn't hit green boxes, but they hit those green boxes all the time. It's funny how that works. It just seems to be a magnet, dragging your car over there. So now, you're going to do the same thing.

Construction -- physical -- so clearly large footprints. So, what else can DOE do? As Tom pointed out, it's cost, it's energy density. If you start thinking about these large units and having to put, in our particular case, 165 megawatts worth of energy storage, that 500 kilowatt, 1500 kilowatt hour unit that we put in place was basically 3 C containers with another C container for an actual PCS. That's 500 kilowatts for three hours. So now, 175 megawatts, or 65 megawatts, you can imagine the footprint that would be required.

Electrical, IT, those are all big deals. Now the operational issues. One of the big challenges actually, because this is a relatively (inaudible) technology, and you do have vendors, I've given lots of talks at various CESA events,

and I get people coming up to me afterwards and saying, well, we've got a battery for you. And again, we come back to them and say, well, where's your PCS? And the answer is, we don't have one. And we go, well, you'd better go talk to somebody that has a PCS. And of course, then we start saying, you know, there are a bunch of vendors here at this particular energy storage conference. You might want to go talk to them first, before you come talk to the utilities and bid into an RFO. Because that really is key. We're looking for solutions. We're not looking for a battery. Some of the immaturity -- cloud based web portals, while that sounds really nice, you have to think about security. And the security becomes a bigger and bigger deal. In fact, we actually had a vendor of a product who basically -- what we found, he had hidden in his software, in his web portal, he had a back door that has his standard password, which was basically password. We told them to actually change that, as part of condition of actually selling it to us, or being able to

sell it to us. They changed it, and then they had a problem they said, because they couldn't get into their system. They forgot their new password. So, there are lots of challenges.

Vendor support -- okay, some vendors are more responsive, and this is one of the things that we found, is that it gets really hard for small companies to actually be able to provide the support that a large utility needs, when we need it. That's not to say all of them.

Scaling is non-trivial. This is another, sort of misconception, that you can just take a small unit and suddenly stack them all up and put them all in parallel series, and suddenly you've got this 500 megawatt battery. And it's all going to work just fine, and the answer is, it won't. Battery energy management system is one of the biggest deals, one of the more complicated things that you really have to worry about. Now that is a big deal.

So I thought I would conclude my presentation -- for those of you who have not seen

a duck curve. And while I'm concluding this here -- Will talked about -- he's got a business model, and his business model, he's going to avoid (inaudible) chargers. Well, it turns out, that what he's actually going to charge or discharge his units, is actually going to be in the belly of the duck. What's that going to do? That's actually going to drive that belly down further. That's what we'd like Will to do. Is we'd actually like STEM to actually charge during that period of time and add more load. You can see though, that some of the ramp rates here -- and by the way, in the center during April, May time frames, as you start looking, that's what the PV is actually doing in the middle of the day. And for us, that middle of the day actually happens to be marine layer. So it's actually pretty coincidental. It's not something where everything makes it all go away, and makes it look nice as you add them up. They all tend to act the same way. So the challenge gets to be here, and this is really something else that perhaps we can do.

For us to go and get rate relief or rate changes, whether it be demand response programs, whatever, we have to go to our commission. We have to go to Mel and say, look, we want to change that. We do an advice letter filing and that's 18 to 24 months, if we're lucky. And then we change our rates. And now this has changed again, and we have to go back and change the rates again. It's pretty clear where this world, at some point in time, needs to get to dynamic rates that allow some flexibility to do this via rates and pricing. So that people are actually installing products, installing devices, that actually from a grid perspective, are actually providing responsiveness to grid needs. And so with that, I think we move on to (inaudible).

MS. REDER: First of all, let's give these guys a round of applause. Thank you. (Applause). I already know that there is a lot of questions that were starting to get posed yesterday, so Rich, is it okay to just start asking for questions?

MR. COWART: Yes.

MS. REDER: All right, well, I'll just open it up to you guys for starters. I don't know who was first, Rebecca or Bob -- Rebecca go ahead.

MS. WAGNER: Thanks, Wanda. Great presentation. As a regulator in Nevada, we always look to California as our early adopter and guidance. And to that end, Mel, I have a question. When this was going through the California legislature, what was originally, the public policy goal? Was it as widespread as the PUC has implemented in terms of grid optimization, integration of renewable energy, reduction of green house gases, or was it more technology driving -- any kind of flavor to the legislation behind it would be helpful.

MS. CHARLES: So, I wasn't around when the legislation -- well, I was around, but I wasn't working on this, when the legislation happened. I think it was more driving the technology and seeing the potential for the technology, in terms of -- I think probably at a

high- level grid optimization and GHG reduction. Those guiding principles, we at the CPUC developed. So that was sort of our brainchild, but I think it does sort of flow back to what AB2514 wanted and what it was doing, so --

MS. REDER: Bob?

MR. CURRY: This is a question for Tom Bialek. At the tail end of your presentation, you connected all the foregoing with a rate. And my question to you is, with these incentives, that are -- incentives is a nice way to put a demand. With the requirement that you have to fulfill the dictates of the CPC -- I'm a former regulator in New York, so that's why I can ask this question. How do you translate that into rates? How do you get compensated for doing this? If you scale up, what do you contemplate? Do you have new definitions of amortization schedules for batteries that haven't heretofore been -- I mean, how does this work from a financial standpoint? How does it play out within your company's balance sheet?

MR.BIALEK: So certainly within the context of any new type of device that would be distribution connected and owned by the utility, we would expect to be able to recover that in rates. And we'd have to make the showing in front of the CPC that indeed that's the best solution, and ultimately we would be looking at the CPUC to agree and then basically we would rate base that. But clearly the depreciation of the useful lives of the particular products change. They're no longer necessarily 40 or 50-year kind of devices. And therefore, you know, you will be looking at a much shorter depreciated life. If you look at the transmissional level, market level types of things, where, you know, certainly we'll be looking at those as well, then the question becomes a FERC jurisdictional issue. And then the question becomes, well, what does FERC think about this? And if it's just really sort of a market device that recovered simply through the market mechanism, under which it's participating. Ancillary services are regular up and down

regulation type things. If it's AT type deferral, and you're looking for relief in transmission rates, we've floated those questions at the California ISO, and to date, the California ISO has not looked at storage as a deferral type of item. They are viewing it as a generation-type item, and therefore, they have yet to come to the conclusion that we should be able to put it into (inaudible). So, I think there needs to be some evolution of thinking -- a little bit of (inaudible) on the rate design piece. And then there's the bigger issue, which is -- we talked about some of our RFO is going to be for distribution connected products, that will then bid into the markets. If we own it as a utility, then how do we deal with that? And we would presume that we would then sit there and take whatever profits we gained by bidding into markets and offsetting the actual rate-based cost that exists. If it's a third party on the distribution side, then I think it would be treated just as a wholesale player.

MR. CURRY: If I may follow up, how far along are you in studying that last ingredient, because it has informative value for what's being considered in New York, which is to let utilities run their own CHP and rate base it, and/or feed the profits from that into ameliorating the cost to the consumer.

MR. BIALEK: There are ongoing discussions with the California ISO, as we speak, so that activity is on guard.

MR. CURRY: Thank you.

MR. FADRHONC: Just to follow up on that, I think one other opportunity that we see, not in California, but elsewhere, is retail choice and retail competition. In Texas you can get free nights and weekends on energy. It's crazy, but it's -- these are companies that have a lot more flexibility in their tariff design. Certainly not on the infrastructure side of the bill, but on the capacity side on the energy side, which, as we've seen in the unbundled rate structures that get passed through seem to be the 75 percent of what

customers are getting charged for. You know, we love retail choice markets, because we can then work with a company that's able to see the duck curve, see the cost structure, and manage risk to that.

MS. REDER: Okay, I think Paul is the next one.

MR. ROBERTI: I have a question for Tom Weaver, on your West Virginia project. We were doing something similar to that in Rhode Island, and I think you said it was deferral of a substation for about 3 to 4 million. By my calculations, that would be -- work up to a revenue requirement of about $800,000 a year, and you deferred it for seven years, so that's about a cost of five million. And I was just wondering, do you have any assessment on the cost effectiveness of that whole project? Are my numbers -- and I know you did get a DOE grant too, that would obviously skew it, but just looking at it more in its raw elements. Can you talk about the cost effectiveness?

MR. WEAVER: Yeah, without getting into specific numbers -- Yeah, I think in that particular case, this was a one megawatt battery, so it was a, you know, less expensive one that the two megawatt batteries we later put in. And the fact that we ended up deferring that project for six or seven years, it clearly was economically justified on its own. We still own that battery, and we're now looking at trying to get some market value out of it, either in energy arbitrage or frequency regulation. Something through PJM -- we're trying to figure out the best way to do that. So on that one, yes, I think it was covered. What I mentioned on the others -- in the time when we thought the cost of NAS batteries was coming down, we began looking economically at where would we put the next ones. And really the best we could do in our estimation, was 50 to 60 percent of the cost, could be justified by the TMD deferral at a location.

MS. REDER: Sonny?

MR. POPOWSKY: Thanks Wanda. That was a

terrific panel. My question is for Will, going back to what you said that struck me, was that your product or your service gives customers the opportunity to participate in the market or in that program, without shifting costs. And I'm just trying to get a sense -- is there something peculiar about your California rate design, or is this just a standard demand charge, which is based on your customers' non coincident peak. And is that a problem for you, Tom, I guess is the question for you.

MR. FADRHONC: I think it's a problem for Tom. I don't mean to speak for him, but it's a tariff design problem. It's probably more of a problem for Mel, in that it's a tariff design issue, and certainly as we as a company start to look elsewhere, but you're right, we're reducing the customers' peak. In California, there are peaks set in the summer at three different time periods. There's off-peak, partial-peek, and on peak. We have to take the utility and the utilities' commission for their word, in that,

that's the cost of service, and that, you know, if the customers managed to that, that means that those services are being appropriately valued. We see the demand charge or something like it, showing up and being calculated differently elsewhere, in New York for example, or in certain parts of PGM territory, what was your contribution to system peak. That makes a lot of sense to me, in that you want to be -- you're on the hook for whatever you were doing when the system was peaking, presumably the highest-priced hour. We may then end up -- I think as Tom mentioned, going to, you know, more dynamic pricing. Maybe what the utility of the future looks like is wires and a dynamic price at every substation. That's a long way out there, but it's -- there's definitely a collision that is occurring between retail and wholesale cost structures. We see it very much with solar and distributed solar. I think that's largely the result of the downgrades that somebody mentioned. And so the better that we can get the cost structures aligned through the tariff or

through some other pricing mechanism, whether it's a direct access provider or not, I think the sooner that customer participation through technology resulting in more robust systems is going to get here.

MS. REDER: Thanks. Pat? Sonny, do you have a follow-up?

MR. BIALEK: So, the answer is yes, indeed. Why do we have demand charters to begin with? I mean, you're looking at alternative different rate structures to get your cost, and some of those are fixed. And given the fact that now somebody reduces what they're paying in their fixed charges, therefore, we as a utility would undercollect. And to the extent that we are on a bundle, that means we would then translate that into shifting it to other customers. So that's part of the challenge in all of this, really. It does come down, and Will's right. It becomes a regulatory problem around rates and rate design. If you look at it historically, when people had no technology choices, volumetric rates were a good

way to recover all your costs. When people have choices -- and example would be, you know, California is looking at (inaudible) homes, all the residential construction by 2020. If you take that at face value, we would build the infrastructure to serve a subdivision for example. And we would yet, under volumetric rates, never recover any costs. So is that a viable long-term solution? The answer is no. Rate design has to happen.

MS. REDER: Go ahead, Pat.

MS. HOFFMAN: So, my question is for Will and then Mel. The first thing is, we had our energy efficiency colleagues here yesterday, and I think there still needs to be some changes in technology evolution on the building side. And I don't know if you have any thoughts. I mean because sometimes you can get to net zero buildings, but for some customers, it's handling critical loads, whether it's just air conditioning or refrigeration, depending on where you're at. Is there any thoughts of what technology, or how

the building infrastructure, energy management systems at the building level should evolve? And then the question for Mel is, at some point in time at lower levels of energy storage, we're just adding value to the system, but at some point in time, we're going to have to have some sort of prioritization or optimization of where is -- location is key, for where do you best place -- I'm not sure whoever answer the question on where is the best placement of energy storage, and how we keep track of that. Is there a need for some sort of open source tool for regulators, that can help define, you know, where do you get the best bang for the buck, or the best value for the energy storage, but that's always a dynamic analysis. It's dynamic. It's not static. But I don't know your thoughts on that.

MS. CHARLES: Yeah, the whole piece, not just for storage, but for renewable energy for distributed generation in general. The whole piece of locational value -- we've been looking at extensively, and we continue to look at. There is

another bill that was passed last year, called Assembly Bill 327, that is looking at distribution resource planning. And that is a key piece of it. We haven't answered the question, but we're in the process of doing that. We are also aware of that. Once piece of the storage mandate is allowing the utilities some flexibility to purchase storage to optimize their grid, based on their specific systems. So that is happening to a certain extent, but I think your point is a very good one, and it is something we're definitely looking in at this point.

MR. FADRHONC: And the question on energy efficiency, zero net energy, and building management technology, is well taken, in that -- STEM, for example, we exist primarily in the CNI space. We've run into customers that have a building management system. It is an extremely fractured industry, and there is not standard protocols to communicate over that, so what we end up doing is, at every customer site, we install our own clad connected, smart meter, right behind

the utilities' smart meter, because we can't get a firm stream of information off of, you know, what was billions of dollars spent to put new hardware out there. So, we do that, and then we have built the software infrastructure in the back hall to pull it all in and pull it up. I can give you a demo after, if you'd like. And that's primarily to manage the storage devices. It is a platform, so we can communicate other devices over things like open ADR or MOD BUS backnet, all these other protocols that exist out there, that are very -- still nacient, it's pretty fractured. You know, we can integrate with the SEAMANS system, but we can integrate with the Johnson Controls, and then there's Trane and then there's everybody else out there. So, you know, again, our mantra is standards are great. It's an early industry. I think Tom made the great point -- just within the battery stack, the battery management system, the power conversion system, the utility interface system. It's very complicated. STEM has -- we started out thinking we could just do the software

controls on top of a battery, and we had to reach much farther into the stack, because the industry wasn't ready to take somebody else's battery cell, somebody else's battery management system, somebody else's power converter, and have it all operate as unit.

MR. BIALEK: Another thing I wanted to add, on top of what Mel said, is AB327 has a requirement in it, that the IOU's, distribution planning groups need to provide a distributional level resource plan for distribution by July 1, 2015. Additionally, we do map all of our substations and circuits with available "capacity." That should result in a minimal interconnection cost for distributing your resources, so that's actually active as well.

MS. REDER: All right, in the order -- for the remainder of the questions, we'll do Carlos, David, Grainger, Anjan and Carl. So, Carlos.

MR. COE: So great presentations -- to all of you. This is to the two Toms, assuming

everything is equal, assuming that energy storage costs come down, and these become much more viable products or systems, where would you put these, as a utility? Now that you look at them, assume that the cost is the same, whether it's a bulk energy storage down to the very end part. As a utility, where would you put these?

MR. WEAVER: So I think we're obviously still learning. One of the things we haven't had experience with yet, is the community energy storage. But if you think about the theory of how those would work, and that they could look to the system, like a large scale battery, and provide those local benefits, that seems to make a lot of sense. So, as a distribution planning guy, I would look for a feeder, and/or a substation, where I needed that capacity relief, that flexibility. I might also look for a place where I have conflicts, because of a high penetration of solar, which we don't have. We don't have some of the things that our California and Arizona buddies have. In all of our 11 states, we don't have that

much penetration. But if we did, or if we had other things that were providing variability, that these batteries could help smooth out, that would drive those locations. So I hope that gives you at least a theoretical answer, and we continue to learn.

MR. BIALEK: So we have looked a fair bit at this. What does that really mean? What we've understood, is that there are places where storage makes more sense than other types of devices. Particular circuits that have much higher or lower, X to R ratios. So we've got a lot more impedance between the substation and the point of coupling of the large PV system, for example, where you really need real power, not just reactive power. There's a lot of stuff around. In California, we're actually pushing out the inverter functionality into California, sooner rather than later, where we'd actually ask for the inverters themselves to dynamically regulate voltage at the point of common coupling. So it becomes a mix of solutions. The one thing, if you

look at an intermittent product, or intermittent generation source, you can mitigate that via, you know, the inverter itself. But there'll be some areas where you're not going to be able to do that and storage makes more sense.

We've also realized that if you look at some other curves, which didn't show, I can provide you with extremely high levels of power quality with energy storage. And in this particular, as I showed, in some instances I could actually, probably island the -- all the secondary surfaces. Are you willing to pay for that? Is that another type of reliability benefit to customers? In our roadmap for smart grid, it said by 2020 we'd be offering differentiated levels of reliability for customers. And if we get to that point, you could see energy storage as being one of those possible solutions, among others.

MS. REDER: David?

MR. MEYER: Well, my question is for Will. Earlier you said that, in terms of bringing the cost down for storage, that it was often more

a software problem than a hardware problem. And I think you alluded to this, in your more recent comment about putting metering in place, so that could profile the customers' usage patterns, and then have a better sense of how to optimize it. Did I understand your point?

MR. FADRHONC: Yeah, I think -- from a cost perspective, I would clarify that -- from the cost perspective, it's a hardware problem, from the value perspective, it's a software problem. So we do install additional metering on site, because what we really think, in terms of the value of storage, or of our brand of storage, is load-responsive storage. So we need a real- time view into what that customer is using, in terms of energy, to make sure that we are reducing their peak, so that we're not overloading a local transformer or substation. If we're mandated to reduce the stress off of a substation or off of a transformer, we need to know what the building is doing, what the building is contributing there. This is also critical for us, to make sure that we

don't export past the point of common coupling, under the distribution system, and interrupt the flow of current on the grid, because that can lead into other system challenges. We really think that the software is where the value will get created, and in having a load responsive product, we can use the grid that we've got, without a lot of upgrades, and therefore, save a lot of costs. Some of that value will accrue to the customer, some of it will accrue to the utility. If you have a lot of data, and a lot of ways to parse that, you can separate both the cost and the values appropriately, and then it doesn't just become one single lump asset, that goes to the rate base. If customer A is getting $500 worth of value, then they should be willing to pay $499. That's how you get customer participation in the power system. Everybody is going to have a slightly different profile and a slightly different value associated with that.

MS. REDER: Okay, Granger.

MR. MORGAN: Mel, I understand that

you're operating under a legislative mandate. But as a matter of public policy, of course, it makes sense to subsidize or mandate technology, only if one has looked at the learning curve, and concluded that by doing so, costs are going to come down. And we've been told several times by Tom, that he doesn't see costs coming down. My suspicion is, is that many of the functions that have been talked about here, could probably be met at lower cost, using other strategies. Probably not all of them, but at least many of them. Is your staff, or is the California Energy Commission Staff or somebody else, looking at the question of whether this large technology mandated or forcing function, is actually going to do anything, in terms of helping to make this technology more cost effective?

MS. CHARLES: So, that's a very good and a difficult question. We actually -- when we were formulating this mandate, we did talk internally about whether it's sort of putting the cart before the horse, whether or not there should be more

time to see if there's an opportunity for costs to come down. The legislation is very specific about saying that only cost effective energy storage must be installed. And so the utilities all have, within their bids, a cost effectiveness metrics and methodologies that they must, basically, value the bids. And the reason we have the deferment, is that if costs aren't coming down, or if it's not deemed cost effective, and there's insufficient bids, then it can be deferred to other years. Another piece in terms of sort of an off ramp, if storage isn't broadly deemed as cost-effective, or we don't see costs coming down, is that, we have the evaluation after three years, to look at this, and to see if these targets are realistic, to see if this mandate's there. The reason we did the mandate is that we were struggling, based on the feedback from different parties of varying interests that, you know, for costs to come down, there needs to be some encouragement of the market, so mandate. Others say that the market is not there, and we don't

know if costs are going to come down. So, at this point, we did sort of take a leap of faith and say, we're going to do the mandate, but we're monitoring it closely, and we will look at it, to see if this is something that is truly feasible in the long run.

MR. MORGAN: So those two assessments you will look at those kinds of issues?

MS. CHARLES: Oh, yeah, yeah. That's a big piece of it, yeah.

MS. REDER: Okay, Anjan.

MR. BOSE: This is also a California question. Two questions -- well, like Rebecca pointed out -- when California puts out the next audacious mandate, everybody says, what did that mean? Two questions -- one is, you pointed out what it meant to the IOU's. What does it mean to the public? Does it mean the same thing or not? The other question is, there was the transmission, distribution, and behind the meter categories. Was there a percentage, or you're leaving the local utility to decide that? And, if so, I guess

the one that intrigues me the most, is behind the meter. One, because, how does the utility even know there is something behind the meter, but more than that, what counts and what doesn't count? Can the utility count all the (inaudible) in their thing and use that?

MS. CHARLES: That's a very good question, and something which we're trying to figure out. So, I will answer your last question, first. So, in terms of how we did the transmission distribution. Yes, there are targets. The table I put up -- there are targets. But we do allow some flexibility, because we want the utilities -- the utilities know better than we do, what, in terms of transmission and distribution, where and what should be procured, and so there is some flexibility in terms of shifting across those targets. But we do have high-level direction and mandate, in terms of, you are supposed to procure this amount. You can shift a certain amount between the two. In terms of behind the meter, that is a funky one, because

right now, the vast majority of energy behind the meter is procured by customers. The utilities are participating in that choice. They do know where it is, because they interconnect some of these symptoms, and it is through programs that they administer. But in terms of the kind of control they have, in terms of procuring that, there's not a whole lot. What we did in terms of the targets -- what we tried to do is, we know the self-generation incentive program is well mentioned. It's been around for a long time. There's been a resurgence, especially in terms of storage technology. And so we have a sense of how much is being procured. How much is going to be procured. And so, again, there was some sort of forecasting, in terms of, you know, how much we think can feasibly be procured for that point. In terms of -- I wasn't sure what your first question was about, in terms of the public and the utility. I think, if you're asking, you know, what are the benefits to the public? Oh, do they participate in the mandate? Oh, so, I answered the question

earlier, actually. So, the public participates in the mandate, with regard to customer (inaudible). So ratepayers, utility customers, that participate in the self-generation incentive program, we have a permanent load shifting program for thermal storage. You can procure storage, and that will count towards the target, so --

MR. BOSE: I meant the public utilities.

MS. CHARLES: Oh, public utilities, sorry.

MR. BOSE: (Inaudible).

MS. CHARLES: No, they don't. We don't regulate the public utilities, so they don't have a mandate with regards to this.

MR. BOSE: I thought this was a legislative mandate, not a (inaudible).

MS. CHARLES: It's a legislative mandate, and as far as I know, I don't know if the municipal utilities are required to procure storage. It's different than RPS, but I can confirm that.

MR. BIALEK: So what I would say -- AB

2514 directed the commission to establish what targets, if any, that the IOU's would be obligated to do. Now, typically what ends up happening in the legislature in Sacramento, is that AB 2514, would have been floated, and probably would have applied to all utilities. Usually, the municipalities are very successful at getting provisions that apply to them removed. And therefore, you get the end result.

MR. COWART: It's such a typical California observation. We have one more question, and then we're going to take a short break.

MR. ZICHELLA: Thank you for the panel, and also, I think, you addressed some of the questions I had. I think Pat's point about location counting, is really important. In California, there's been some thought given to this also. Carla Peterman had proposed, when she was at the Energy Commission, looking at doing distributed generation zoning. We've had the pilot projects, the PUC has approved, with

relation to the Songs outage and retirement, that looks at, and I think an important point is -- storage is part of the solution at fortifying key substations. This was mentioned also, I think, by one of the Toms. I think Tom W., talking about, if you were to look at where you'd put it, you'd want to fortify key substations, based on your need, whether that need was going to be a combination of energy and voltage support, or whatever, as we're having in California, you'd want to look there, but you wouldn't want to look at it in isolation. It's not a silver bullet. So in California, we've got these pilot projects that will look at distributed generation, demand response, energy efficiency programs, aggressive marketing to the consumers about participating in those, and storage. So, I think we started -- we always fall back on the silos when we have this suite of things. It's a little like teaching a duck to fly, we talked about yesterday. It's not one thing, but it's a number of measures in concert that helped solve that problem by trimming

the peaks, shifting when -- charging the batteries, when you really need to be charging them, that kind of thing. So I think those questions got somewhat addressed by a variety of different people, and that's just what I was interested in hearing more about, was the locational aspect of it, and the application of planning to this. I think that's what Tom Bialek was talking about. Having more of a method to your madness. I think he helped to bring down the cost and improve the learning curves by being strategic. You don't put it everywhere. You start to learn more about the capabilities and creating economies to scales, by being more strategic about it. So, that's just what I was after.

MS. REDER: Thank you panelists, appreciate it.

MR. COWART: All right, thanks to you all. We're running -- it looks like a little bit behind schedule, but we're actually well ahead of schedule. And I'm trying to see how we can

arrange the day to finish before the lunch break. So that we can just be done, and don't have to come back after lunch. We'll see if we can do that. During this break, I'll consider that. With that in mind, let's make this break a short one. Come back in ten minutes, 20 after, and then we'll begin the next panel. All right, folks. Please take your seats where -- I sense there's pent up demand for offline conversations that we've built up this morning by running through with an earlier break. As I noted a few minutes ago, we're going to try and run the agenda today, so that we finish our business before lunch. Then everybody can have a leisurely lunch, and be on our way. I hope we'll be able to do that. I should ask for the record, whether anyone has signed up to address the committee this afternoon? Any member of the public?

UNIDENTIFIED SPEAKER: (Inaudible). (Laughter).

MR. SAMIR: This is Samir. No member of the public has made any request to provide

comments to the committee.

MR. COWART: Okay. Thanks very much. The panel, as you know, concerns the recent proposal of the USEPA, under section 111(d) of the clean air act, to regulate carbon emissions from power plants. Instead of giving you an introduction to this topic, which I don't think you need to hear from me, I'm just going to turn immediately to the panel. We really have a terrific panel. We've been blessed by people who are willing to come and speak with us during these meetings. And in order of appearance, we have Reid Harvey at EPA, the director of the Clean Air Market's Division. He manages the market- based clean air programs, which, when you think about it, that's a big domain. The acid rain program, the clean air interstate rule, and now he has responsibility for this as well.

And second, we'll hear from Karen Obenshain, the director of fuels, technology and commercial policy at EEI. Her recent experience has been focusing on policies that support fuel

flexibility and electric generation, which means, I think, in EEI terms, across coal, gas, (inaudible), and some kinds of innovative technologies, maybe CCS. And I will only note that intriguing aspects of the bullet points I saw of her past, is that previously she was a petroleum geologist and also a risk assessor for nuclear weapons' facilities. And so, I think this clean air act stuff is actually pretty tame.

Third, we'll hear from Sue Tierney, the managing principal at the analysis group. And Sue is probably known to everybody in the room for her deep expertise in energy policy, environmental policy, consulting widely on these issues with governments, industries, NGO's, you name it. She has has extensive governmental experience as well, both as an energy regulator and an environmental regulator. And you were assistant secretary of this department a while ago. (Laughter). Sue and I served as regulators at the same time, so we suffer the same benefits of experience.

And finally, my colleague and friend,

Ken Colburn, a senior associate at the Regulatory Assistance Project, who provides policy assistance quite broadly, internationally on energy and environmental issues. He is also a former regulator, as the former director of NESCOM, and it's the Northeast States --

MR. COLBURN: Coordinated Area.

MR. COWART: -- management, right. I always forget one of the letters. So, he has been in the area of the regulatory world for quite a long time. We're thrilled to have him working with the energy regulators at RAP. We're happy to have him here today. So, I think we'll just take it in that order, and Reid, start with you.

MR. HARVEY: Thanks, Rich. It's a pleasure to be here this morning. It's good to see Tom again. We were on a panel last week at the Energy Storage Association, and glad to be here with all of you. What I wanted to do today is -- for those of you who haven't read all 675 pages of the preamble, and hundreds of pages of all the technical supporting documents, just give

you an overview. So, if you have started to get into the details, it may be a little bit high-level for you, but if you haven't, hopefully it gives you a big picture perspective. I'll look for Rich to kind of cut me off, but I think -- should I aim for like a quarter of? Okay, 12 minutes. All right, that's precise. Because there are too many slides for 12 minutes, I'm going to skip over some. But they'll be available for you, as a reference, as well. And we have an extensive website with all the documents available.

Just for background, so you all know this, the power center is responsible for about a third of U.S. Greenhouse gases, and about 40 percent of USCO2 missions. What I wanted to do today -- give you a summary of the proposal, a couple slides summarizing it, talk about our legal authority under section 111(d), talk a little bit about the outreach that we've done so far, and then particularly start to dive in a little bit about the approach that we use to set the goals,

state by state. And then talk about the state/federal relationship, in terms what states have flexibility to do, under this rule. I'll touch briefly on costs and benefits, not dwell on it. And then talk about the way going forward.

There are a lot of words here, but I think the basis message is that this rule is part of an effort to address greenhouse gases broadly, across the government. We're using our Clean Air Act authority, but the president has also issued the Climate Action Plan, and under that plan, we've taken steps in a number of area, both through voluntary and regulatory approaches. You know that we've already issued rules for vehicles, working with NHTSA. And when we look at the effect of this rule, when we model the goals that we set, and we look at sort of, how the rule might actually be implemented by states, our assessment, and it's just illustrative, and the reality may turn out to be different. Our assessment is, if those goals are met by 2030, we would expect to see somewhere in the neighborhood of a 30 percent

reduction in CO-2 emissions, from this sector, from 2005 levels. But again, that's -- that's really just a retrospective assessment. It's really not the number that we use to define and parse out to individual (inaudible). It's really a retrospective modeling book on how the goals might turn out. At the same time that we're addressing CO2 emissions from this sector, we also see significant co-benefits from reductions of SO2 and NOX. And we quantified those in the regulatory impact analysis to the rule.

I'm going to move on. One of the critical things for us, as we worked on this rule, was to try to build on activities that we're already seeing across the country. Many states, as you all know, have extensive energy efficiency programs, real portfolio standards. There are a number of states in the Northeast and in California that have started to do market-based programs. And so we're no breaking new ground here, we're trying to build on things that states are already doing, looking at how we can kind of

follow in that path. Again, following the approach that's imposed upon us by the Clean Air Act. We provide a great deal of flexibility in this rule. It's very different from new source performance standards. When we do existing source standards, we set broad guidelines, and then states come forward with plans for how they meet those guidelines, and we believe we've provided a great deal of flexibility to states in coming forward with those plans. Some of those flexibilities are, starting in 2020, we provide a ten-year period, over which states can work to attain these goals. They're intensity based goals and rates, but we allow states that choose to do it, the ability to convert from a rate to a mass-based approach. There is flexibility in terms of states doing it on their own, or working with other states. And so again, we're seeing this as a real state/federal partnership, in trying to provide the space for existing activities to continue, and for the states to come up with plans that suit their own unique needs. I

think the clicker has a life of its own, because it's moving on ahead of me. It already slipped past several slots. So, I just wanted to note that our authority is section 111(d) of the Clean Air Act. You all know that under section 111b, as in boy, of the Clean Air Act, we issued new source standards. The comment period on that recently closed. That is the predicate for doing a 111(d) rule, so you have to do new, follow by existing. And it sets out a number of factors, which I've listed here. Things to consider, what's a reasonable cost, what's demonstrated, what's achievable. We took all of those into account in the rule. We've had extensive outreach. We've probably talked to several of you already. We've talked extensively with states. We've talked to environmental regulators, to PUC's, to energy offices, because we really want to kind of learn what states are already doing, and how we can design an approach that's flexible to meet their circumstances.

And I've made this point already -- the

activity is already underway. I'm not going to dwell on this, but this is again, sort of illustrated in the point about states are doing this. So, really two parts, we set the goals, and then states derive plans. And because we're time limited, I'm not going to go through in detail how we set the goals, but essentially this illustrates the flexibility over time, that we provided in the plans from 2020 to 2029. So we're not mandating year-by-year rates. We're allowing flexibility over that whole time period, and states can come up in their plans with their own kind of process. Yep, the next slide, I think will hit that. That's why I was sort of trying to come to here. So, I'll stop here, and kind of focus on this. So, in setting the state goals, we looked at the existing fleet, as it existed in 2012, and we picked 2012, because that's the latest year for which we have good emissions data and good generation data. So we looked at the existing fossil fleet in that state in 2012. And then we said, taking into account the legal requirements

under section 111(d), what is the best system of emissions reductions. And in doing so, we came up with what we call four building blocks. Listed here on the left side -- things that plants can do themselves to make themselves more efficient. Ways to move from higher carbon sources to lower carbon sources through dispatch. Third, ways you can move towards more renewable or cleaner sources. And fourth, what's the role of energy efficiency, and sort of meeting the overall demand, and how can that help?

So, we looked at each of those building blocks. I'm not going to go through the technical details about the numbers in each block, but we sort of said, what are the technologies and practices that you can do in each block. Those are listed in the middle column, and then the final column, this is one point that I want to stress, is, we are not holding states to any individual block, or any of the individual assumptions we used in deriving the state goals for that block. What we're saying is, there's a

composite that aggregates across all four of the building blocks for a state. There's one number, and if the state chooses to meet their goal, solely through doing more renewable, or doing more energy efficiency, that's fine. So these are not meant to be imposed on individual plants, or there's not a mandate in this process for each block to apply, in and of itself. So we're providing flexibility for states to, in their plans, come forward with a whole menu of things that they can do, beyond the factors that we considered in setting the state goals, in the middle column. We've illustrated on the right column, additional things that states can do in order to meet their goals. So that's a critical point to understand, is just because we considered a technology or a practice in setting the goal, that's not a mandate that flows down at that level.

So, I'm about to run out of time. This is my main point. We set the overall goal, and then states come up with plans to do this. Okay.

All right, well, just give me the high sign.

We've illustrated a range of flexibilities that states have to do this. I'm not going to go through each of these, but you can read it at your leisure. Again, I mention the flexibility both on timing, the form, the fact that states can work on their own, or with other states, and they have a broad flexibility in the sorts of measures that they can pick from.

Again, another illustration of the sort of technologies that are available. I'm not going to go into the mechanics of state plans. There's more information in this slide deck, as well as on our website about the timing.

I'm not going to go into the details about the benefits of cost. I gave you the overview at the beginning. Our estimate is the aggregate cost is around 9 billion dollars, but we believe that there's substantial, both climate and health benefits, accruing from the rule. We see a rise in aggregate of electricity rates, but with significant penetration of energy efficiency. In

the out years, it could lead to lower bills in the future.

We also see that there continues to remain a diverse source of generation across the country, so that, although there is a decline in coal from current levels, it still retains a healthy share of the overall projected generation mix in 2030. This illustrates that -- I'll see if I can make the pointer work.

This is 2012, about 300 gigawatts, a little bit more, and then projections in business as usual. And then we analyzed two different options -- sort of a regional option where states cooperate with each other, and then an option where states tackle the goals individually, without working together. And so you can see business as usual in 2020, the effect of the rule in 2030.

I'm going to skip over this. So next steps, here's our website, where you can read all the technical details. We have plans for four hearings, Denver, Atlanta, Pittsburgh, and

Washington. There's a 120-day comment period on the proposal, and Karen tells me that the Federal Register office has now announced that the rule will be published tomorrow. So the 120 days begins from tomorrow. And we have a docket, in which you can give us comments, and I'm not going to go through the timeline, but this illustrates sort of the process that we would follow. So, sorry for the rush through of the rule. I want to make time for others to comment and weigh in, but thank you for your attention.

MS. OBENSHAIN: I do not have any slides today. I don't know if that's a good thing or a bad thing. That means you're going to have to pay attention to what I say. That's a little scary. Thank you for inviting Edison Electric Institute to be here. We are the trade association of the investor-owned utilities. Our membership includes all of the investor-owned utilities in the United States, about 70 odd international members, and about 250 associate members, mainly vendors of technology, such as Austin and Siemens. I just

want to give you a very brief overview, as I look forward to your questions. I just want to remind everyone here, and I'm sure you know this, but the electric utility sector is undergoing a pretty significant transition to a cleaner, lower-emitting fleet. And we're doing so fairly rapidly. Some of this is due to environmental regulations. Some of this is due to increases in the efficiency of emission control technology. A lot of it is due to market forces. The low cost of shale gas is making decisions of what to build a bit simpler, REGO gas. We also have slow economic growth, and we have low to flat electricity demand. And even though the EIA is projecting 28 percent energy demand, by 2030, the market signals at this time, and we -- remember, we build long-lived assets that could last 30 to 60 years. The market signals are fairly weak, so we're having some discussions on, what do we need to build and what will be most effective in the long term?

I just want to mention, on the ongoing

transition of the fleet, when it comes to carbon dioxide emissions, in 2013, the electric utility industry was 14 percent below 2005 levels. Again, most of this is due to the transition of the fleet to a lower emitting fleet. On 111(d), we get a lot of questions -- oh, and by the way, Reid, I am one of those people who has read the preamble of the regulatory impact analysis, all seven technical support documents, and become thoroughly lost in this red sheet from heck. Lots of good information, and I was telling Reid earlier today, every single member of EEI is confused, so you did a good job there, but we are working with EPA on clarifications, and we really appreciate that cooperation. That's worked well with other proposed rules, and we look forward to doing the same cooperation here.

But what impact would this have on the utility market? Well, as Reid pointed out, once the rule was published, the states have to come up with a compliance plan. So really specific impacts on the utility industry, it's hard to say

at this time. It's a little bit further out in the future. But it's clear, just looking at the bones of this rule, that we are going to have to do more investment in natural gas and renewable and energy efficiency and the transmission that supports all of this. So that's a big investment. All at the same time when we have low to flat energy gross. So we don't have the revenue to go back into investments. So this is going to be a challenge.

So let me just -- I do have some slides, but I'm not going to show them to you. So, some of the impacts we have -- we definitely know that this is going to accelerate the shift away from coal. Right now we have 70 gigawatts of announced coal retirements -- based on -- I mean they're publicly announced. Some of these are based on -- we don't want to retrofit the plant to comply with MATS, or it's simply no longer economic, due to shale gas prices. So, there are a lot of reasons -- and we have 70 gigawatts retiring. That's a lot. The EPA proposed 111(d) rule, estimates that

close to another 50 gigawatts of coal will also retire. If that happens, that's about a third of the fleet. So, that's rather significant. And we're not sure, and maybe Reid can help, when we keep talking with him -- we're not sure that EPA really took this big of a chunk of retirements, and its reliability into consideration when looking at this. But that's something that we will be discussing with EPA. We also have some concerns about increasing -- the rule proposes to re-dispatch natural gas. Go from around 36 percent capacity factor, which is what the existing natural gas fleet is now, up to 70 percent. We have to work in a system, an energy market system. It's not up to our individual utilities to say, oh, I think I'll run this natural gas plant at 70 percent. It doesn't do us any good because we know it needs to sell the electricity to generate. It's going to be difficult to get all of our existing natural gas fleet, up to 70 percent, plus we do know we have constraints on the natural gas infrastructure, and

that was really seen during the polar vortex. I know everyone is tired of us alluding back to the polar vortex, but it did show the importance of having a generation technology and fuel diverse portfolio for electricity. Many of those coal plants, they ended up running at higher capacities because natural gas was constrained. Most of those, or many of those have been slated for retirement in 2015, so it's a concern for us on reliability. So, it's a concern for us on reliability. Because our obligation is to provide electricity. On energy efficiency, I had a CEO point out, energy efficiency for us is basically beyond our control. This is human behavior, or its new building codes. It's not whether utilities have control over it. And if we don't have control over it, it makes us a little nervous, because we are what has to comply. We are the regulated source. But EE energy efficiency is also what we consider demand destruction. That need for electricity goes away. So, I think the rule is over a ten-year period, 10

1/2 percent increase in energy efficiency. That's a significant amount. And we're not sure where that's all going to come from. I think Sue's going to talk a bit about EE, after me.

Another point that I'd like to make is, there's a lot of confusion, as I said, on how is this going to work, when so many states generate and export their electricity to another state, or many states import electricity. And you have these different state goals. In the rule where it says, well, you can form a region, lots of states could get together and do a region. You won't have a state goal. You'll have a different goal for that region. But it's unclear, how, say Virginia has a reduction percentage to get to their goal, twice as much as their neighbors West Virginia and Kentucky. I don't think West Virginia and Kentucky want to join with Virginia, because it would make their goal more stringent. At least that's what we think at the moment. We're still looking at this. So, as I said, I'm going to keep my comments very brief. I just want

to give an overview. We have confusion. We're working with EPA on clarification. We do have reliability concerns. We have technology concerns, especially on the gas side, and for structure and just physical capability of these plants, and how all this works in the energy markets, the independent system operators. So I look forward to your questions. Thanks.

MS. TIERNEY: Thank for the invitation to be here, and great to hear from Reid and Karen about this rule. I wrote a paper, right before the rule came out, keeping my fingers crossed that I would have some idea about what it was going to do. Unfortunately, I was more conservative. I want to praise the EPA, because I think they did a very reasonably ambitious rule. And I say that because I do think it is reasonable with regard to the time frame and the flexibility. And the outcomes, I think, will be ambitious. And I think we're beyond the 30 percent at the end of the day. Let's see if I can figure out how to do it.

So, here's my report. You know, it's

nice bedtime reading for those of you who would like to. I was really focusing on the question of reliability. I recalled that during the run, up to the issuance of the mercury and air-toxic rule, and across state rule, there was a human cry about whether or not the lights were going to go out, as a result of environmental regulations. So, I was interested in looking through that lens to see whether or not one could have concerns about the carbon pollution rules. So that's what my focus was. But I took the opportunity to actually go beyond that to talk about the flexibility concept. We already knew before the rule was published in proposed form a couple weeks ago, that there would be a lot of flexibility, because that's the nature of this provision in the Clean Air Act. So I wanted to talk about what that might mean, and how that might help their reliability story.

So, this is just to say that I was ahead of the rule. Okay. So, my bottom line is that, as long as people get their act together and do their job, the industry and the states take

actions, as anticipated by the rules. There really isn't a reasonable basis on which to be concerned about the lights going out, as a result of this rule. It's pretty straightforward, and that has to do precisely because of the character of this rule, and the flexibility that's built into it. So, EPA's cleaner act does not address reliability, but everywhere around the edges of the run up to the proposal of the rule, we heard about the need to make sure that reliability was built into the way in which the industry could respond. You guys know about the schedule, but my bottom line here was that -- I assumed that the EPA would require compliance earlier than they actually did. And so I think that the two-phased, step wise compliance of an averaging period from 20 to 29, and then a second bite of reductions by 2030, that is a much more generous and liberal time frame than I anticipated. And so my analysis, I think, is conservative, because I assumed that there would begin to need to be demonstrations of compliance, even as early as

2018 or 2020. My PowerPoint made a little mess up. Those red lines are meant to describe two aspects of reliability, one, resource adequacy and one, systems security. You know these issues. I don't really have to describe those two concepts to this group. I had a very robust conversation with NERC folks, after I issued this rule. And they said, you know, this isn't just about a resource adequacy in megawatts. And it isn't just about megawatt hours of energy and ancillary services for making sure that we have enough supply. Those two things really don't describe the nature of reliability, as we know it today. And I wanted to make sure that everywhere I go and talk about this, I know that the industry is undergoing changes. I know that as we deepen the industry's dependence on distributed energy resources, as you were just hearing about, and as we see the duck curve growing and spreading its wings across different states over time, there is going to need to be -- you're right, it just moves. It moves on its own. I do know that there

will need to be different ramping capabilities. I do know that there will be different shifting of demand. I do know that all of those changes are happening now, whether or not this rule goes into effect. And so those things need to be addressed by the industry, and these attributes of electric system that really enhance our ability to be resilient, to be responsive to different types of demand, all of those things continue to happen. And thank goodness that this rule, anticipates the first commencement of compliance started in 2020. There is a timely period for response.

I already told you this part. I already told you that part. So my report provides what I hoped were a number of tools for people interested in understanding this rule, the lay of the land of the industry, and I have a chart of all the generating units that are affected by the rule, by state, by type of field. I indicate what we know today about announced retirements, and what one could anticipate, and the location of these resources. I describe in my paper, the very

nature of the difference between the mercury and the (inaudible) rule. In the past we've seen rules where all of the actions for an effective generating unit needed to take place by those generating units that are directly affected by the rule. Either inside the fence of a generator like the mercury and air toxic rule is -- there is not allowed to be inter-facility trading. There's trading within the footprint of one station, but not across. That's very different when you think about whether or not there are going to be the ability to have flexibility, and the emissions rates are of different rules, are over an averaging time period, that is very different than the year long or multi-year averaging time rate periods, for which compliance will need to happen under the carbon pollution rule. So there are really different things about the nature of this rule, that really invite a different lens, when looking at the reliability issue. I just described that. You heard about the SIP. So one of the things that I decided to do in my paper,

was to really try to illustrate how states might, in different circumstances, in the country, might think about this compliance in different ways. And so I pulled out the Champ Swiss Army knife as an example once again, that there are tremendous variations in ways that states can tailor their approaches. We heard inside and outside the fence. In my paper, I go through and identify the types of tools that are right now being used, and that in fact, EPA relied upon, when it was looking at how aggressively a state would need to reduce its own emissions. And these pictures reflect different lenses with regard to the capacity factors of gas units in places, the extent of reliance on energy efficiency, the extent of reliance on renewable and other things, including nuclear generating units. And so you can see, this is just meant to be, that there are a variety of tools, that are available to people to whet their appetite for thinking about what happens. I included in here, information by region about the type of retirements that are on the deck.

The last part of my paper, I intended to be a way for people to think or envision how they might go about doing this rule. So what I did was, in about ten examples, looked at situations where a state, in a particular industry context, could look at its system. So, down here, let's see if I can make this work. This one is an example of a multi-state holding company belly, that has a system, or TVA, that has a system that is currently dispatched across state boundaries, within the boundaries of that company, of course, buys and sells on the margin, but has a fleet that it dispatches across its footprint that is multi-state. So there are examples of places where the states could sit together and say, for example, that Southern Company could continue to operate its system, in the same way that it operates today. Again, just looking at averaging across just Southern's system or TVA's system. That state might choose to or not allow other parties to trade with that particular multi- state holding company. So those kinds of things are

anticipated for states to sit down and figure out how they want to craft a rule. Alternatively, is a situation where a state decides it wants each and every owner of power plants in that state, to operate as it does today, and operate its system in a vertically integrated state, as it currently does today. You can picture, however, a state like Illinois, that sits in two RTO'S. The State of Illinois could bifurcate its state and decide that some generating units in its states are going to go and have a conversation with the MISO states and the generating units that are in the PJM part of the state, could have a conversation with those states. There are infinite varieties. Another example, of course, is the situation that the nine Northeast states have, where there is a different circle around state geographies, that is entirely coincidental with the state boundaries of the nine states in the regional greenhouse gas initiative. They span two and part of a third RTO, and that particular approach, which is a cap and trade program, operates seamlessly in the context of the

electric system. There are signals to grid operators with regard to the pricing, to include as part of the dispatch, just as I can imagine a multi-state holding company could do the same kind of approach. So there's examples here. All of that goes to me to the reliability question. We have time here to have market signals bringing forth new generation additions for resource adequacy. We have the ability to operate systems as we know them today, with a lot of different frameworks, for including and internalizing carbon emissions that are tailored to the appetite and policy preferences of different states. And we know that we need to have the kinds of flexible attributes of systems that we're going to need for a transitioned energy industry going forward, and I think that's it. Here you go.

MR. COLBURN: Thanks, I'm Ken Colburn. It's a pleasure to be with you here today. As you know, Rich and a couple of colleagues founded RAP 20 years ago, as a group of veteran regulators to advise current regulators, so as not to make the

same mistakes that they had made. So then when RAP decided three or four years ago to do the energy air quality overlap, to get some veteran air regulators, they knew right where to turn. My mistake today, I guess, is following Sue, always an unwise idea. But let me try to proceed and share at least a couple of insights, if this will work. Have you ceded control over to me? There we go. As a starting point, it's really important to recognize that states asked, EPA listened, and indeed, EPA came out with a proposal where essentially anything counts. We talked generally about inside the fence, outside the fence. EPA even went further than that. So essentially, now the question is where to begin? And that's not a trivial question for states. Remember, the Clean Air Act is unusually prescriptive. So for 40 years, state air directors have essentially been doing what they're told. Now, what EPA said is, what do you want to do? And air directors aren't used to answering that question. So there's a real earth shift there, in how environmental

agencies are going to be able to approach this rule. Fortunately, there's some beginnings already underway, some pretty constructive ones. This is data from Georgetown Climate Center, and shows that already ten states have achieved 30 percent or more reduction there, greenhouse gases since 2005 levels. Those are the green states here. The red states have actually experienced increases, but interestingly there, one of those states, one of only two that are over 30 percent, Arkansas, made the comment in the person of Teresa Marks, who's Colette Honorable's counterpart on the DEQ side, said, this isn't going to be a big Armageddon, not a huge problem. We can deal with it. And a lot of the utility feedback, to date at least, has been fairly muted. EPA's provided a lot of flexibility, and utilities know that they can work with their state legislatures to craft appropriate state plans that they can work with. States themselves understand that there's some strength in numbers, and so they're starting to look at regional approaches, makes all kinds of

sense in my view. It's better for the power sector because you have broader areas over which to ensure reliability. You have more compliance options, essentially, this is the underpinnings of cap and trade systems, that the broader the universe, the more lower cost options there are in that universe that you can pursue. Similarly, it's better for states. There are fewer (inaudible) issues. You know efficiency here causes back-down generation elsewhere. How do you deal with that? Well, it's better if they're in the same region. And it's lighter lift. You know, the nine REGI states don't have a heavy administrative staff or enforcement staff. It's all pretty self-enforcing, self-running. So, the shared costs and lighter lift therein, is also an advantage. And then, yes, there is strength in numbers. You know, if little Rhode Island and little New Hampshire goes to EPA, maybe we'll get what we want, maybe we won't. But if nine or ten or 20 states go to EPA, that's a different voice, as you'd expect.

And then finally, it's better for EPA as well. Those were liability issues and cost issues, of course, where EPA can be most vulnerable. So if they're minimized, EPA's risks are reduced. And the last thing EPA wants is in a year's time to have 50 state plans, laying on its doorstep. Because it has a window as well, prescribed by rule, wherein it has to approve those. And actually that's a pretty short window, four to six months. So EPA would certainly welcome fewer reviews and subsequent approvals.

Besides exploring regions, states have also done a lot of preliminary work for other reasons, that can feed well into the 111b process. Many states have engaged in energy plans, work force development plans, associated with energy, IRP's, et cetera. This example is just one example out of Mississippi a year ago, and I submit that to a large degree, that can double as a 111(d) plan. There's some enforceability issues, there's some non- trivial considerations in that, but this should certainly not be treated

entirely separately.

Similarly, there are huge co-benefit opportunities here. And this isn't just a nice thing to have, that I'm talking about with co-benefits. You may be aware that EPA's Cleaner Act Science Advisory Committee just voted to recommend the EPA to make more stringent the ozone NAAQS, National Ambient Air Quality Standards. The effect of that would be to put more (inaudible) in the country and non-attainment, subject to non-attainment sanctions. Here we have the opportunity -- this two by two matrix illustrates air quality on the vertical axis good and bad and climate actions on the horizontal axis. There are things you can do, like installing scrubbers that are significantly helpful to air quality, but from a climate perspective, the parasitic loads mean you have to burn more fuel, so it's a detriment from climate. Likewise, across the map, where you want to be as a policy matter, to the extent that you can, is policies that address both. You know, how many

times do you want to go back to do ozone non-attainment. How many times do you want to go back to do PM non-attainment. How many times do you want to go back to do regional haze, and then also comply with 111(d). There's a lot of opportunity here to get them all in one fell swoop or at least a few fell swoops. I already said that. 111(d) done right does air quality, air quality done right does 111(d). I didn't mention water. Many of you are experiencing droughts. They are probably chronic at this point, rather than episodic. We've already had d rates and shutdowns due to water issues. This is going to be a problem. Another way that 111(d) can be crafted to minimize that problem. So, overall, doing a multi-pollutant, multi-media, lowers cost, produces better results. This is a graph of the state-by-state results. You know, the overall is 30 percent reduction from 2005, but that's not the rule. The proposed rule has individual state reductions, and if EPA was playing poker with the industry, or playing poker with the advocates,

this is 52 pick up. There is nothing recognizable about this graph. You don't have your usual bicoastal brotherhood of California, Oregon, Washington, and the Northeast. This is all over the map, and it will induce some complexities. For example, are Minnesota and North Dakota are going to be in a region together? And if so, is North Dakota going to say to Minnesota, I'm sorry, you've got a heavier burden, but I'm not going to increase my workload because of your burden. This is a very, very interesting situation, and the states are trying to digest this now.

They'll have to, as I said, develop their own individual plans or do so in groups. And even that's challenging. This is a pretty simplistic two by two as well, but it's one that may not have occurred to you very often. When you look at how little experience air regulators have, working with public utility commissions, and vice versa. Some states have exceptions to this rule, but by and large, they don't cross paths very often. So when you look at where the authority is

for adopting 111(d) regulations, it's going to be with the air guys, not the PUC's. But then when you look at who has the authority to implement programs, typically efficiency renewable, RPS's, whatever, and institute orders for cost recovery. It's all PUC's, nothing to do with the environmentally. These guys got to talk with each other. The rule itself is essentially full of EPA seeks comment on. Now that's a good thing, because it's a proposal, and that's what EPA should be doing. But there are just so many, so important elements of this role. I didn't go through them all, but what EM&V is necessary? What about interstate effects? What about federal enforceability? What about how the numbers were determined in the first place. All of those things, EPA seeks comment on. You should essentially look at it, read it, with the view of, I'd like to submit a comment on that, or I disagree with that, or I think they could go further here. Because that's the kind of feedback that EPA wants and has provided time for.

There's some concern out there, as I illustrated, with Minnesota being one of the states, and Washington being the most heavy reduction state. States that have been early actors, have they been penalized? And how come some of the slower moving states have such lighter burdens. This will all shiver off, but there's a little concern about that. One thing to be aware of too, is that federally, America has a place in the world, and hasn't acted on that place very much. The president's concerned about that, that devolves to EPA, so this rule has international ramifications as well. In fact, when it was proposed, China the day after came out and said, we're going to do an overall cap as part of the 13th, five-year plan. So, I don't think that's why EPA is doing it, but they're also certainly cognizant of those effects.

So I guess the take homes are that we should expect, we can indeed be certain of, a lot of uncertainty for the next year or three or five. EPA has never done this before. You know, 111(d)

is referred to as the 40- year-old virgin, right, because it's hardly been used. So, this is new turf for EPA, and we should regard them as such. Recall when 111(d), EPA essentially didn't re-engineer it, but added major revisions to it along the way. We can anticipate something similar here. EPA itself is note monolithic. Remember their policy offices like OAQPS, the Office of Air and Radiation, and so forth, not just headquarters. And then there's there the regional offices. They have to get the message, and part of Reid's job, no doubt, is going out and talking to ten regions, and trying to make sure that they understand all the subtleties that are built in. So, at this point, states are just trying to get their arms around it, understand the rule, understand their options, understand their approaches, figure out who they might work together with and so forth. Once the rule is finalized in a year, we can expect, no doubt, lots of litigation, (inaudible). There may be extensions and approvals, and finally,

implementation. You ought to think in terms of a minimum of five or six, may be seven years. But another good reason why EPA starts the clock at 2020. The important thing is that they're getting something on the books. Bringing carbon into the mix as a regulated pollutant, makes it real, and there are financial and other decision- making of everybody. And it's probably time that that happened.

The take home I guess is that this is new ground for states and new ground for EPA. And as a result, we'll have all the speed bumps that you wouldn't expect with new ground. But ultimately, I expect that it will be harder to change the regulation, the regulatory systems, the command and control that we've endured over history, than it will be to actually comply with the reduction requirements. Thanks very much.

MR. COWART: All right, first, can we have a round of applause for all those guys. (Applause). And I want you all to know, I had this stopwatch going the whole time you were

talking, and you were all like brilliantly, either on or under your time. Congratulations.

So, we will entertain questions, and I've got some, but I'm going to let you all start. Granger.

MR. MORGAN: So, Reid, I admit to not having read the entire document. I have looked at the state-by-state tables. Can you tell us a little bit more about how those state-by-state numbers were developed, and then the extent to which there's likely to be vigorous argument, about -- oh, my number ought to be higher or lower. I mean, it strikes me that in some respects, you, I mean, you know, I commend the effort, but I'm also worried about whether you've set yourself up for sort of endless bickering among states, as to what the numbers ought to be. That's the general question.

The specific question I also have is, if I do something like change out all the large motors in my coal plant, to improve the efficiency of air handling, do I suddenly trigger a new

source review, or do I get some exemption in that case?

MR. HARVEY: Those are good questions. With respect to setting the state goals, I'll try to give you the high level, and we could talk afterwards, if that's still not clear. So we look at the suite of fossil units in 2012, and as Ken noted, we are taking comment, because this is a proposal. We're seeking feedback on the data that we used, the approach that we used, and so these are open for feedback now, before we do the final rule. So, we looked at the suite of existing fossil units. For building block one, we said, we believe, based on operational and technology analyses that we did, that on a national basis, you could get something like a six percent (inaudible) rate improvement. We're not saying that every plant is capable of that; we're just saying that's a national assumption. States could not impose that sort of approach on their individual units. So that forms block one. Block two is dispatch, and what we said there, is

looking at the mix of coal and oil/gas steam units. What's the ability in each state to shift away from higher emitting coal or these oil units to natural gas units, up to their availability. So, if you had a theoretical state that has no gas, then you wouldn't have any dispatch. But in states that have a mix of both, we would say, the gas units could theoretically run higher. Karen mentioned 70, although that's not the outcome that we model. But that was the assumption that we used in setting that building block. We said, if you could run the gas units up to 70, you would back down the coal units proportionally, so that's block two.

Block three is the renewables. And we looked at, and here's where we are seeking a lot of comments, because this is a tricky one. We looked at six regions of the country. We looked at the average of the renewable portfolio standards that existed in those regions, and so we said, what if each state moved toward the average goal that the RPS's for that region set. And so

some states are already further along, because they've already had an RPS, or it's more aggressive. Other states are starting from a lower point, and they're moving towards that point. But we also put out an alternative approach, that looked at data from NREL that DOE provided to us, that looked at the resource availability of renewable in each state, and then we kind of said, well what if that were allowed to be used to set the goal up to a certain price point.

And then the fourth approach is energy efficiency. We looked at what the top 20 percent states are already doing on energy efficiency, and we said, what if nationally, other states who are not at that point, could move up to that point. So, all of those together added up to that goal, and that's why it's a very state- by-state approach. It's using a nationally consistent method, but every state is in a different position, and so it reflects where they are in their current mix.

MS. TIERNEY: Could I just add something? The percentage charts, I think are -- they're deceiving. Because every state has a different numerator and denominator, and so the ones that look like they're going very deep, it's a math issue to a certain extent. It's not a thumb on the scale.

MR. HARVEY: And the other challenge of the percentage charts is they don't reflect what people have already planned to do in 2015 or 2016, so it may look aggressive in a particular state, but if they had already planned for other reasons, for economic reasons or for other reasons, to retire a coal unit, then maybe the lift is not so great. So that's not reflected -- this is not a forward-looking assessment. We didn't look out at what people were planning to do, in that point of time, so that's a note of caution. And we've also noticed, you know, sometimes people do the match a little funny, so it's not straightforward.

MR. MORGAN: So on the second question, if I change out all the air handling equipment, do

I run the risk of triggering a new source review for my coal plant?

MR. HARVEY: This is not -- EPA is a large institution and actually new source review is not in my purview, but generally we decided to provide a lot of flexibility to states, so that they could design plans, that would fit the needs of their own situations. So, we think that we've provided a flexible approach, so that these sorts of concerns can be addressed. But that's really -- again, sort of up to each state for how they want to address that.

MR. COWART: Do you want to respond to that question?

MS. OBENSHAIN: Granger, if I may, I just want to add something. You're absolutely correct. When our CEO's first took a look at the proposed rule, they had mass hysteria, because they thought everything they had done -- like Colorado, Washington, a lot of the states who did a lot to decrease their CO-2 emissions, they thought it wasn't being acknowledged, especially

in the goal reduction. We hadn't heard this before. We had a concern of about what could be -- I don't want to used the word counted, but what could be counted toward reaching your state goal? And I'm glad to hear that it is things that we are doing or plan to do between 2014 and 2020. Because we weren't sure about that. It's not clear in the rule.

MR. COWART: One observation from me on this subject -- when I first saw the numbers, for all the different states, I thought -- I looked at the numbers, before I looked at the way the numbers were generated, and I thought, wow, somehow, somebody at EPA tried to do some kind of political calculus, which escapes me. And the reason that I thought that, is that I've been working in Europe, and when the Europeans did their 20 percent reduction for carbon, under the European trading system, that is what they did. They actually got the energy ministers and the heads of states in a room, and carved up the European goal. And they have a great name for it.

It's called effort sharing. They agreed politically on a degree of effort sharing, that took into account a lot of history. It took into account per capita income in different countries, willingness to pay in different countries, lots of things. And I wondered whether that was even remotely possible in a 50-sided negotiation. So, then reading how the numbers were -- as Reid just explained, how the formula actually was created, I thought it was an impressive feat, to take some of those important factors and then do something consistent across all the states. Who knows what the next step will be? I'm just going to work around the table, going that way, starting with Marilyn.

MS. BROWN: Okay. That was a wonderful panel. Thank you so much. And Sue, I look forward to reading your report. I especially appreciate your attempt at trying to diagram the different mosaics of regional partnerships, and how those might play out. I wanted to probe a little more on the energy efficiency. I have a

question for you, Reid. It seems to me that -- and I've looked carefully at the Georgia numbers. I haven't really done a full U.S. analysis. But the numbers for Georgia in energy efficiency, the goals that you set, are pretty modest, six percent for renewables, seven percent. It seems to me, from my knowledge of the renewable resource availability in Georgia, that's a high number for renewable, and a very low number for energy efficiency. I'm wondering how you arrived at the energy efficiency goal in particular. Karen, you mentioned that you thought it went out to, on average, 10 point something percent, maybe through the whole period for the U.S. I think it's probably more modest than that, as a whole. And maybe you'd want to weigh in on this as well, Sue. On my own sense, is that there's probably such a degree of uncertainty about the M&V associated with demand reduction or efficiency, that there's sort of a dampener put on it. And I know, Karen, you mentioned that utilities don't have control over many of these measures. But there are ways

of gaining some credit. For instance, in many of the states in the Southeast, the building codes are in poor condition. Even if they have the right codes, they're not enforced. The utilities could work with states to work on that sort of -- typically not a utility domain of influence, but I know there have been ways that California has worked out giving credit to utilities for assisting with building codes. So anyway, just sort of a sense of -- I don't think that the goals set for -- at least the states I'm familiar with for efficiency, were particularly aspirational. I do appreciate that some of my work was cited in the 650 page document. I hope it wasn't that my work was not sufficiently aspirational.

MR. HARVEY: So again, on the approach, we used a nationally consistent approach, looking at the top 20 percent of states who have energy efficiency programs, and seeing that they've achieved, or will achieve by 2020, something like a 1.5 percent annual avoided demand rate, right? And so we said, well, what if states started from

where they were, given their existing EE programs, and grew annually towards that on a cumulative basis. I think that's where Karen got to her number, was that's more a cumulative number. But if you applied that 1.5 percent to Georgia, starting in 2017, from where they are today, I think that's how you would see our numbers. There are these spreadsheets that Karen referred to -- my numbing spreadsheets, which we're happy to walk you through the Georgia specifics. And we love your comments on this, if we got the numbers wrong. But we tried to apply that kind of universal approach across the country. So it does reflect where states were starting today -- in Georgia, starting today.

MS. BROWN: But it doesn't reflect the potential they have, does it?

MR. HARVEY: It's based on that 1.5 annual rate.

MS. BROWN: Every state is the same, with respect to that.

MR. HARVEY: It's a uniform approach.

It's not -- Georgia has more potential than Wisconsin.

MS. BROWN: That's my problem.

MR. HARVEY: Yeah, okay.

MS. TIERNY: So remember that -- what I think EPA tried to do, and Reid will correct me, if I'm wrong on this, is they tried to say, what do we know about technology today? Not, what do we project will be technology advancement in the future. And I think, without being a lawyer, I think that's because they wanted to stand on ground of what we know today, about the best system of emissions reductions. And they built on -- we know we have a combined cycle technology. We have nuclear plants being built today. We have X, Y, Z happening. Those are known commercially today. And so, I think it gave them a standing point that is stronger legally, without having to say that they were relying on projections where you could really, really tap things.

MR. COWART: And you're right. 1.5 percent per year, starting in 2016, in a modest

efficiency objective. If you were to look at the top ten states, or, you know, where the most ambitious states are now, based on their learning curve, setting their incremental standards. That just means we know as time goes by, we'll be able to do better, and it will cost less. Sonny.

MS. TIERNEY: Actually, can I say one more thing about the energy efficiency thing? Remember that a state -- this is different than the MATS rules. MATS rules affected individual owners of power plants. And they had to take actions. There are really two sets of actors here. The state -- the state could adopt and apply insufficiency code, without a utility having anything to do with that. Of course, they're going to weigh in. And it affects the market conditions in which the utility or the power plant owner is going to operate. The state could adopt a stronger building code. And so this is more like the ozone state implementation plan, where -- when I was head of environment in Massachusetts, I had to negotiate -- I was going to be presenting

the plan for Massachusetts to EPA, but I had to sit down with the Transportation Department, because it affected the roads and a variety of other things. And so, it's the state that actually has a program, and then a lot of those affect the environment in which the plants are operating.

MS. OBENSHAIN: I just want to add one thing on energy efficiency. You don't believe that the 1 1/2 percent national is that big of a stretch. 48 states have EE programs now, and most of those programs have gotten the benefits from what we would call low-hanging fruit. It's cost effective. It's easy to do, et cetera, et cetera. So I really think -- I'd push back a little and say 1 1/2 percent increase in energy efficiency a year, over ten years or so, is going to be a stretch for some states. It's going to be more and more challenging to find those cost effective ways to decrease energy demand.

MR. COWART: So, Sonny, I think you're next and then David.

MR. POPOWSKY: A couple questions -- sort of math questions, but it follows up on what you just said. On energy efficiency, and then I have one on dispatch, particularly from my perspective, coming from a restructured state, where we don't regulate these guys, you know, economically. If we do a program in Pennsylvania, you know, we have a successful energy efficiency program, and we're being regulated, based on the amount of emissions per megawatt hour produced. We're simultaneously lowering the numerator and the denominator, and haven't reduced the emissions per megawatt hour produced.

MS. TIERNEY: You're assuming it's linear, right?

MS. OBENSHAIN: Okay. We'll have a math discussion here.

MR. POPOWSKY: Well, but just general -- you see what I mean. So I think you'd have to switch to a -- so the weight-based approach, I don't think is going to work as well for energy efficiency, as the mass-based approach. So it

would seem to me -- if you really want to rely on energy efficiency, and you want to lower the numerator and the denominator, you'd want to go to a mass-based approach, and the rate-based approach wouldn't work all that well.

MR. COWART: Sonny, I'm sorry to interrupt your question with my question, but I think it might help. As I read the EPA summary of the rule, it stated that the imputed megawatt hours from energy efficiency, are in fact counted, as though they were generated at zero emissions, just like renewables. So, that would be an answer to the concern that you've raised. So, if you have a megawatt hour of efficiency, it goes into the formula as though it was a generated megawatt hour or a nuclear plant. So, I hope -- I was trying to help.

MS. OBENSHAIN: It would be zero emissions in the numerator, but you would increase the megawatt hours in your denominator, so your rate goes down. At least that's how it's supposed to work, right?

MR. POPOWSKY: Okay, great. And then my other question -- that does solve the problem. I wasn't aware of that. And then the other question is for dispatch. If you want to move from -- if you're in PJM, and you want to move from coal to gas, then you have to increase the cost of -- we in Pennsylvania, don't regulate the dispatch of our power plants. It's based on, you know, economic dispatch. If you're not going to put a price on the cost of carbon, in a place like PJM, how do you affect the dispatch?

MS. TIERNEY: I think there's lots of ways that Pennsylvania could do it. I'll use that as an example. For example, Pennsylvania could shift over and join something like RGGI, or create its own cap and trade system, within the state. So that every generator in that state, had to put an effective price in their offer price in the PJM. So there's lots of ways to do it with shadow prices and with actual allowances. So again, there could be a cap within Pennsylvania, the same way that the cap runs across RGGI. I've heard of

states seeking, that are not contiguous, to a state with a cap and trade program. They could essentially do the same thing. Let's just say in theory, what is it -- California and Quebec. I mean, that blows my mind, but in theory, again, if you're counting the carbon that is emitted within that footprint, then you can allow trading. There's, of course, leakage across the border, as it happens right now, between Pennsylvania and Delaware and Maryland. But there are ways to do it.

MR. COLBURN: And just to add to that, Sonny, you'll recall that Great River actually, also proposed that carbon price be added, to affect dispatch order. There's some pros and cons to that, not surprisingly, but that can be done as well.

MR. COWART: David.

MR. MEYER: This is a question that goes to the panel as a group. Many of us in the room, spend a fair amount of time thinking and working on problems related to what we loosely call, grid

modernization. And to me at least, that means a major transformation of the grid, over the next couple of decades. And I'm using the term grid very broadly and inclusively. So, now comes this other transformation that we're talking about under 111(d), and so my question to the panel is, how do these things relate to each other? Are they synergistic, perhaps? Are we that fortunate, or are there major problems, where they're not going to be quite so synergistic. Or is it really more indeterminate than that?

MS. TIERNEY: I think the honest answer is, we don't know. But I see them as highly synergistic, potentially. Both of those are a phenomenon that are happening the world, that will be modernizing the electric system. I actually think that the grid modernization constructs are actually harder and more complicated than this. But the overlays can align very well, going forward, because when people talk in many of the settings, that at least I hear, grid modernization is a mechanism in which there will be a number of

investments in different parts of the system, some of which is a lot of rooftop, customer-generated activity -- a lot of things happening within distribution systems, that didn't happen before. That could allow you to capture some of the benefits of low-emitting sources that may go on rooftops, and a variety of other places in the future. But we don't know.

MR. COLBURN: I think that's an attractive characterization. You know, you have two venn diagram circles, and how much do they overlap? Are they congruent, or no overlap? But I'm inclined to think that they're probably largely overlapped. But a big variable that I see, is sort of what I might call secondary effects. If you just think that a traditional utility sector and utility rate payers, we might put those circles somewhere. But what the grid modernization is going to allow, is aggregators to really play in this game, in a way that they haven't before. That could have profound effects, leading to, say, renewable generation or

efficiency, that then benefits the 111(d) direction markedly, even though it wasn't the purpose.

MS. OBENSHAIN: I'm sure you're aware EPRI, the Electric Power Resource Institute, put out a recent paper on grid modernization, and it's very interesting. You might want to take a look at that. And it describes some of the same things that Sue and Ken have described. It's a complicated -- and we're working on it.

MR. COWART: Paul?

MR. ROBERTI: Coming from Rhode Island, the install capacity in my state is 99 percent natural gas, but we're been part of an integrated regional grid, all the way back, even before deregulation or restructuring. And the contract paths for the electricity that comes into Rhode Island, does not actually match the 99 percent install capacity. And when I look at the -- we also have aggressive energy efficiency with the lowest per capita use of the electricity in the nation. I think beat California, because we

started on this more than 20 years ago. But my question is, when I look at the reduction targets, on the base, not the potential for EE or renewable, Rhode Island is no different that West Virginia, in terms of how much we need to reduce. And I'm just questioning -- what level of equity has gone into the fact that we just happened to have the gas pipelines, just north of the Rhode Island border, where Rhode Island was an easy state to situate thousands of megawatts of natural gas for the benefit of the region, and now we're burdened to the same extent as some other states, for having situated these gas plants. And I don't know -- are my concerns unfounded, that there's an equity issue in how this will roll out in terms of the costs put on Rhode Island, as compared to other states?

MR. HARVEY: These are good comments, and you should follow up with us, and we should talk specifically about it. This is the purpose of the proposal -- is to talk about the consequences of the best system uniformly applied,

and to hear this feedback, so please do follow up with us.

MS. TIERNEY: Paul, when I think about Rhode Island, and all of the six states in the New England RTO, and then the nine states that are currently part of RGGI. I think that the ability to capture that emissions reduction target, is going to be summed across those different organizations. So, Rhode Island actually may end up never hitting that exact target, because of bilateral agreements, multi-lateral agreements that you have with the other states that are part of the regional hull. So picture if the Rhode Island natural gas plants today are not operating at 70 percent, but could in the region be dispatched more, and thereby displace some of the coal units in another part of the RGGI states. You exceed that target, because your actual emissions are going down, because somewhere else in the region, it's going to be sculpted out. So that's how I'm picturing -- when I hear the RGGI states saying that there will be some proposal

that's akin to RGGI, put forward in that.

MR. COWART: And I gather that EPA is really interested in promoting those multi-state arrangements.

MS. TIERNEY: They're likely to continue to get the lowest cost carbon emissions reduction first, if it happens that way.

MR. COWART: Carl.

MR. ZICHELLA: Yeah, similar relationships between Montana and Washington with coal plants, and shutting off coal plants in Montana. If they have a regional relationship, they would get some credit for that. The point I wanted to just ask about, was David's point about grid modernization. And I can see, as Ken said, the circles are overlapping a fair amount, a lot actually, because you're influencing the generation stack dramatically, about what you're planning transmission for, and what the future of grid will be. And I think just about everything that you read about the future grid, indicates that it will be more flexible. It'll be faster

operating. It'll be more resilient. It'd be better coordinated. These are all the things you need to do, to really get deep penetrations of renewable. And the changes in the generation stack, certainly favor that, because the resources coming out, tend to be slower starting -- baseload, resources, less efficient resources, so isn't that right? I mean, it just seems to me that there's a pretty obvious synergy here with 111(d) in a working and wet transmission plant. And we're certainly assuming that that will be the effect, and the real consideration is that regional reliability in responding to that.

MR. COLBURN: I don't have anything to add. I think you characterized it well.

MR. COWART: Any final words from the panelists?

MR. BALL: Just a simple question for Reid. Is there a -- and I know it's been reiterated several times, this is not the MATS rule. But during that process, there was this whole debate between various government agencies.

I guess EPA and FERC. Is there an effort underway to not have that train wreck again? And I don't know the answer to that. It's an honest question.

MR. HARVEY: I think Sue did a good job of talking about how this rule is very different from the Mercury toxic swirl. But that being said, we've certainly been attentive to the concerns about reliability, and one of the things that we've done successfully, that grew out of that, is we have frequent discussions between FERC, DOE, Pat's office, Mike's group, and each of the ISO's and RTO's, to talk about reliability issues, and we think that there's a lot of flexibility here, that as Sue pointed out, is a very different situation. And because there's a different role for states versus EPA here. So, we think that there's a lot of room to address that. But I don't know if others want to --

MR. COWART: All right, well, once again, thank you all very much. I'm sure this will go on. (Applause). So I think our final piece of business this afternoon, is to hear from

Wanda on the work force task force.

MS. REDER: Yeah, I think this is going to be pretty quick. There was a memo that was sent around in draft, before the meeting, essentially outlining some past activity. From a work force ad hoc committee, we put together some recommendations, back in 2012, I believe. And then in the fall of 2013, again, refreshed that. And now the committee has met a few times since. And essentially, we're sitting here in kind of a situation that Billy suggested yesterday. We still have challenges with expertise. We know it's out there, and yet, you know, there's various activities within the departments, not only DOE and others as well, NSF, Department of Labor, et cetera. It's become very apparent that there needs to be a leader in the energy work force aspect, in order to pull all these fractions together. And we think that OE is ideally suited, but we also recognize that there is staff limitations. So, the recommendation in the memo is saying, EAC believes that OE should take this

position. But we wanted to put it out there in draft form, get you guys thinking as a whole, so that we could bring it back up in the fall, and then actually take, you know, an official position through a vote. And then, you know, obviously, Pat and others will come back and say, well, we either think that's a good idea or not. But at least it kind of gets off dead center, which is, I think, where we are right now. So, that summarizes it. I do want to give Anjan credit for writing the memo, because he took some real rough notes, that came out of some conference calls, and turned it in to what it is.

MR. BOSE: I think you put it in the right perspective. The main thing is -- that came out of our meeting, and we had people outside of DOE, on our phone calls from the Department of Labor, NSF and so on. Who were somewhat involved with work force issues. Nobody took responsibility for it. It was something -- as part of some time in their plans, they had a project or two, to do something in that arena, and

now they're not doing anything more. The only people who have a long-term responsibility for education -- science and engineering -- education is NSF, but those don't necessarily target this industry -- the energy industry. So, that's where it kind of lies, and I think it's up to this group to decide whether somebody -- there should be some part of some agency, who should at least take a lead through all of this.

MR. COWART: And Pat, do you have a comment? Do you think this is a good way for us to proceed to advise you?

MS. HOFFMAN: Yes.

MR. COWART: All right, thank you. That was efficient. Anything further?

MS. REDER: Nothing else.

MR. COWART: All right, thanks very much. I believe that we have concluded our business. Is there any other matter that a member would like to bring to the committee? All right, I see no tent cards. So, we stand adjourned. Thank you very much. Congratulations, and thanks

for working through part of the lunch period.

(Whereupon, the PROCEEDINGS were adjourned.)

* * * * *

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

Notary Public Number 351998