U.S. Department of Energy
Electricity Advisory Committee Meeting
Ronald Reagan Building and International Trade Center
Washington, DC
March 6, 2012

Minutes

EAC Members in Attendance

Richard Cowart, Chair
Regulatory Assistance Project

Irwin Popowsky, Vice-Chair
Pennsylvania Consumer Advocate

Rick Bowen
Alcoa

Clark Bruno (Representing Edward Krapels)
Anbaric Holdings

Lisa Crutchfield
National Grid USA

José Delgado

Robert Gramlich
American Wind Energy Association

Dian Grueneich

Michael Heyeck
American Electric Power

Joseph Kelliher
NextEra Energy, Inc.

Barry Lawson
National Rural Electric Cooperative Association

Ralph Masiello
KEMA

David Nevius
North American Electric Reliability Corporation

Wanda Reder
S&C Electric Company

Brad Roberts
Electricity Storage Association

The Honorable Tom Sloan
Kansas House of Representatives

Gordon van Welie
Independent System Operator of New England

Mike Weedall
Bonneville Energy Administration

EAC Members Not in Attendance

Guido Bartels
IBM

Frederick Butler
Butler Advisory Services

Ralph Cavanagh
Natural Resources Defense Council

The Honorable Robert Curry
New York Public Service Commission

Roger Duncan

Richard Vague
Energy Plus Holdings, LLC

Brian Wynne
Electric Drive Transportation Association

DOE Staff in Attendance

Lauren Azar
Office of the Secretary

Anjan Bose
Office of Electricity/ Washington State University

Bill Bryan
Office of Electricity

Caitlin Callaghan
Office of Electricity

Jay Caspary
Office of Electricity

Kerry Cheung
DOE, AAAS Fellow

Michael Ducker
Office of Fossil Energy

Louise Fickel
Office of Electricity

Imre Gyuk
Office of Electricity

Debbie Haught
Office of Electricity

The Honorable Patricia Hoffman
Office of Electricity

Rachna Honda
Office of Electricity

Hank Kenchington
Office of Electricity

Michael Li
Office of Electricity

Eric Lightner
Office of Electricity

David Meyer
Office of Electricity

Doug Middleton
Office of Fossil Energy

Brian Mills
Office of Electricity

Joe Paladino
Office of Electricity

Bill Parks
Office of Electricity

Brian Plesser
Office of Electricity

Matt Rosenbaum
Office of Electricity

Non DOE Staff in Attendance

Tim Bagley
The Bagley Group

Venkat Banunarayanan
ICF International

John Bear
Midwest ISO

Jay Clark
Battelle

Don Digg
Crowe Horwath LLP

The Honorable James Gardner
Kentucky Public Service Commission

Katherine Hamilton
Electricity Storage Association

Tom King
ORNL

Paula Klein
ICF International

The Honorable Cheryl LaFleur
Federal Energy Regulatory Commission

Larry Lamm
SEL

Sheri Lausin
ICF International

Kurt Longo
Federal Energy Regulatory Commission

Janine Migden Ostrander
Regulatory Assistance Project

Phil Mihlmester
ICF International

Gabe Nelson
E&E Publishing

Elliot Roseman
ICF International

John Shenot
Regulatory Assistance Project

Elizabeth Stipniek
Edison Electric Institute

Peggy Welsh
Energetics, Inc.

Meeting Minutes

Welcome and Opening Remarks

Richard Cowart, Chairman of the Electricity Advisory Committee (EAC), opened the meeting at 8:00 am EST by welcoming the EAC members and also Lauren Azar, a former member of this committee, who joined for the morning. Mr. Cowart mentioned there would be a few announcements by Elliot Roseman.

Elliot Roseman, Vice President, ICF international, announced the WiFi access information and asked everyone to sign in on the sheet that was circulated and indicate which subcommittee(s) they would like to participate on.
Mr. Cowart reminded the committee that by law they are required to have certain subcommittees with certain numbers of people on them. Therefore, sometimes assignments are made in order to comply with the law, but no one has been refused admission to a subcommittee that they have signed up for.

Mr. Cowart then began the meeting by talking about transmission and introducing Mike Heyeck.

EAC Transmission Subcommittee 2012 Work Plan Deliverables and Discussion

Mr. Heyeck welcomed those participating and stated that he wanted to be sure the group focused on what would help the Department of Energy, not help somebody else through the Department of Energy. He recapped his topic from Monday to recognize that DOE has enormous talent in the science area, which will be continually discussed through the next five categories referenced in his presentation.

Mr. Heyeck addressed fuel dependency, highlighting the intersection of gas and electricity, particularly the market elements. He further discussed that there is some reservation about pursuing this given that FERC is also pursuing it and that the only area of assistance may be infrastructure security. Mr. Heyeck also discussed technology and its role in grid reliability, which ties into the long- term mission of the grid reference by Bill Parks yesterday. Further he covered transmission siting to help review those comments to discern what can or cannot be done. In conclusion Mr. Hayek stated that the only gap identified is that there is no industry movement toward coming up with hardening solutions for electromagnetic pulse. In closing Mr. Heyeck talked about plugging into the long-term vision that Bill Parks opined on yesterday. The area of power electronics would be a natural for transmission to dive into because that is really not only the past but also our future.

Lauren Azar welcomed the offer of assistance with regards to the comments. The comments with regard to the 216-H rule have already been received. Ms. Azar indicated there was a new request for information out, but welcomed the committee to look at comments on 216-H noting the timeframe for review was very quick. Ms. Azar gave a review for those not on the Transmission Subcommittee in EPEC 2005. Ms. Azar asked if there was any way in which we should be defining when the application is complete in a different way to make the one-year deadline more in sync with what Congress was thinking. There is a disconnect between Congress's timeframe and what the agencies think is feasible. The other RFI that is out right now gets to the same question – how long should the federal government be allowed to take in permitting its transmission lines. Comments are due within three and a half weeks now.

The second RFI approaches it from a different metric, which is the chicken and egg problem with regard to generation of transmission. One reason the transmission doesn't get built is because it takes so much longer than generation. Another benchmark should be to list what is needed in order to get the transmission built. These two information points are needed to negotiate. The transmission times need to be commensurate with the generation. Number one is to get comments into the RFI. And number two is to come up with these two different points. This would provide tools to present to the nine agencies that are part of the rapid response team and it must be data driven. It would be helpful to have the comments of the current 216-H within a week or two. Once the RFI comes in, it will also require a quick response, the RFI is on the DOE web site.

Mr. Cowart announced that Commissioner Cheryl LaFleur had arrived. He was looking for comments on Mike Heyeck's recommendation that the Transmission Subcommittee focus on the second thread of his five groups and an invitation from Azar for the committee or its members to opine on the current RFIs if that's possible for this committee.

Mr. Heyek welcomed the committee's input, but recognizing it is a short timeframe.

Mr. Van Welie supported the proposal to pick the second item (infrastructure security - above) even though there is big vested interest in the first. It is receiving attention at the FERC, so I think the second topic makes sense to me.

Ms. Dian Grueneich endorsed it, and suggested focusing on the second area and looking at the information that's coming out from the ARPA-E projects, and then understanding how that could be more comprehensively than used in the transmission system.

Ms. Grueneich believed that we could all do better if we worked collectively, on transmission, to understand the new technologies that we can bring into the transmission system and how we could actually make that effective. To the extent possible observations on the comments should be sent in. But his understanding from David yesterday was that the subcommittee could not, per se, give any recommendations back to DOE. It would then have to go through the full committee as far as any recommendations. The timelines will limit this to be pretty ad hoc.

Mr. Meyer stated that it would help to discuss this before the next meeting and have another face-to-face meeting before the EAC itself can act. It will take extra effort and quick response would be needed by members.

Dian Grueneich asked if the RFIs that go out will end up being a formal rulemaking, a rule that the secretary adopts, or is the feedback back for use in your informal negotiations.

Lauren Azar clarified that there are two things happening. The first is the 216-H was a NOPR, comments we received as of February 27th were in response to a NOPR. So if the nine agencies don't move, then it is a rule. The second RFI would not result in a rule; it may result in other things, but not a rule at DOE.

Mr. Gramlich believed the proposal was sound and referenced a discussion about focusing on what DOE has the authority to deal with. One of the suggestions was on the power marketing administrations for which the department, which oversees the PMAs, is making a number of important policy decisions, and this committee could discuss and advise on those. Mr. Gramlich asked if that was consciously left out.

Mr. Heyeck requested more context on this.

Mr. Gramlich stated that there have been a number of activities from WAPA and the Bonneville Power Administration in particular that do relate to transmission service in interstate markets, and there has been a lot of discussion on that. The department is making very tough decisions on these issues, and would be good if the group could fruitfully discuss and advise the Department on.

Mr. Cowart asked about the specific topics where the Department is in need of assistance from the committee.

Mr. Gramlich replied third-party transmission financing, which was a provision in the Energy Policy Act of 2005. It's a new authority, not been used yet, but there have been applications in for that, so that's still before the department. Other issues of open access in the Northwest with Bonneville, curtailing certain generation, and letting other generation operate. That has serious transmission service and market impacts. With regard to building transmissions -- there has been a lot of progress from both Bonneville and WAPA, with the Recovery Act funding.

Mr. Cowart introduced Commissioner LaFleur.

Presentation on FERC/NARUC Forum on Reliability

Commissioner LaFleur discussed a chart that was circulated earlier, and indicated that she agreed that this group might be uniquely situated to help on the technology piece. She mentioned that there is a lot of work going on with gas/electric interdependency at NERC and for David Nevius and that hopefully FERC will add something. LaFleur indicated that DOE has a tremendous amount they can contribute on siting. She stated that the technology is a little bit freewheeling right now in the sense it's not clear who's doing it.

Mr. Cowart asked if there were any additional comments on the Transmission Subcommittees proposal.

Patricia Hoffman suggested the technology categories and DOE authorities. Ms. Hoffman suggested to review the authorities from 216-H that DOE has, and identify if there are any opportunities or flexibilities or challenges and to look at a different viewpoint on some of those authorities.

Mr. Heyeck noted that the subcommittee knew that March 8th was the first and that it should be narrowly fleshed out to see what they need to work on. If the PMA issue is addressed it would be within the context of the DOE authority. 1222 really being dormant.

Ms. Azar countered that 1222 is not dormant, and a decision will be made soon.

Mr. Cowart asked Ms. Azar to state the questions that would be most important for the committee or its members to provide input on.

Ms. Azar referred to the RFI which she noted was very specific.

Mr. Cowart questioned if there was something specific that this committee and its members were especially apt to comment on or where it would be useful for the committee's input.

Ms. Azar stated that the goal is to define timelines for trying to make generation, whether it is PPAs or developing generation, and transmission commensurate. It needs to be figured out what that outer timeframe is in order to tell the agencies. In reference again to 1222, there is a decision coming out soon.

Mr. Cowart introduced Commissioners Gardner and LaFleur on the FERC/NARUC Forum on Reliability.

Commissioner LaFleur also introduced her advisor from FERC, Kurt Longo. Commissioner LaFleur stated that she and Commissioner Gardner would discuss the forum and NARUC. FERC doesn't typically get involved with EPA proceedings. Recently FERC had the responsibility for the reliability of the bulk power system and there have been suggestions that the pace and numerosity of the new EPA suites of regulations could impact reliability. FERC held a technical conference last fall which indicated there would need to be a lot of coordination and flexibility to make this work in an effective way for everyone. Based on that outcome it was suggested that an on ongoing forum between the state commissioners and FERC be conducted. This led to the FERC/NARUC Forum on Reliability and the Environment that David Nevius of Indiana, Phillip Jones of Washington, Phil Moeller and I chair. The Forum last February was successful. It was a good airing of views, heard from DOE on their potential authority under 202. There was conversation in real time and a groping toward understanding all the dimensions of the possible ways to extend time formats, and consensus that this was a good group to keep meeting.

Vice Chairman Gardner was introduced to discuss his impressions of the group, and talk about the FERC white paper.

Mr. Gardner discussed the forum and NARUC's new Task Force on Environmental Regulation and Generation. The FERC/NARUC Forum on Reliability and Environment aired the vast differences among the states and regions, with respect to these EPA regulations as it relates to reliability, cost impacts. The timing and coordination of the planned outages were crucial.

Mr. John Bear, President of MISO, expressed concern for the construction and the ability to make it happen as all of these retrofits are going to occur. The Forum will meet again in July at the NARUC meeting in Portland.

Mr. Gardner then discussed the new Task Force on Environmental Regulation and Generation (TFERG). The Task Force has 10 different states, including: Texas, Maine, Utah, Colorado, Kentucky, Florida, Ohio, Illinois, Indiana, and Connecticut. Mr. Gardner explained that the Task Force will be NARUC's eyes, ears and mouth for its interactions with federal agencies, and will interact with state agencies such as NASEO, NACAA, and the state clean air officers. The Task Force will be advising the NARUC standing committees on the different EPA and environmental issues. There will be a major component of education - internally, to educate members, and conduct webinars for external members.
The Task Force hopes to have a role of educating FERC about EPA, as well as the concerns of the states and any impacts that will be felt by the members. The Task Force is bound by a of couple resolutions that NARUC passed in February, 2011 and July, 2011. There were five resolutions: 1) One resolution is that NARUC has taken no position with respect to the EPA regulations themselves, 2) The second resolution urged EPA to avoid compromising system reliability, 3) minimize cost impacts, 4) provide appropriate degree of flexibility on timeframes, and 5) engage in meaningful dialogue and encourage EPA to engage with state regulators.

Those are the resolutions that set forth NARUC's position. With diverse members there would be difficulty in crafting a resolution and an approach. In closing he discussed the comments that NARUC submitted to the FERC staff white paper. The process of the task force was to work with Chuck and Robin Lunt, who prepared initial draft to the Task Force. It was then circulated to the different standing committees, and then it was approved by the executive committee of NARUC itself. In general, it was agreed with FERC staff on how input will be provided to EPA. It was recognized that the states and other reliability organizations may address issues beyond the Federal Power Act, Section 215 Reliability Standards, such as resource adequacy, integrated resource plans, and the states may consult directly with EPA on these broader issues. And that was part of the white paper message submitted to FERC.

Commissioner LaFleur concluded that all power supply decisions are the reflection of choices that people make on the cost of electricity, its reliability and security, and its environmental impact, and how you trade off among those. Commissioner LaFleur recognized that a lot of different people make decisions all the time -- Congress, in the Clean Air Act as implemented by the EPA, the states and all their resource adequacy decision. In December EPA put out their Mercury and Air Toxic Standards -- three years to comply, an extra year that your state administrative authority can give you and then potentially a fifth year that you can get under the administrative order function, which we were reassured by EPA is done routinely in other cases, under a policy memo that EPA put out that would outline how they are going to give these fifth years. The policy said on a case- by case basis EPA will seek advice from FERC, NERC, the regional entities, the ISOs and RTOs, the planning authorities and the state commissions. FERC staff put out a white paper before the forum. The staff white paper demonstrated one approach - when an organization, a utility or planning authority thought it needed more time either to defer to a retirement, to bring in a transmission line or a new resource, or to sequence retrofits because there were potentially an RTO might have too many retrofits to do in the timeframe, they would file an application supporting the reliability need in detail. In the white paper it asks that they file simultaneously with EPA and with FERC. The white paper proposes that the commissioners would take a vote and issue some kind of advice to EPA in each case, not necessarily -- not a hearing and an order with an appeal, but something that would actually be transparent and voted on.

The white paper asks for comment on the applications. The white paper would put forth three options.

1. The first option is the NERC rulebook – which indicated these 215 standards are what we go by – notes that it may be a violation of the 215 standards to grant more time.
2. The second option is somewhat loosely described, 215 and everything else in the Federal Power Act. This is an effort to look at all those FERC jurisdictional things and do our best to render an opinion to EPA.
3. The third, broadest option is to look at all the body of material that's out there, pull it together and render a reliability opinion, whether it was FERC jurisdictional or not.

The second thing asked for was comment on the standard of review. Should it be a hearing where people come in and explain? Or, should it be a paper hearing and accept or deny the papers/give it a stamp of approval? Many comments were received and in summary almost nobody thought we should stick to 215, which was where the FERC staff really pushed the debate in its white paper. People said, 215 was too narrow and that it wouldn't find all the places where with real reliability issues. But they were vague as to where you should go behind 215. Others said sort of a hybrid of stick to your jurisdiction, FERC; don't butt in with the states, but also weigh in on everything and be an all-purpose source of advice for EPA within your jurisdiction.

Commissioner LaFleur noted that it is being evaluated, and that they should stick to their jurisdiction. It might not be limited to 215, but don't believe we can start babysitting state resource adequacy decisions. The second issue was the level of review. If it looks legitimate, put a stamp of approval and package it up for EPA. LaFleur said if we agree to everything, then we're not adding any value. The standard of review was undefined. She welcomed comments from this group because they are in uncharted territory in terms of how all these agencies work together. Regarding the Forum, it is a place to gather and talk about state applications, and EPA's assessment and participation. Comments are welcome. FERC wants/needs to keep the lights on. That is job one.

Mike Heyeck stated he was pleased with the FERC and NARUC efforts. Two main issues are black- start and frequency response. Many of these units that will be retired can load reject and actually dump to house load and be ready to black-start the system, or be able to black-start themselves. In working with the regions (RTOs) to figure out how to provide that ability, they are looking to the transmission owner. And in the space of a transmission owner, transmission owners don't have generation assets to have black-startable units.

Mr. Heyeck thought NERC should lead in determining the need of black-start for the grid. In integrated utilities, you have that vehicle. But when it comes to a functionalized, where transmission owners don't have generating assets, it's very difficult to come up with black-start. The other is frequency response. Given the new order of things, these units will not move as fast as some of the smaller ones, and this needs to amped up. Joe McClelland has addressing that particular issue. Mr. Heyeck concluded that the black-start issue should be noted as a global issue, and currently the market is not responsive, particularly in PJM, to come up with those black-start resources due to cost. The units need to run all the time, and they may not be the most economical for an event that may be once in every 25 years.

Mr. Bowen expressed thoughts from both a generation and transmission. Mr. Bowen's concern was what we still don't know. There are a lot of participants in this market today who are not regulated utilities, and the inclination is that the regulated utilities will be forthright in what they know is going to happen and how they're going to be impacted by the rules and rule changes. Unfortunately, the regulated utilities, while they do make a good bulk of the system, are not all of the system. The independent power producers would say that our system is not a state system any longer. It is a well integrated system across many states, and so it's going to be difficult to rely upon the individual states to pull the triggers on them. Some of these states are inadequate as it relates to the regulation of their systems and their input into the systems. Some do it better than others. There are multi-state jurisdictions of various transmission generation owners and you've got different generation owners who in many cases are not interested in telling anybody when and how they're going to turn their generation off as a result of MAT rules. It is FERC's role to ask the questions that a lot of state jurisdictions cannot ask, and a lot of the independent system operators cannot ask because of rules, around market rules and things of that nature.

Mr. Bowen expressed concern that there are too many people who do not want to admit they will shut down 1,300 MW because it's going to have a direct impact to their financial bottom lines and people will start selling off their shares. For those who live off of generation, there needs to be a methodology. By looking at their generation capacity, their age and what they have in the way of emissions control devices. That information is needed or people might bail out, which would cause a catastrophic situation of the system going down, and also a catastrophic cost shift because they are all going to put in gas turbines to try to get the system back up as quickly as they can. All of these systems that we are referring to are in load centers because they were built 40, 50 years ago. When they are pulled out of the load centers and put gas turbines 200, 300 miles away from the load centers, then it creates transmission issues and voltage sag.

Mr. Gordon Van Welie noted there is not a "one-size-fits-all" solution to this issue and expressed it starts with the ISOs, the RTOs. There is a large incentive to keep the lights on. So FERC may require each region to have a plan for dealing with this transition and has been driven as much by the economics of natural gas relative to everything else. The EPA rules are the straw perhaps that breaks the camel's back. The low price of natural gas has been disruptive and will push a lot of these older units out of the marketplace anyway. So the transition is being forced through economics as much as the environmental policy. From a New England perspective, there are a set of procedures in place that actually can deal with this transition, but the tools that we have in our toolbox are not going to result in efficient outcomes. So we think we can keep the grid reliable, but we might end up having inefficient infrastructure investments. Each region needs to look at the problem and figure out the best way to get through this. FERC then gets involved as those RTOs bring forward their decision-making and their plans. Mr. Welie noted the Salem Harbor, NE case study with a directive from FERC to each of the regions to indicate a problem, and request a plan, including issues like black-start.

Commissioner LaFleur appreciated Gordon's explanation and noted the challenge that diverse and different structures demand different planning solutions. And FERC might have a more limited role or just a different role than in one that's governed by an RTO TRA.

Mr. Gardner echoed that in Kentucky the largest utilities are not in an RTO, although AEP is in an RTO, and Duke is in an RTO. But the largest GNTs are not.

Mr. Van Welie expressed in those situations it would be up to the state regulator. Most RTOs and utilities are just looking for is some jurisdictional authority that is going to back them up if they've got a compelling case that there's a reliability problem. They just need to have somebody look at it and say, this is a reasonable request.

Mr. Barry Lawson mentioned that NRECA was part of a set of comments that were submitted on the white paper. Those comments were from several of the industry trade associations including EEI, APPA and a subset of APPA, the Large Public Power Council. The comments focused on the broad memberships across the country just looking at reliability standard violations would be too narrow for determining the impacts of the EPA regulations. They are looking at reliability, adequacy and planning.

Ms. Hoffman noted that one of the first things was to start out with timely notification. The second was identification of the problems. The federal government should utilize all the resources and capabilities to make sure to ask the right questions, think outside the box, and make sure all the appropriate stakeholders are involved. Look beyond boundaries in engaging those entities and that we deal with the very specific regional issues that are going to come about.

Ms. Hoffman stated that the discussion should be transparent enough among the inter agencies so things can actually move forward in addressing issues or asking pertinent questions.

Commissioner LaFleur reiterated the federal government community aspect and believed that is how we should behave and do what is possible to promote this meeting and coordination. I think it is very useful because it's what people out there think Washington should do.

Mr. Gardner referenced a good example of the conflict between must-run orders for reliability and shutting down to meet the standards. The committee plans to hold a webinar that will hopefully have some EPA officials on it, talking about exactly how the fourth and fifth year will work, really sort of drill down into that, to really understand that and what options are available, so members understand it.

Mr. Jose Delgado mentioned that the system can take a loss of any particular unit. Were you to look at the petition for a shutdown as one at a time, you're going to miss something. The system cannot take multiple losses and must be looked at globally, the same with the states.

Mr. Cowart asked the committee members if they would like to make a recommendation for action.

Commissioner LaFleur stated there is a direct role for DOE in terms of potential emergency orders and the work. DOE is planning to do work, and to the extent there's a DOE role, it would be good for this committee, which is supposed to be advising DOE, to be aware of that and making sure they're doing what they can do.

Mr. Ralph Masiello asked Gordon if there were engineering studies and simulations for a rigorous virtual practice of a black-start?

Mr. Van Welie replied that most regions do some form of practice of black-start, but there's lots of room for improvement in terms of simulating through some sophisticated model, what the system would look like. And they we're putting more effort into that as well. Another thought was interconnection wide planning; it was sort of launched with the intention of saying how we deal with interregional transmission issues. But there's a mechanism now for the DOE and FERC to study the grid impacts of losing large amounts of generation, which can be done on a bigger scale to get at some of the issues that Jose just mentioned. The "what if" questions could be asked and answered through that sort of planning forum now that it's been set up.

Mr. Cowart said that the committee addressed this question more than a year ago, and one of our recommendations to the department was to work with FERC, and also with the state regulators, to establish a process whereby these reliability challenges could be directly put in front of decision makers for an evaluation. Mr. Cowart noted that it has been done over the past year and this process has been created and the forum with NARUC has been created. Congratulations for moving ahead with that.

Ms. Hoffman introduced Bill Bryan, the Deputy Assistant Secretary for Infrastructure Security and Energy Restoration Division within my organization. She stated that a lot of what they do is help plan, prepare, respond, and mitigate emergencies and disruptions. Some of the topics from the EAC have been timely in this area as they look at how we're doing business, and how to improve business.

Presentation on OE's Infrastructure Security and Energy Restoration Division (ISER)

Bill Bryan continued by giving an overview of what they are doing in the energy infrastructure with respect to emergency response and restoration, planning and preparedness. Further they discussed the EAC and some of the topics for future discussion. Mr. Bryan's presentation covered defining security as energy independence, but within the area of infrastructure security, looking at the world in three areas -- reliability, survivability and resiliency.

- Reliability. What should be done before an event occurs? What's the steady state to make the grid, or the energy system, more reliable? More focus on systems than individual sites.

- Survivability during an event. We built this whole infrastructure in the United States about protecting against a terrorist attack, but we've had over 50 storms of significance since that time that we've had to be prepared for. So it's very important to know what that threat is and be prepared for that, and be able to survive it.
- Resilience. How quickly we respond and recover from an event occurring? This is post event.

Bottom line is within our office, two primary things -- infrastructure security and energy restoration. On the infrastructure security side, we do promote infrastructure security policy, working closely with the White House, working closely with the interagency for all three of those -- electricity, oil and gas -- as I mentioned before. The key to take away is that we like to see ourselves as providing the tools to enable reliability, survivability and resiliency more effectively. Somehow, we've got to get the word out, that this is a serious problem and people have got to start thinking about this. There is no silver bullet. There are a lot of technologies being talked about; technologies that are on the horizon, but these are things are going to have to be tested. We want to involve this group in looking at some of these options that are out there. What are the ones that are viable to be tested?

Mr. Bryan's presentation covered the various actions such as installing sensors, and working with NASA and EPRI. Further, they look at technologies to better measure the life of transformers. There are very two distinct camps in this area of geomagnetic disturbance. One side will tell you that the world will end as we know it and we're going to go back 20 years if something like this ever happens. Another side will say it's not quite that bad; we need to have a measured response to this situation. Measuring, using technology to better measure the life of these transformers, we're going to know if that 25-year-old transformer just lost 10 more years of its life. There are a lot of old transformers and that is a concern. Better scoping is needed to better predict and understand the impact on these transformers.

Mr. Bryan noted a couple of questions that we wanted to pose to this group. What should the federal government do to mitigate this? What is our role? What would industry like to see as our role? There are a lot of people (regulators, legislators, the federal government) looking at this. The legislators will legislate a solution, regulators will regulate a solution, and us in the federal government; we're hoping we can get to a solution through participation. Legislation is good; regulation is good, if it's smart and if it's right and if it's focused. And sometimes you may only get to the 70 or 80 percent solution and have to use legislation or regulation to fill that gap. But we've got to do it smart, and we're going to do it smart by working together as a team, so when that time comes we can better address it. We've developed a criticality methodology. The key take away from this is it's an objective approach. It's also consequence based as opposed to risk-based, to identify infrastructures of concern.

Mr. David Nevius referenced a concept whereby new transformers would be acquired and installed in place of older transformers. And the savings in the losses by having more efficient, less loss transformers would be used to pay for this inventory of spares. The older transformers would be put into a spare capacity to be used in case of a major emergency. All the economics were done, and supposedly, it was a money savings issue, or at least you'd have enough money saved from the reduced losses to pay for the new transformers.

Ms. Hoffman said she would go back and look into it.

Mr. Heyeck referenced when the Transmission Committee first put out a draft of grid security, it was recommended that DOE do everything. It was reminded by a lot of folks, that NERC was doing something. There's got to be a point where DOE can help. The areas that the subcommittee and the full committee identified were in the area of modeling and testing, to harden the system because we have EPRI also doing work with respect to GMD. But one area that the industry is not developing hardening techniques is for EMP. So, what can DOE do that is not overlapping with NERC and actually works with NERC, on the resiliency and reliability side?

Mr. Bryan informed that right now, we work very closely with NERC. Every event, every activity that they've been involved in we partner with them, and also Joe McClelland over at FERC. There's not a lot of funding to do this kind of stuff. Testing of large transformers, all the recommendations that we've received today, what would it take to fund something like that? It always seems to come at the off-cycle of the budget and never come when the budgets are due. So putting these people who would want to fund something like this, it just doesn't get into the appropriate budget cycle. The White House is energetic about trying to find ways to fund these kinds of things; they recognize that's a concern.

Mr. Heyeck addressed the funding issue. In EPRI, down the road, these neutral blockers for transformers to block these currents -- these neutral blockers are great to block the currents, but they're also the failure mode if they're put in at the wrong time and it could actually fail the transformers. But from a funding perspective, they looked at modeling and operating procedures as the initial foray into it, and that's what we're addressing. The DOD is also looking at micro grids, to live on their own. If the DOD has got some funding on that perspective, there may be funding from that perspective to actually get into hardening, which you might not need in a micro grid in the first place.

Mr. Bryan said there are many activities with DOE that we're engaging in. We are aware of what they're doing and what we're doing and we're trying to merge those R&D activities to better -- so we have more efficiency in doing the research and development on these types of things.

Mr. Barry Lawson mentioned that NERC just issued a GMD report, and it is a very good report. It has some very thoughtful recommendations, not only for industry but for other entities, such as what the industry needs from the government side of things. The NERC report should be looked at very closely as a road map for where we might all want to go on, especially on the GMD issue. In conclusion there is hope that DOD is going to not allow the EMP thing to happen. That's not something we as an industry can prevent.

Mr. Van Welie suggested that it might be useful to have a conversation with NARUC because the issue of electricity reserve, which is going to be expensive. And the states, particularly the states that have been affected by big storms recently, are thinking about the same problem. This is a discussion in states like Connecticut and Massachusetts because of the Halloween storm that knocked out the power system for two weeks. Some of the ideas include how to create resilience in the power system through essentially micro grids of some form. So how do you deploy at schools and so forth, back-up generation so that if the power systems go down for a week or two, you've got some sort of basic level of support.

Mr. Sloan wanted to pick up on that and bring something else to Commissioner LaFleur's attention, and that is that EPA has been issuing rules that have impacted generally municipal, but it can be REC, diesel generation units that have been used for peaking purposes. They, in effect, have been a micro grid, particularly in the Midwest where we have storms that take out transmission lines. And the only way that we maintain some semblance of the integrity of the system is that these summer peak units come on in the fall, spring or winter, and they tend to violate EPA hours of regulation or of operation rather and emissions.

Ms. Hoffman referred to Mikes comment about DOD and hardening, and indicated the approach should be to look at the system as a whole and take a holistic approach on how to provide resilience either by hardening or looking at fuels, generation, upgrades to the system as a holistic perspective for improving services. It comes back to the fundamental crux of the issue, which is that there are the expectations for reliability and restoration times by a customer, and I think some of those expectations are changing. The Connecticut event and other events have shown that there is very little tolerance for a week-plus nowadays for restoration times. So as utilities are looking at their business model, some utilities are really taking the micro grid term and evolving it into their own ownership, which we had a EAC discussion on that a couple months ago, and saying: Okay, how do we start tailoring some of our services to meet those expectations,

depending on the customers, and how do we work some really creative solutions of assets that can be placed at a customer's premises but operated by utility, but in an emergency have an innovative structure where they provide certain services, depending on the customer and what they need. There is not a silver solution in this, but there are multiple solutions that we need to go after -- hardening the system, looking at improvements and upgrades in the system, looking at specific loads and load isolation, depending on what the circumstances, getting better in touch with customers on reliability expectations and restoration procedures, and other things that I would say even go beyond that. You mentioned EPA. But you're talking; once again, the fuel infrastructure of not only is it the reliability of electricity, but it is the reliability of natural gas and the other resources that are going to impact the electric system. So we are taking a holistic approach. We formed a public private partnership with the DOD. It's called ES3P -- Energy, or Electric, Sector Public Private Partnership. But the push and the focus is we've got to look at all of this because in some cases it may be a simple solution of doing some upgrades here and there, and adding some redundancies. In other cases, it's going to be a more complicated solution. So it's going to be very tailored and specific to the customer.

And that's why some of the criticality analysis started focusing on the customer and the consequence point of view because that's what we're ending up really starting to focus on -- is the confidence.

Mr. Heyeck agreed with the subject of the holistic approach. But if you do have an EMP event, what good is the grid when all of the load will also be disabled as well? So the definition of what critical load means today versus what it meant to state regulators 30 years ago is very different.

Ms. Reder expressed her thoughts that it's important that we really cohesively understand the impacts. It's easy to have a demarcation in our thinking on micro grids versus kind of traditional electric system. And I think really it is an issue of resiliency, hardening and where are they best placed. To the extent that we look at it holistically and think about the consumer's expectations and how they're evolving, while it's in a context of traditional delivery system and micro grid, I think that's definitely the best approach.

Mr. Van Welie asked a question to the group at large. I'm not sure this is DOE's problem, but it seems to me there's a complete disconnect between the average consumer's expectation in terms of the quality of service they want and what they're prepared to pay for. I mean, you just have to sit and listen through two days' worth of discussion here about all the problems we're trying to solve -- gas/electric issues, EMP issues, getting spare transformers stashed away. I think -- but people don't want to pay for it. All of these things are on a trend to drive electricity costs up significantly. The transition that's going to occur with the generation fleet across the nation as we take fully depreciated assets off the system and replace them with brand new assets, that's going to be something to watch over the next 10 to 20 years.

Mr. David Meyer asked Gordon if there is a lot of this change in innovation and turnover coming, doesn't that give us a chance to achieve some of these associated objectives at a comparatively low cost, or little incremental cost, in the process?

Mr. Van Welie didn’t see that there would be a massive infrastructure investment required over the next couple of decades. He agreed that the better coordinated the investment is the more value we'll get out of it. If everybody is sort of rushing off in different directions, trying to solve the problems independently, risk is increase d. How can we escape spending a lot of money to solve some of these problems, and I don't think consumers know what's coming yet.

Ms. Reder commented that it's really important to understand the resiliency aspect on the delivery and the impacts on the micro grid because to the extent that we don't do that, you can easily have those few that are very interested in high reliability and are investing in it. Rick brought up ALCOA's situation earlier, where there are certain pockets where people will pay for it from a micro grid perspective, and then the

ramification back onto traditional rate-making philosophy and what happens on how we get that infrastructure so that it continually is reliable.

Mr. Sonny Popowsky responded to Gordon that he faces the issue all the time where a group of angry consumers are out of power for a week or two. Mr. Popowsky noted that he tries to tell folks that the cost of losing a refrigerator and freezer full of food really does hit hard. As hard as it is for me to say that, it is worth it for customers to pay an extra couple dollars a month to do what's necessary to make sure the system is reliable.

Mr. Ralph Masiello recalled when we had the panel on micro grids in the fall meeting, one of the things that came up was interconnection standards where the micro grid projects would say, first principle of being a micro grid is you can island and operate independently. And there was a lot of concern expressed about if micro grids are backfeeding at the moment of an event and disconnect, you've aggravated a contingency.

This issue is also a hot burner item in California now where DG interconnection standards, especially photovoltaic, are up for question because of the need for fault ride through, low voltage ride through. It's, again, the same issue. But this whole blackout discussion then triggers, I think, another question. Interconnection standards could be looked at as a way to say if you're a micro grid or a virtual power plant or distributed generation, your inverter and your protection need to be able to provide black-start. But this gets into issues of control and monitoring. It's not just simple protection.

Mr. Heyeck added that the first 345 KV line was put in, in 1953. The first 765 KV line was put in, in 1969. And I just read a Sid Gray study that says the average life, the median life of an ASCR conductor is 46 years, plus or minus. The industry will be replacing these assets, and they are not the ones that desperately need replacement. Some assets are very old, and need to come down or be rebuilt in a smarter way.

Mr. Cowart asked what the committee should agree to do.

Ms. Wanda Reder stated she was fine with the Transmission Subcommittee taking it on. Hearing this discussion and remembering our discussion yesterday on the vision grid of the future. I think that this whole element; it would be very useful to make sure it's also reflected in that document and maybe -- I can't remember if it was, but there's a lot of stuff here that we've talked about that I would love to be seen incorporated in that document as well.

Mr. Cowart asked for additional comments.

Mr. Heyeck added that the micro grid is probably about to drift into the Smart Grid Committee, and Ralph has got a play in this too, and storage.

Morning Break

Presentation on OE's Research and Development Division's Smart Grid Program

Mr. Elliot Roseman announced the Ethics Briefing that would take place in Meridian C.

Ms. Hoffman introduced Eric Lightner, one of the founding fathers in the smart grid area and has a lot of thought and vision with respect to smart grid.

Mr. Eric Lightner's presentation discussed some of the OE's R&D Division's Smart Grid Implementation Plan. The vision includes leverage, IT communications, technologies to increase reliability, efficiency and engage the customer and give the customer more choices, opportunities, deliver value to the customer. So everything sort of stems from that. There are smart grid characteristics, which present certain challenges,

and all of our key activities here really feed into those. There are demonstration and deployment projects, and R&D programs. We're involved in standards along with NIST, and are looking at interconnection planning and analysis. We have workforce training and a stakeholder engagement and outreach effort, which I'm going to talk about today a little bit. We also monitor national progress and have newly released the 2010 Smart Grid System Report available on SmartGrid.gov.

The R&D program, specifically the smart grid R&D program, which is one of a few R&D programs within our division, has a multi-year program plan that sort of guides what the investments are. This was developed through a multi-stakeholder process as well. We went out to utilities and other R&D entities, like EPRI, and really tried to define the needs were for the future. So really, our investments are based on that.

In summary, the goals specifically for the R&D smart grid program look at what those seven characteristics are and how to enable them, as well as long-term targets associated with those. A 20 percent reduction in SADI, a 98 percent reduction in outage time, of critical loads, and increase the load factor or utilization by 20 percent -- are some of the long-term goals. That feeds into looking at self-healing and improve reliability as well as integration of demand response, DER and plug-in electrical vehicles. There is a DECC facility down at Oak Ridge National Laboratory, which is really looking at sort of the interactions between multiple inverter devices on circuits and what the impact of that is. They are also looking at the impact through some modeling of smart appliances and what their impact might be on the distribution grid. There were four specific areas, and those reports just came out a couple weeks ago. The areas included: distribution of automation technologies, DG technologies, energy storage technologies and demand response. GridLAB-D is also discussed in this presentation, but is an open-source time series simulation at the distribution level. So it's looking for the substation all the way down to the loads. It's a very detailed model and it doesn't use a lot of estimating of what a bulk circuit might look like. It looks at all the devices, all the loads on that circuit and doing a very high resolution simulation of that.

He then focused on the Smart Grid Maturity Model which was really a decision support tool for utilities to use in their planning process towards modernizing their company really. Not just what technologies to install but a thought process to go through. This tool would help think through all those different decisions needed. The tool is free, but SEI could facilitate the workshops for a minimal cost. He also mentioned they are looking at how to use electric vehicles to better integrate renewables. They commissioned a study at PNL to look at using plug-in electric vehicles to help with integration of renewables. And specifically, looked at if they had 10 GW of additional wind; what's the balancing requirement for that in the Northwest Power Pool, which represents about 12 percent of the RPS.

Mr. Van Welie asked to clarify if they are looking at there is regulation and not ramping?

Mr. Lightner agreed that it is regulation. He continued to spend a little bit of time talking about the task force and the different activities and things that the Smart Grid Task Force is involved in. He said the task force is a group of federal agencies that coordinate smart grid activities across the federal government. These are the member agencies here. NARUC is also an ex-officio member, not an official member since they're not a federal agency, but they are invited to our meetings and have participated on a regular basis. Every year we put together a work plan. These are four activities that we were pursuing this year. The work plan ends in June, so a new work plan will be developed and begin starting in June. These are the activities that we're currently pursuing as a group. We are looking at the federal government as a driver of smart grid, and what we mean by that is we're looking internally at our agencies, to ask if there are policies, executive orders; are there processes, that we can leverage? Are there efficiency requirements that maybe we could do better with some smart grid technologies? We are looking internally to ask what we can be doing. The federal government owns a lot of buildings across the United States. There should be a way to influence some of the activities the buildings participate in.

This group drove the formation of what we call our Smart Grid Data Access Funding Opportunity Announcement, which just closed last Thursday. This group was instrumental in defining what that FOA was, what the requirements were. They will be very much involved in the review and selection of those projects. That was a big success. We also are working on Green Button. Green Button looks at how we can give something to customers to get value out of all these market investments. Something real simple, something easy, and provide them with access to their data. That's the idea behind Green Button.

A common-sense idea is that electricity customers should be able to download their own energy use information in consumer friendly, computer friendly format. That's very important. It's a standardization thing. So if you download your data in California and you download your data in New York, it's the same data and you can use the same applications that are developed by a third party, in some way to help you with your energy decisions or whatever the application might be. It is to give you power, give you more control. And this goes back to empowering the customer, which is one of the characteristics of the smart grid -- empowering the consumer. It was also one of the tenets, if you will, in the Smart Grid Policy Document that was released last June by the administration. Empowering the consumers, that's what we're trying to do here. And it's an easy, simple step towards that.

There's been a lot of work on standardization through the North American Energy Standards Board, the PAP 10 Energy Usage Information Standards, and the Energy Service Provider Interface Standards through REQ 21. There's been a lot of work over the years on these things, and all the Green Button does is implement that and gives people the data in a standard format. He reinforced that it is good for your customers to empower them with information. And so far, I know that California has signed up for this, Texas, Maryland, Delaware and others. It's a growing trend and we are happy to see that. It's kind of like the iPhone app or the cell phone. There is uncertainty with what the applications might be by liberalizing the data. They could have something to do with better utilization of your home energy, your heating and cooling systems and could use the information in education scenarios to better size renewable energy for your home depending on what your objective is going to be. There is going to be a whole host of applications that develop around that information. The FOA very much leverages the Green Button effort. The effort to be able to incent utilities to put in place procedures and a process and a policy for allowing third-party access directly to consumer information based on permission from the consumer. The phase one can demonstrate that with at least 1,000 customers, with a third-party provider and showing that policy and procedures are effective in delivering some value to the customers. If so there's a phase two it would be to roll out this benefit to all customers, and the phase two is worth up to $2 million. Both these phases are cost-shared 50 percent. The third leg of this stool is privacy. So the administration, two weeks ago, released a document called "Consumer Data Privacy" in a Networked World, but it's basically an internet privacy framework for data, and it has a consumer bill of rights in it for what consumers should expect with how this data are handled.

Efforts have been to convene utilities on a regional basis to talk about engaging customers about education, deployments of smart grid technologies, and have a peer-to-peer forum to share best practices. Basically the themes that come from the discussions with the utilities include:

- One size doesn't fit all.
- Address customer's concerns right up front. Don't think they're going to go away or don't hope somebody doesn't ask the question about brain damage from my meter because you're going to get those questions and you have to be ready to answer them, right.
- And communication with the customers and public, and really, what that means is on a constant basis, right -- before, during and after, constant communication with your customers about what you're doing, when you're doing it, how you're going to do it, what they can expect.
- Set reasonable expectations, right. So don't talk about all the hype and all the things you're going to be able to do with this information if you don't give them services and products that actually do something with the information. So Green Button can help in that category.

There are seven or eight peer-to-peer, in the Northeast, Southeast, Texas and one in two weeks in the Southwest. NV Energy will be hosting that one. And that will be followed by one in May at Portland General, May 9th and 10th, and still working on a Mid-Atlantic one.

Mr. Joe Delgado inquired about a situation from two years ago where somebody from Google said an initiative that they had to take meter data from customers and showing it back to the customer. Has the department looked at, or is that everywhere? Are you aware of that? It was Google with a program that would take the data from the utility meter and then give it back to the customer and compare it with similar houses, or with a similar number of people, the whole bit.

Ms. Hoffman replied that Google dropped it because of the data, the meter, the access, and the privacy permissions. It was so complicated, that they had to sign up with each customer, so the whole privacy.

Mr. Joe Paladino said he was going to shift gears and discuss the ARRA-funded projects and the smart grid one specifically. His involvement with that is to try to describe what the technologies are doing, what the recipients are doing and how that relates to impacts and benefits. His slides showed an estimate by EPRI that it would take about $340 million to $480 million -- billion dollars -- to 2030, to implement smart grid technology, and that's in the customer space, in the distribution space as well as the transmission space. She referred to how much money ARRA provided to the advancement of that technology, it's about -- if you take the Smart Grid Investment Grant, and it's close to $8 billion. If you add the demonstration program on that, it comes to about $9 billion, which is fed money and cost-sharing money. The amount of money is small compared to the overall job, but the ARRA funds are definitely going to provide an incredible catalyst with respect to moving this technology forward. The main point was that they have two jobs. One job was to describe the lessons learned and to take advantage of the information coming out of these ARRA projects so that they can actually educate the industry and they can undertake this process in a really efficient manner. The other job would be to get information that will educate about the value of smart grid technology. And hopefully that information will inform decision makers like public utility commissioners, with respect investments in this kind of technology and the benefits that can be expected.

Also he discussed customer system-based technologies, like in-home displays, et cetera, that are being deployed. Many of the projects are deploying pricing programs. There is advanced metering infrastructure. Smart meters are being deployed. There are systems like automated switches and automated regulators, capacitors and sensors that are being deployed in distribution systems, including sensors that you would put onto equipment to be able to sense what the condition of that equipment is and to operate it at a more efficient level. And there is Phasor Measurement Unit technology that is being deployed across the country. With respect to advancing and deploying Phasor Measurement Unit technology, there were about 150 or so network PMUs in, and at, substations, embedded in the transmission systems before we started. When completed there will be about 1,000 of those. With respect to movement, advancement of the technology, it's moving fastest and accepted and deployed fastest in the distribution arena. Utilities are more comfortable with that. That includes deploying smart meters to help with distribution system operations. What we're trying to map, what kind of deferrals of generation capacity there will be as a result of deploying pricing programs or how much energy use is being reduced, peak demand reduction is being reduced. The goal is to measure those things and see if costs to consumers and society are actually lower.

There is evidence right now in the Oklahoma Gas and Electric work that we're doing where they're deploying a pricing program and they're actually seeing major peak demand reductions as well as lower prices to customers because they're using less energy showing evidence of the results.

With respect to distribution systems, we're looking at optimization of voltage and reactive power. There are a lot of benefits that accrue as a result of optimizing voltage and bringing voltage levels down. Efforts are looking at technology with automated feeder switching, and improvements to outage restoration. Also, looking at synchrophasor technology and how that can be applied in real-time and off-line analysis. Information is being created and as the technology is deployed, it results in certain benefits. This is a major concern by people with respect to sitting on all this great information; and how best to get it out.

There has been work on a methodology that actually maps technology to benefits. A lot of that methodology is captured in this joint DOE/EPRI report on methodology for cost-benefit analysis. That's freeware on the EPRI site, and the SmartGrid.gov site. Guidebooks that have gone to the recipients that talk about if you're deploying this kind of technology; these are the build kind of things we want to see: What kind of assets are you deploying? How much do they cost? What is the extent of your deployment? And we want them to also be able to tell us what impacts they're seeing. One guidebook actually maps impact types of metrics to the kind of technology that's being deployed.

There's a computational tool which is a spreadsheet model being used internally. It's all freeware available on SmartGrid.gov. and can be downloaded.

GridLAB-D is a tool that Eric had mentioned. NRECA is one of our major recipients on the demo side. They're actually advancing this tool so it can be -- and putting an interface layer on it and making it so it's more easily used by industry so that GridLAB-D can be used more readily by the private sector, to be able to determine if I deploy these kinds of technologies, these are the kinds of benefits that may be achieved in the distribution space. All analytical methods and calculations are actively being documented. The PowerPoint presentations are on SmartGrid.gov. They are hopeful to advance those methods through this process over the next like two years so that in the end, the calculations will be codified and they'll be able to be used in business case analysis that utilities need to undertake.

The final tool was one that the Lawrence Berkeley Lab developed, which a utility can use to determine how much reliability improvement it's getting, and it applies the IEEE 1366 standards. These exist and are on SmartGrid.gov. With respect to reporting, there is a Smart Grid Investment Grant Progress Report that we're working on right now that's going to talk about where we are with respect to technology deployment and kind of some of the impacts that we're seeing. But we're also actively engaging in more detailed reports, and we're trying to get those out twice annually, that really take a hard look at here's how the technologies are being deployed and this is specifically how benefits are derived and this is exactly what we're seeing in the projects. We're working on that right now, and we hope to have something out within the next like eight weeks. However, the projects are early in deployment. Many of them have never done this before. They are all at different levels of understanding. They've got to take this technology and integrate it to make it operational. They have to be able to trust the data they're getting from sensors, et cetera. This has never been done before, largely. Projects are working through systems integration issues that they've never had to do before. It is going to take a while. We're seeing impacts in certain places but not across the board and it may take a while to really see permanent impact.

There is a Technology Configurations Report which is done but not yet released. It is incomplete, but it was mentioned yesterday that information should be posted as quickly as possible. Information should get to public utility commissioners. The intent of this was to talk about how the technology is being deployed, and what kind of functions it provides. It's at a fairly high level and it may feed your desire to develop something for the public utility commissioners that explains how the technology functions.

In addition to that, there's an annual update to the North American Synchrophasor Initiatives (NASPI) s RAPIR report. And what the RAPIR report is; it has to do with the application of synchrophasor technology across the nation. The first RAPIR report talked specifically about our synchrophasor technology, how it's being applied and what our projects are doing, that are deploying synchrophasor technology. They are developing an annual update to that. In fact, we've got a chapter developed, which talks about how much progress our projects have made to date, and that is also going to be issued on SmartGrid.gov. That chapter is, again, in draft form, but it's close to being finalized. There are 11 very rigorous consumer behavior studies that are ongoing. It is expected to get interim and final consumer behavior study reports developed by each of the recipients. Oklahoma Gas and Electric will have their interim report that's up already on SmartGrid.gov. The final report will be put up in the next month. The final report is being looked at right now. Marblehead is another one of the recipients engaged in a consumer behavior study. They'll probably have an interim report done in mid-summer. Those are all going to be posted on SmartGrid.gov.

In addition to that, there will be a cross study report looking across all of these projects, all of these consumer behavior study projects, and gets into at a real analytical level customer retention, customer acceptance and customer response with respect to pricing and what the influence is of either education or technologies like information technologies and control technologies. The first report will look at customer acceptance at the end of this fiscal year 2012. And we have a schedule for when the interim and final reports are coming out and the cross study reports are coming out.

On the demonstration side, each of the demo projects are developing interim and final technology performance reports which are going to talk about the technologies they're demonstrating, the kind of performance they're getting out of those technologies as well as what kind of impacts those technologies should have on grid operations. There is a schedule that's developed for when those reports are coming out.

The next effort will be an energy storage meta- analysis which will take a look at all the energy storage projects. Just moving, stepping back a little bit, there are demo projects -- 16 are energy storage projects, 16 are smart grid projects. And look at the energy storage projects and undertake a meta-analysis. This is followed by efforts with EIA. So for instance, EIA, with funding from us, actually developed a report. It's on their site. That gets into legislative and regulatory policies, with case studies across the nation. What are the regulatory and legislative policies that actually may affect and incentivize the deployment of smart grid technologies that exists? And then, we are going to be updating Forms 861 and 441. Those forms go to the industry now, and they're asking industry what kind of technologies they deploy.

The goal is to augment the forms in order to gather new information from industry on how they deploy smart grid technologies and get products on SmartGrid.gov. The web site is being reorganized briefly. The goal is to use a list serve to be able to tell people that it exists and they can get it from SmartGrid.gov.

We have been actively engaged with industry groups and regulators. Efforts such as webinar with public utility commissioners, as well as a smart grid working group set up through NARUC. Peter Cappers who supports us from Lawrence Berkeley Lab is talking about results seen to date on the consumer behavior studies.

There have been active discussions in effort to inform and have relationships with EEI, EPRI, NRECA, APPA, NASPI, consumer Advocates, NARUC and PUCs. EEI is very interested; NRECA is very interested, in working together to advance this analytical methodology and share results. There were webinars to communicate findings to targeted audiences. Again, I mentioned the meeting that we're having today

on the consumer behavior studies, but we've also had meetings with the recipients because they want to learn more from each other about their experience with respect with volt/VAR optimization.
With respect to the consumer behavior studies, we think there are a couple of conferences. Like there's the town hall meeting coming up, et cetera. That's just an example of a demand response conference. There's the annual DOE/NARUC Electricity Forum Conference. This is where industry will come together, share their experiences and exchange and learn from each other, and we want to encourage that.

With respect to AMI distribution system automation, DistribuTECH would be a great conference to focus, and in fact, we're working on developing a major session at DistribuTECH next year. But there are obviously other conferences.

In the transmission space with respect to synchrophasors, NASPI is already a public-private mechanism. They meet three times a year. The industry comes there, and they're sharing across with each other, what experiences they're having with respect to deploying synchrophasor technology. It's a very good, strong working platform to exchange that kind of information, and we support that program.
And then, there's obviously specific technical assistance, for instance, to public utility commissioners. We would be happy to have a webinar or whatever with you to explain exactly how that is set up and you can access information off of it.

Mr. Cowart confirmed with Joe that the webinar you just mentioned that Pete Cappers is doing, would that be the kind of thing that would be posted on SmartGrid.gov?

Mr. Paladino replied yes there are other webinars that we've given that are on SmartGrid.gov, and some of these have the audio portion with them. There are a couple of them like that right now. For instance, this volt/VAR discussion that we had, that's on SmartGrid.gov. The audio is there and you can listen in.

Ms. Dian Grueneich, while we are getting set up, I'm wondering if sort of outside of the work plan, you and Eric might put together a one-pager of the most important or significant reports or stuff you would think for us just to be on top of. I don't know. It's clear we could all spend full time looking at everything you have or be pretty haphazard of what's out there.

Mr. Paladino replied that would try to synthesize the information.

Ms. Wanda Reder: One of the challenges in thinking through the work plan for the EAC as it relates to the Smart Grid Subcommittee is just to get in sync with all of the very good that's gone on at DOE. It's just amazing how much is there, the phenomenal effort that's gone forward, and the results speak for themselves. It's been a challenge to try to get in, understand it and figure out what our role is, to truly add value. And that is the essence of what we need to do.

We actually started out fully recognizing there's a bunch of effort underway and those projects are now yielding some results. We looked at the statute because some people said, what is our role in this? So Sonny actually stepped in and tried to figure out. It's very broad-reaching in some respects.
Within this context, we realize that we need to work closely with the information that's already there, be forward-leading and try to help establish priorities through the course of 2012. What we don't want to do is get in the way, duplicate, redirect, that type of thing. That's certainly not our intent. We want to add value.

In response to Dian's comments, which were really a good set-up here for this presentation of the workforce, or on the work plan, is that the first thing is to try and figure out how we take the lessons

learned and the benefits and truly take extrapolations from that so we have forward-looking recommendations as a result. And that will ultimately facilitate smart grid investments in the future. We are at this critical point in time where there's just a rich amount of information. How do we take that and move it forward so that it truly is a catalyst, like Joe mentioned before, leveraging that seven to eight billion dollars in order to try to get it to the broadest reach possible?

There were varying degrees of opinion on how much effort that would take. Some people said we could spend the entire effort through 2012 just on point number one. But getting the foundation built so there is a good platform of recommendations, becomes a springboard for the other pieces. The other pieces are to map a communication outreach framework with these findings and recommendations so the messaging is clear, and it's very much in sync with what Joe suggested, that an effective outreach tool is needed that reaches the stakeholders. There is a lot of opportunity to get this information in the hands of folks that can use it. And so, that would be the essence of point number two. Then point number three develops a connection with the regulators so that the materials and education wherewithal is there to guide questioning and, ultimately, make sure that the lessons learned are there and understood.

The specifics around that are in the next three slides. Eric referenced that this 2010 Smart Grid System Report has just been released. One of the things that we thought would be useful is to look at that report and various other materials that have been in development and provide guidance on the frequency, the value of the meta-analysis, the use of the findings, but actually get in there and be a sounding board.

We do realize that to the extent we can take this and create an overarching framework that will guide incremental investments going forward, that will be useful to actually leverage these seven to eight billion dollars to spend into the macro marketplace. Understanding the type of data that needs to be presented and providing guidance along those lines, we think would be perhaps a useful effort from our perspective -- where the key messages need to go, that type of thing.

The last one, of course, is making sure that the metrics are in place so that as we transform the industry we are what we measure, ultimately. So probably, the metrics that we've been using in the past aren't necessarily the ones that we want to use going forward, and we can be a good sounding board for that as well. So that is really the essence of number one - that is foundational for the other two pieces.

The other two, we will apply our efforts for this outreach framework. We believe we can add value to try and get the messaging out, make sure that we understand and have a cohesive definition of the audiences that we're trying to reach, making sure that the partnering organizations are identified so that we are fully leveraging the community and those that are willing to help cascade the vision and the messaging as an industry. It was mentioned yesterday that we as engineers aren't necessarily always the best ones at connecting with the media and driving key messages. And so, to the extent that we can make recommendations along these lines, to get better leverage out of the good work that's been done, we think there can be a lot of value to the industry at large.

Last would be to get feedback and coordinate with the federal Smart Grid Task Force and others. So that's point number two. And then, point number three we think will take a while. There is already good outreach with NARUC, but to the extent that we can continue to facilitate and build collaboration there, it will likely build momentum and understanding so that the utility and state relationships will foster and it will be easier for dialogue for ongoing smart grid investments. Some of the discussion in the last iteration on the grid modernization on the value extrapolation and to keep from doing a like-for-like replacement becomes very important as investments go in for grid modernization, so that

we make sure that technologies are finding their way in as the grids are getting updated and investments are finding their way.

A question arose about what we aren't doing. And a couple things that came: suggesting not to get involved in understanding consumer opinions and customer behavior, and not going to get involved in smart grid privacy and standards. We think that in both cases they're either well underway or we're not necessarily well equipped to be involved in consumer behavioral studies and scientific research that corresponds to that.

The bottom line is to make sure that we develop the relationships effectively and the messaging is in place and to closely coordinate with DOE and understand the activity that is already there, so that we're truly adding value. The next steps are monthly meetings already on the docket. They know that members will be added. That is the essence of the 2012 plan.

Mr. Rick Bowen stated that communications needs to be a fundamental piece of subcommittee efforts. Unlike looking at the technical issues that we do on devices or things that we could work together on, there is just an enormous amount of data, information, and desire particularly by device communities out there who are looking to try to do something with this. Getting focus is so fundamental to that because it's everywhere. There's just an incredible amount of stuff that's there to be worked from. So they are on the right track. There are a lot of people who are in the foray of doing those studies, and I would assume that the manufacturers by themselves are probably out trying to get that, to try to get some focus on their devices. I think there's a significant communications piece here, Pat, that we've got to deal with, right. How is it we can recommend to you all how to communicate that better and how to get the public to embrace it and to ask for it? It is a push-pull thing, where we're trying to pull the community with us. It's the challenge just getting focused with the things that have the higher potential to have success quickly because what we found out in the community that we all live in here is people see so many things, they get distracted and they lose interest, because there's too much.

So if there's anything your team can really do to get people focused that way and to not be all things to all people and to really take the things that maybe are a high ranking, if you will, of what you think will have the greatest impact the fastest, so we don't lose people because that's what will happen. It will just be -- you know, people just get so clouded up. They'll just feel it is too much.

Relative to all of us in the industry as well as those of us as consumers, it becomes too overwhelming, and we can't put enough people on it. So get it focused fast and then figure out how we can use you all to make that communication, either through the NARUCs or through whatever it is that we've got, to make that communications piece. But I think you're on the right track. Stay away from the stuff that's too soft and can get you distracted with trying to deal with people's opinions and what works, what doesn't work. The device owners, who are the people who are trying to bring it forward, can do that for you. It's going to be more about how do you keep people concentrated on low-hanging fruit, what will hit the ground, what will work the fastest, what will have the greatest impact and then how do you get people to actually communicate that.

Ms. Dian Grueneich asked three comments. The first slide said that there's $8 billion in ARRA funding and the need for the smart grid is -- what was the number?

Ms. Reder replied $340 billion.

Ms. Grueneich asked what percentage it might be. Further she asked what the game plan is for where the remainder of that money is coming from, and how is all this effort at DOE actually working towards thinking through, strategically, where that funding is coming from? Is it coming from state utility

commissioners authorizing rate increases to fund that? I don't think so. I mean maybe a portion of it. Is it coming from additional somewhere-down-the-road federal budget money to have grants? Is it coming from the private sector where there are some new business models authorized by state commissions to be bringing that money in with the utility? It seems to be the elephant in the room, which is what is going to be a game plan, strategically.

Ms. Reder confirmed they're going to be on there.

Ms. Grueneich said the third one was I thought that we actually had discussed for the third work product that it wasn't a commitment to develop a handbook this year because that seems to me one -- if there's going to be a handbook developed, it would probably be by DOE itself with our input.

Ms. Reder replied yes.

Ms. Grueneich: We're still not entirely sure how much DOE is actually doing. Let's put a little bit more nuance around how we list that third work product.

Ms. Reder agreed that it was a good point. In the subcommittee, while the handbook was thought it would be a really good idea -- and kind of following up on Rick's point that there's a hodge-podge of things out there, it would concentrate the high value-added and be a good communication tool -- we fully recognize that DOE would have to be a big part of it and it could take a while to get done. So we didn't think that it would be likely that that would be in the 2012 plan itself, but we would probably be doing some front running so that we could get that successfully teed up for a rollout later.
Mr. Cowart made a few comments. First, just going back to the first presentation, I guess this is a comment on Eric's slide. I noticed the emphasis on improving load factor and reducing peak. I would have added to that improving the ability of the demand or load to respond to the availability of variable renewable resources, which is quite a bit different than improving load factor.

It's improving the alignment of resources that are available at low cost on the system to when those kilowatt hours are being used. And I know you all have that in mind. The smart charging of vehicles is the classic example. But there are other ways, as we've discussed in the storage environment, for heating hot water or making ice when the wind blows, or the sun is shining as it were, and that's an attribute of the smart grid as well that I think deserves to be put on that list. And then related to it, we talked about reducing peak, for example, and then secondarily, later, with the conservation voltage reduction talk about reducing consumption. But actually, using smart grid technology to reduce total consumption efficiently is also an important public policy goal. And so, just presentationally, I would think that you'd want to add that to the list of high priority items. A lot of people will ask, when we get around to answering Dian's question, why should we spend $400 billion on this stuff if we're not actually helping customers use electricity more efficiently? You know, we're going to be scratching our heads collectively.

It is estimated they are spending maybe $5 billion a year now, collectively, on energy efficiency. Compared to a number like $800 billion for smart grid that is 100 years worth of energy efficiency spending. What are we getting for it in terms of making our entire system more efficient? Second, it seems that one of the huge challenges DOE faces, and certainly the state regulators face, is not only what can these technologies enable us to do, but what policy reforms are needed in order to make it possible for these technologies to deliver what we believe they can deliver. What are the market rules? What are the regulatory rules? What are the financing rules? Whatever, including what are the tariffs and what is the information customers have to see in order to actually make the technology work? People don't want smart technology, especially expensive smart technology, unless it's linked to policies that will actually deliver as much of the benefits and the technical potential as we could

realistically capture. One of the objectives of the Smart Grid Subcommittee would be to keep asking and keep a list of those, like what are the policies that really would help to unleash the potential here, because without the right policies it doesn't matter how smart the meter is, for some of the benefits. Ms. Reder agreed it was a good point to track the policy issues and weave that back into the process.

Mr. Popowsky asked if the ARRA funding created some sort of I guess you'd call them controlled experiments where you can actually track how this stuff is working, but we've also had some uncontrolled experiments recently in the Mid-Atlantic and the New England states with the outages and the difficulty of restoration. At least in my discussions with Pennsylvania utilities, PPL for example, is pretty far advanced on some of their smart grid technologies. And I believe that they have a story to tell with regard to their ability, not obviously to prevent the outages, but their ability to restore outages, to do restoration activities perhaps a bit more efficiently than their neighbors, through some of the grid technologies that they've already put in place. He asked if people have tried to at least talk to utilities that have -- you know, went through what we just went through last year in the outages and see where the new technologies have been of assistance. Mr. Paladino agreed it was a good point. One thing that they tried to do is develop case studies where he would speak and work directly with a specific utility that is typically a recipient. Mr. Paladino added PPL is on the list. There are several case studies that we've developed. They're all on SmartGrid.gov. We're trying to -- they're like two or three pages long. They talk specifically about what they're doing. There are a couple of them that talk specifically about outage and storms that have come through. So for instance, I think it is Chattanooga. The Electric Power Board of Chattanooga has had some very successful outage management experiences because they've deployed automated switches and things like that, and they're actually seeing improved reliability. Your comment is well taken. We'll try to focus more on the case studies. They're posted on SmartGrid.gov. And we'll get PPL up on the list. But especially to capture the last season of storms, if there's an event that happened, follow up with the utility to see if the technology worked and how well it may have functioned.

Mr. Cowart asked to try to figure out a way to test the reality of two.

Mr. Paladino agreed.

Mr. Cowart replied it is certainly likely that people would report that the meters really helped or this new stuff really helped. Obviously, you have to test that against some control group to find out.

Mr. Paladino agreed that it really did.

Mr. Cowart acknowledged the perception that it helped is really true.

Mr. Paladino agreed that it was a good point because in all of this we have to be technology-neutral, right. And so many of the stakeholders we work with have said, we don't want to promote this technology; we want to be able to say tell it like it is. So we're trying to conform to that.

Mr. Cowart introduced Brad Roberts.

Mr. Brad Roberts referenced the previous discussion, going back to Bill Bryan's restoration presentation and then talking about Eric's smart grid activities, which focus on the dynamic aspects of the grid. What about just simple things such as having lived through a lot of storm related outages, and putting more of the distribution system underground? I mean is there any effort? I know it's expensive, but I've had my distribution system torn down 3 times in 11 months and put back up, and that money is given by -- recovery takes place under the PUC to get that money back. And it's expensive, but there seems to be

some logical steps that need to take place in figuring out what parts of the distribution system should be buried, as a step in that whole process.

Mr. Lightner said he didn't think he looked at specifically what could be undergrounded or what the cost would be of undergrounding. But we have looked at, from a technical standpoint, the condition of cables and how they fail, specifically underground cables, and looking at how to better evaluate the condition of cables while they're in service and be able to predict when they might fail, to better schedule maintenance and other kinds of things. So we've looked at it from a technical standpoint as far as longevity of those lines and what some indicators might be of life and capacity and failure and things like that. So we've been looking at it from that point of view, not necessarily from a planning or decision-making point of view as far as undergrounding, which would pretty much be out of DOE's jurisdiction anyway. From a technical standpoint, hopefully, we can inform the decision-makers that would think about those kinds of things as far as the kind of cable and its expected performance.

Mr. Lawson provided two comments on the Smart Grid Subcommittee work plan:

- Number one, it seems like a lot of work to do in one year. Do we really think that this can be accomplished in one year? It's an extensive list of work.
- Number two, is throughout this work plan there wasn't much discussion about the costs and risks and issues related to the smart grid. We tend to focus on all these incredible benefits, and we know what the consumer wants. But we're not talking about costs; we're not talking about risks. I think these factors need to be somewhere in this analysis and other work that the Smart Grid Subcommittee wants to work on. I think we need to be looking along those lines as well. We can't be just a marketing tool for the smart grid. We have to present an unbiased complete view of things. There are costs, risks and issued that also need to be focused on.

Mr. Van Welie noted that this conversation made him remember his areas of discomfort around smart gird, which is I think as an industry we get too wrapped up in defining the smart grid as the outcome, which to me is the wrong way of looking at it. In no other area of business do we say, well, we've got to have IT deployed across every business out there and specify the technology and so forth. People use technology to achieve an outcome.

To address Dian's question earlier on, the money is going to come from the applications. If people can find something useful to do with the technology, they'll deploy it. There must be a logical point at which we stop talking about smart grid as sort of an end state and just let the applications take over and drive the application of the technology. DOE has done a great job in terms of showing what's possible.

All of this investment is really just demonstrating what's feasible, what's possible, but in the end it's going to have to come down to each state, each utility figuring out what they want to do with this. You can't sort of mandate this from the top-down. It has to be bottom-up in the end.
When do we get to the end of the discussion on smart grid and sort of say, okay, we all know now that there's lots of different technology out there that we can apply, and then start going back to Rich's point, essentially, which is to say, okay, what are the things that we want to drive in terms of behaviors? That is a discussion between DOE, FERC and NARUC, to say, are we serious about getting DR going at the retail level? And once you've got that, put the energy there and then technology will follow. Part of what's happened is that there's been this hype around smart grid and a lot of manufacturers are driving it as much as anything. What happens at the end of that – does Pat or somebody have a view on that from a DOE perspective?

Ms. Hoffman replied with her we're talking about cyber security, smart grid, some other things, what capabilities and functionalities do we want and do we need to have in the system as we look

towards the future, and how are they complementary to some of the issues? How does smart grid enable some of the other things to happen on the system? Restoration and recovery -- SADI safety -- is an easy kind of here's the first out of the door, kind of value- added service that can be built from some of the smart grid technologies. Then you've got peak load reduction. Then you've got system efficiency. We talked of some of the characteristics of volt/VAR optimization. You know, you can build all those buckets. Later it's going to be some of the consumer applications. As we have demonstrated, it's not the first one out the door. But as part of consumer applications, you pull in your DR, your energy efficiency validation and verification, measurement and verification that can be supported by some of the devices and technologies out there. So from a high level those are at least some of the introduction kinds of framework that I see the value added, but I think that's where we've got to focus the conversation -- is how should this be framed? And it may be taking a hard look at that systems report -- and how do we structure the systems report to look at some of these capabilities and grouping them for restoration purposes, peak load reduction purposes, customer services.

Another item focuses on the fact that DOE spends a lot of time driving consistency of data, standards in the data, use of the data, and privacy, and trying to handle that part of the discussion. There is also education that can be talked about on how to optimize the investment based on the architecture design and the security requirements as a result of that. So we could talk about communications in general, or we could pick a couple topics within that to focus on. That was my only other comment that I would ask the committee to consider.

Mr. Cowart asked for any additional questions.

Ms. Reder voiced that she appreciates the feeback and that there were some good suggestions. Some of the things that I picked up just in a recap quick is when we look at the handbook and the regulator outreach peace, we certainly had suggested that could be a multi-year thing, but we want to try and position it so that it will be successful. It has been discussed with the subcommittee, realizing that education with the state regulator and getting this information into their hands, especially with a quick turnover, is a really critical piece. So doing that successfully is important.

Some comments that didn't come up -- and it kind of stems off of Brad's discussion -- is from a grid modernization perspective, how do we get the dollars flowing and what's the business model that ultimately will move us from where we are in an aging infrastructure perspective to something that's the forward-looking? What are the resiliency aspects? What are the smart grid aspects? This is a scope of work that needs to be on the forefront.

Joe may have some efforts already underway in this area, but making sure that we are at least teeing up and understanding, so that as these decisions are being made it's not a like-for-like and we're guiding those outcomes. That's a bit peripheral right now, but it is something to keep an eye on.

The policy piece and keeping a list so that can be addressed, I think would be something that we could do and would probably add quite a bit of value. Picked up the risks, and it's not only a benefits stream, but it's also what are the risks with more complexity. We need to tell that story.

The idea in that statement number one, where it suggests we need forward-looking recommendations, behind that there certainly was dialogue to that extent. But it's a good point, and it didn't really pop out.

We will take a look at that systems report, Pat, and try and think through a little bit about the structure and what it might take in order to get the grouping so that it would be more applicable as well.

Mr. Cowart said to Wanda that he is going to pick up on Gordon's point and toss out a thought about any report that the subcommittee does. It would be useful if we started by talking about capabilities; that is, system capabilities that we would like to see.
Ms. Reder agreed.
Mr. Cowart asked the questions that flow from that as opposed to starting with the technologies and saying, well, there's this technology and this technology and this technology, and what can they do and who can sell them.

He said Gordon's point is we're starting with system capabilities that provide resilience, security, restoration, efficiency, integrating renewables, et cetera, but those are the services that we seek from the investments in things that we lump together and call smart grid.
Looking at it through that lens, it seems to be a useful thing for the subcommittee to do and then to urge upon DOE.

Ms. Reder said turning it back from a capability perspective rather than a technology for technology's sake.
Mr. Cowart agreed when you hold up your smart phone and you say, why do I have this? Is it because it's cool technology? No. It's because it has applications that I value. Everybody will make that same point.

Ms. Hoffman remarked that you could also say there are requirements needed to communicate with my boss or there are system requirements. So I think we interchange capabilities and system requirements.

Mr. Cowart agreed.

Ms. Reder agreed as well.

Mr. Sloan as the policy person here clarified when you are talking about capabilities, is that a euphemism for priorities? What should the utilities and the commissions and the DOE be advocating for? The last day and a half we've talked about how much money is going to have to be invested, and a couple of times we've had discussions about so how important is A relative to B. And so, should we be helping to establish what those priorities are?
Affordability is something that gets mentioned in passing, and yet if you're a PUC commissioner or someone like that, that can often drive things. Or, for Sonny's purposes, I mean that can drive him.

Mr. Cowart didn't disagree.

Ms. Reder said she heard loud and strong on the capability piece, and also said that is fundamentally the same thing as priorities. This is a conversation topic that is needed, now that we've had some proof of concept, if you will, and that really is a big part of the catalyst in order to move it forward.

Ms. Hoffman noted that part of what we did with the Recovery Act is help look at where we get the biggest bang for the buck. As we look through all these demonstration projects, we'll be able to say: Okay, from a priority point of view or a cost effectiveness point of view, here are some of the early hitters. Here are some of the easy wins. Here are some of the things that you get the most

value out of. And then it's as we look at grid modernization we have to really start figuring out how we want to leverage all the different technology deployments.
Mr. Cowart concluded that discussion and dismissed the Ethics Briefing in Meridian C and then lunch. Reconvene at 1:30. This is a good time to ask once again if there are any members of the public who have signed up to address the committee this afternoon. The last time we checked, there were none.

Mr. Cowart informed that he had another meeting and was leaving at 2:30 so gave final remarks. There's a lot of work that we're talking about doing with this committee, and we have to figure out how do we want to streamline some of the stuff, prioritize and focus in all the activities that we're working on. Mr. Cowart gave his list of priorities. From his perspective, he would like to have in each of the subcommittees, a sense of the technology priorities and the technologies opportunities in each, and what are some of the focus areas that we should have in each of those subcommittees. So what are some of the technology opportunities? As we look at it, resiliency -- so, I'm sorry, back to technologies.

How do we strengthen the distribution system? It's a key thing that we need to work on -- is strengthening the distribution system. So that's just one priority or one pressure, strain that I feel that's occurring, that I would love your help in organizing around the strengthening of the distribution system, the technologies, the priorities around that.
The second area is on transmission technologies. How do we look at the transmission system in the future? How do we utilize the system in the future? How do we balance AC versus DC? You know, really taking a hard look at that.

So that is the technology kind of category. When it comes down to the other activities at the department area… under transmission, we have authorities that we can deal with. On the distribution system, it's how to leverage the Recovery Act funds to get the most value out of it.
I don't know whether it's a complete messaging but really diving down into a couple key points over the next year, to say, look this is where we can get the most advancement and help aid some of the discussions that are occurring.

The second area, as we talk about each of the working groups, is really how we build in resiliency as we're talking about whether it's transmission technologies, whether it's the distribution system, whether it's smart grid. How do we get some of the resiliency components in there? And -- because as we look at security and issues that are coming up, we're going to have to really look at the system and take a hard look and figure out how we can build in additional resiliency. I'll say capabilities and functionality. So, we look at anything we can do in that area. And then, the third area as we look at each of the subgroups is really optimization, efficiency. How do we drive some of the discussions that lead to optimized -- here's where we should be heading versus kind of the near-term reaction?

We've had some conversation with the EPA where ultimately this would be the ideal structure. So back behind everything else that we're talking about is really just a point of how do you optimize on the system. Please think about that as we decide the work plan for 2012.

Mr. Cowart said he would prefer not to have a broad, general document than a very set of focused point papers that do pros and cons, and really helps explain and clarify the issues. So as we move forward, he asked the committees to all think about that and think about how we can actually try to accomplish some very well thought out pieces that help continue to move the discussion forward.

He mentioned that last year, we had some really fantastic conversations on very specific issues, that as people looked at the minutes and the notes, they said, wow, there was a lot of thought and discussion that occurred. And they were able to use that to build additional meetings and other activities around that. Mr. Cowart encouraged the committee not to lose the value that I really appreciate in this group, which is the debates, the discussions, the pros and cons, and really getting into an issue and a topic. Please, keep that in mind, and I thank you for all that you've done.
Before we get to our next presentation, we have the follow-on to our discussion yesterday on the Workforce Development Working Group proposal. And Wanda has thought about everything that happened yesterday and woke up this morning feeling even more brilliant than she felt yesterday, and she's ready to give us some of her conclusions.

Ms. Reder talked through her slides about what emerged the previous night over several discussions.

One - why should DOE care about education, and what is the space that drives the interest. Ms. Reder didn't think that the idea was to go after the broad space of education, but really, the fundamental points of where and why they should care is to the extent that it provides the nation with reliable energy, one, create innovation to secure leadership position with related technology advancements, two, and to achieve the vision of future. So it's very focused and contained.
And, the approach -- you know, certainly there's a lot of wherewithal within DOE itself that can be brought forward. There's smart grid education stimulus money. There are other projects. So all of that can be brought forward and leveraged with other organizations that have interest.
Those set the context, if you will. Then there was a question around what are the steps, what are the actions, what are we looking at doing. First and foremost is to identify the potential partners, those others that have interest. And then, ideas that were being mulled around last night on what we might pursue were things like:

- Performing a reassessment of the situation, given the changing landscape, and we talked quite a bit about all of the changes;
- Defining the gaps that emerge in grid transformation and trying to hone in on what those might be to provide some suggestions on how to fill in that space;
- Looking at the developments and initiatives that have been underway and try to further leverage and connect those;
- Looking at emerging areas and if we have those fully satisfied in the education process, i.e., convergence of technical domains, cyber security, privacy and the like;
- This next piece, I think mapping a cohesive energy hub strategy that connects resource investment to workforce development needs;
- And the last two are really enhancing related career awareness and emerging opportunities through the STEM process and defining an approach that aligns.

It's interesting how if you talk to educators versus research and industry, you don't always get an aligned perspective on what should be done. That is what was summarized from the discussion as some of the themes that could be pursued, not that we would do them all, but that's what bubbled up through discussion.
With DOE's assistance, participants are asked to participate in a discussion to further vet out and identify this, utilize this as inputs to ultimately frame a plan that could be put together, bring that forward, get approval and then have DOE receive it and move forward.

Mr. David Meyer asked Wanda to go back to her previous slide and reference the third bullet from the bottom, cohesive energy hub strategy -- we are talking about a hub with respect to the grid modernization work that Bill was talking about yesterday, or a series of regional centers. But there are other hub entities already in existence that DOD supports. There's one for buildings. There's

one for batteries. Every one of those hubs could have a workforce component, and we should not ignore that. We should broaden our focus to get all of those aboard.

Ms. Reder agreed and said that's really the connection that's trying to be made here -- is that there are already efforts underway, really good efforts. But a little bit of connection to think about the workforce development needs, we could further leverage that.

Mr. Cowart thanked Wanda and noted this is the result of a great conversation we had last night after our meeting here. Pat was with us, and we chewed on this for quite a while. This is the time at which you just simply invite other members of the committee who want to work with you on this to volunteer.

Ms. Reder asked to take names of volunteers.

Mr. Cowart replied that everybody has her email and can let her know if they want to participate in this. There is no official action for the committee to take. Rather, this is -- your list of activities is an exploration at this point.

Ms. Reder agreed.

Mr. Cowart introduced Tom Sloan who asked if they need to formally accept the working group. Otherwise, she's out there by herself. I don't know if we have to, but I'm certainly willing to. So if you're, in essence, making a motion that –

Mr. Sloan agreed.

Mr. Cowart said there you go to complete the motion. You're making a motion that we endorse the creation of a working group that at this point in time will take those steps, and then you'll be coming back to us with action steps that the committee might take. Is that correct?

Mr. Sloan agreed that was his motion.

Mr. Cowart said the motion was put in and seconded. He asked for any discussion and all those who would accept the motion to say aye or raise your hand. There was a chorus of ayes.

Mr. Cowart asked if any were opposed. There was no opposition so the motion was complete.

Mr. Sloan expressed his thanks for recognizing the need for a motion.

Mr. Popowsky asked Elliot to assist in helping Wanda sent out an email to look for volunteers because a lot of people were gone.

Mr. Nevius asked to include the slides.

Ms. Reder agreed.

Ms. Hoffman introduced the next speaker, Dr. Imre Gyuk. He has been working a very long time in energy storage and he didn’t consider anyone more of an expert in the area of energy storage than Imre and has spent a lot of time working in partnership with the states, looking at research opportunities, looking at cost-benefit analysis and really trying to drive hard what some of the

needs are and what some of the opportunities in the energy storage area. Ms. Hoffman also introduced his colleague Rachna Handa.

Dr. Gyuk began his discussion on energy storage and stated he is the Program Manager for Energy Storage Research and have been so for -- I don't know -- 10, years, something like that. Dr. Gyuk said that energy storage provides energy when it is needed just as transmission provides energy where it is needed. But, in spite of this pleasing symmetry, transmission has been developed into, well, what is considered one of the marvels of the technological world whereas storage is slowly beginning to become an important subject. In fact, when I started this program, hardly anybody was even able to recognize the notion of energy storage -- utilities, others. There were a few researchers in the field, and the Electricity Storage Association met once a year. My program held a review once a year with somewhat scarce attendance.

Since then, things have sped up very considerably to the point where now energy storage, along with smart grid, is considered one of the hottest subjects in the electricity field, and right about 2010 is where it happened. Suddenly, there is a plethora of conferences. There are more researchers in the field. There are demonstrations, largely due to the efforts, or at least partially due to the efforts, of our program and the people involved with it and working at energy storage. Right about that time, a lot of important people suddenly decided that yes, storage was indeed an important thing, and we got affidavits from people like Secretary Chu and Chairman Wellinghoff and Terry Boston from the PJM.

Now why would we want to be doing storage? Well, for a variety of reasons, but one of them is we have 29 states that have renewable portfolio standards from between 10 to 40 percent renewable, and as we all know, the wind more or less, or frequently, blows at night and not in the daytime. It doesn't always happen that way, but it happens often enough to be disconcerting. And in fact, if you look at all the ISOs across the United States, in each of them, the capacity during -- the actual wind available at peak is about 10 percent of the nameplate capacity. That's somewhat of a problem, and it would appear to be something that storage could help with. And of course, this sort of thing is going to become more so. Look at the development of wind, solar and hydro over the years. And obviously, we are not expecting a linear extrapolation there, but nonetheless, it's going to happen that way for a while, and they are moving upward into greater and greater roles on the grid.

Now there is, of course, storage already on the grid. Notably, there is pumped hydro. This is the worldwide one, and it's a couple of years ago. There is pumped hydro like the sun surrounded by these little planetoids of various other technologies. In the U.S., pumped hydro represents about 2.5 percent of the U.S. electrical baseload capacity. So the existing storage is already something fairly serious in the overall electricity budget. Now what is happening now is pumped hydro isn't going anywhere very fast. We may well get more pumped hydro eventually, but industry prognoses are that we are not going to get more than perhaps four plants in the next ten years.

On the other hand, the battery and similar storage is moving much, much faster. In fact, here is a list of major projects around the world, and you can see these aren't just cobbled together car batteries. These projects are beginning to play a role on the grid -- our own 27 MW, but very briefly only, up in Fairbanks, Alaska; the humongous Rokkasho one, 34 MW, 245 MW hours. But then in 2011, 2012 and 2013 these are snowballing and we're seeing substantial projects coming online.

And by the way, as a matter of pride, the Hebei Province, China, project -- 14 MW, 63 MW -- is not the biggest one in the world now, and it certainly will not be the biggest one in the near future either. It's touted as the biggest storage in the world, but hey, it isn't really. But it's there, and it's very encouraging that China is doing an all- out effort in involving storage on the grid.

If you look at people whose profession is to make prognosis, like Pike Research, but others like KEMA and so on as well, you see a very sanguine picture. Pike Research, for example, estimates 121 MW in 2011. That's annual new deployment. And in 10 years, they see that growing to 2,353 MW annual deployment.

So things are not only interesting. Now they're going to get even more interesting, eventually. Now as I mentioned, we have had a storage program for the last decade, and the way I see this program; it really encompasses everything. You might also remember that this was before science got involved in the issue. It was before ARPA- E. It was before the hub. In the beginning was energy storage, our program. And we did everything and still do everything because I believe that you can't do these things in pieces; you have to have coherency from researchers to companies that deploy things to venture capital and so on. So we have research projects with grants that develop technology, not as far down as Office of Science where they're really just looking at electrochemistry, but this has to do with device development. We then get into cost-share projects as soon as devices are ready to be fielded. Cost-share is very important. I've always done cost-share projects. We don't throw money over the wall and hope something will happen to it. It's got to be a close relationship. And then, loan guarantees -- well, some of those are fortunate; others are not fortunate. But nonetheless, in principle, they play an important role.
Meanwhile, other things have to happen, and these are things that we are in contact with and we partake of those communities. Venture capital is very important to bring into the field. The FERC is absolutely essential, and FERC has taken this all very much to heart. And particularly in the frequency regulation business, they have come up with some very good rules that help the industry, and they continue to do so. They are now thoroughly involved in the storage picture.
Then there are mandates, notably California, with its AB 2514. It's not exactly a mandate for storage, but it is a mandate to look at storage in a serious way and have it as part of the planning process. And even though it does not force people to do storage, it has already had very beneficial influence by making people aware of it and considering the storage angle in planning.

There is also a part of the self generation initiative where storage has now become a serious player, and Texas has recently gone into this game. I believe today, in fact, they are considering passing a bill which would be in some ways similar to AB 2514.

And then, there is the possibility of tax incentives like the Wyden Bill, and although the present Congress probably does not give too much encouraging -- encouragement for passing it, again, its existence has been very heartening in the community and it has alerted people that it really would be a good thing and why shouldn't it be along with -- supported along with renewables.
And within the program, we don't just think these things up on our own. We interact very strongly with the community. The other year, we held a series of workshops, one with the utilities and one with the material scientists, and we did these together with the PV folks from EERE and with ARPA-E. And we generated these reports on the needs and opportunities of storage.
Out of that, we developed an OE Energy Storage Program Plan which had considerable buy in from the other offices involved in storage.

Now our main laboratories are PNL and Sandia. I'm not going to go into the technicalities too much, but there are interesting projects. Like at PNL we are doing redox flow battery development, two new chemistries. Both are vanadium, but one involves a mixture of solutions which vary considerably to enhance the efficiency of the batteries. The other one involves vanadium iron batteries. Both of those are now seriously in the process of commercialization. So the main research on improving devices goes on, but we are already on the verge of having spin-offs, some of them with considerable funding returning back into PNL. We do sodium metal halide battery. This is the plainer model.

We work at low cost, long life lithium ion batteries. This is quite different from the kind of lithium ion batteries that you would look in -- use in your laptop computer and so on because the aim here is to really have low cost, large assemblages rather than small footprint and higher cost. Sandia, similarly, has a program. They have developed an entire new class of electrolytes which are very cute because instead of just being simple things like sulfuric acid, they are ionic liquids with a metal at the core and then sort of organic tendrils coming out, so that the electrolyte is also the electrode at the same time.

These are worldwide accepted research efforts as witnessed, for example, by publication in well thought of journals. In fact, they got the front page.

We also have a small effort in power electronics, largely connected with storage, and we do very well also. We have two of those with both of them with R&D 100s in the last 3 years. Incidentally, ARPA-E has now taken these projects over, and they will make incremental, if not transformational, improvements on them.

Now the biggest thing on the stage is still the ARRA stimulus funding. For storage demonstration projects, we received $185 million, and we have managed to garner a $585- million cost share. That is almost four times the amount. Very proud of that because it shows the considerable degree to which industry and utilities are willing to come up with their own money provided a certain amount of federal money is used to seed the project.

So we are doing large battery systems. We're doing compressed air, frequency regulation, distributed projects, and I snuck in a little technology development because we always have to start something new and improved if we're going to progress. Now it turned out all the large battery projects I have were for wind integration. In principle, they would have been open for solar as well, but people chose to do projects integrated with wind. Now I've shown you this graph before, where the wind blows at night and less during the day. That's a big task because it means large amounts of energy over large periods of time. More easily tackled are ramps, for example. These wind ramps do occur, and they don't always necessarily occur just locally. Here, for example, you can see wind ramps going all the way through the Bonneville Power Authority territory. And of course, when that happens, you can't compensate by shuffling electricity back and forth locally. You'd have to borrow it somewhere else.

If you want something impressive, the February 24th, 2007 ramp in Texas, which extended over all of Texas, and went about 500 MW in a 2.5-hour period. Not 500, it's 1,500 MW in a 2.5-hour period.

Now the interesting thing is yes, they recovered, okay, mainly by letting a lot of major users lower their demand. But the point is to make up for this they had to buy electricity on the spot market for as much as 30 times the usual price. That doesn't get into your average benefit calculations for storage because if you have one of those, the spot prices are way out there and you can clean up. It turns out these ramps aren't that infrequent. Twenty-five percent ramps occur every two days or so, and fifty percent ramps occur about once a week. If you have storage, you have a buffer. If you don't have storage, well, you have other things and prayer.

Here's an example of one of those wind connected storage units -- Primus Power in California, 25 MW for 3 hours. And this is to provide firming for 50 MW of wind in the system. This is a small utility. And they worked out what it would cost them to do this with gas turbines and what it would cost them to do it with storage, and with gas turbines it's about $75 million, with storage

considerably less. And if you do the balance sheet -- and the utility has done the balance sheet -- storage comes out much better than the gas turbines.

Another project at the Tehachapi Wind Field, this one by Southern California Edison, using A123 lithium ion technology -- and again, this is not going to solve the fluctuation problem of the Tehachapi Wind Field, but it is there to be online but to learn how the storage unit performs and how it would benefit the situation. So that's 8 MW for 4 hours.

Frequency regulation is a field that is very interesting and that may very well be the first cost effective storage technology on a wide scale. The one that you see here by Beacon was built with a DOE loan guarantee and a somewhat complicated history because the loan guarantee basically wanted their money back in a hurry because they thought the company wasn't making enough money in time for payback. Eventually, the company was sold with all its assets.
And the new company, basically a finance company, intends to manage the New York State project, build the Pennsylvania project and then go into production, creating a lot more. So we basically are all set. There was a flinch in the management, but I think we are online now.
Similarly, you can do this, of course. You can do it with flywheels very nicely, and you can do it with lithium ion batteries. AES has fielded it, together with A123 has fielded 8 MW. Eventually, they want to do 20 MW. And what they're all waiting for, to some degree, is the FERC order which asks the ISOs to pay for performance. The thing is flywheels and batteries can come on almost instantaneously whereas fossil fuel takes, well, several minutes to come on. And during those several minutes, they are not really providing a service up to their capacity.
So the idea is to keep track of how much the technology actually provides. And it turns out instantaneous response, like with batteries and flywheels, is worth about, say, twice of what fossil fuel is worth. Also, it has a 70 percent reduction in carbon footprint. And we have reputable companies that worked out these details.

Another technology that seems to be coming back is compressed air. Compressed air works very nicely. Basically, you take electricity off-peak -- at night, say -- preferably, when the wind is blowing, and you use it to compress air. And you put it into aquifers, salt domes, caverns, abandoned oil or gas wells or even in above-ground pipes. There, it sits under very high pressure, and during peak, you feed that into a gas turbine -- special gas turbines, of course.
So you don't need to compress the air and the gas turbine is then much more efficient. Essentially, you've scooted the energy from off-peak to on-peak. Unfortunately, there are only two of these in the world -- one in Huntorf, Germany and one in McIntosh, Alabama. Both of those were built during the nuclear heyday, as were most of the pumped hydro projects. In fact, if you look at a graph of pumped hydro project construction, it mirrors completely the construction of nuclear power plants. So they've been there, and they've worked for the last 30 years. And there wasn't much incentive for building new ones, but with the advent of extensive renewables there is now a groundswell of interest in compressed air. And correspondingly, we are doing two projects -- one on the East Coast, one on the West Coast. They may not eventually turn out to be constructable for whatever reason, like economics or geology, but at any rate it's a good try.
PG&E, for example, is going to use depleted gas wells, and they have a gas pipeline nearby the existing transmission line. And because the site is right in the middle of the Tehachapi area and here's the area of depleted gas wells, you have a very good match there. The geography works for you. The idea of the distributed projects was to let smaller utilities or others try out a smaller 500 KW, 1 MW, 2 MW project and see and gain experience in it. This is one which is already commissioned. It was commissioned in September of 2011. In fact, this was the first of my projects that was commissioned. And it is based on a lead carbon technology.
Now this lead carbon technology is very interesting because it looks pretty much like a regular lead acid car battery. But you look at the behavior and the lead acid car batteries go like this over the

cycles and the lead carbon battery goes like that. The lifetime is about 10 times longer, the cycle life. So you get something that has roughly the price of a lead acid battery, but you have 10 times the cycle life. Well, based on this testing at Sandia and other input, East Penn went into production of these batteries, and they won an award for ARRA, and together with Public Service- New Mexico. It integrates photovoltaic field with 500 KW, 2.5 MW hours of storage for smoothing. Everything has been going very nicely. I get reports now and then. And they will try this in various combinations -- like you can put it all into the peak, you can stretch it out so that you have electricity for a longer period, and there are other modes in which we are exercising this demonstration.

Another area in which we are very much interested in is community energy storage. In community energy storage, you go smaller, you build a lot of little units, but you gang them together so that they can serve as an aggregated opportunity for the utility. Basically, the idea is that you put four or so into a group, and they can serve for in case of backup, in case of outages. You can put your rooftop solar on them. You can use it for EV charging, all those things which the utility would like to have smoothed out and done locally. Here, we have 80 of them for each one is 25 KW in 1 hour, and well, those are being built in the AP territory. Another one is being built in Detroit, slightly smaller. Among the research projects, there are a few notable ones -- for example, Aquion Energy, which was the winner of the 2010 World Technology Award and has amassed about $30,000 in venture capital. And they are building a battery with a cost of less than $200 per KW hour, environmentally benign because it's built on readily available materials. With their venture capital, they're in the process of building a factory now, and they expect to have a market input in the reasonably near future. Another project has a look at compressed air, and basically, they want to have smaller compressed air units. But by carefully juggling the temperatures involved, they intend to get along entirely without extra fuel input, so no gas like regular compressed air. It will be a totally green energy storage unit with considerable efficiency and can do it in buried pipelines. You use regular gas pipelines. They have enough ability to withstand pressure, and you bury them in a shallow grave. And -- well, we'll see whether it works. But again, they have attracted considerable venture capital and all kinds of awards. Another one is EnerVault which uses an iron chromium flow battery, and their first application is going to be in an almond grove where there is tracking PV. What they intend to do is they intend to collect basically the entire PV input and concentrate it into the peak hours where electricity is the most expensive and where the almonds want to be watered. They have just attracted $15 million in venture capital, and we are working at fixing them up with a major wind manufacturer for an integrated storage wind unit.
We also are doing a consortium to evaluate reuse of EV batteries. It's a looming problem because if EV hits the market seriously, as they hope, after five years of use you're going to have millions of used EV batteries.

Now lead acid batteries can be recycled wonderfully. Ninety-five percent is recycled. In fact, the price of a lead acid battery relies on reusing the lead and the acid, and so on. But nobody has figured out a good way to reuse a lithium ion battery unless you do a whole lot of environmental sculptures. We have a chance there of, if the economics works out, having both cheaper EV and cheaper stationary storage. We do this at Oak Ridge together with a consortium that involves General Motors and some of the other car manufacturers. And EPA is in the game, and our EV program. Now we were talking before about -- or, you were talking before about education and outreach. Well, we are beginning to take outreach very seriously, and we have a suite of outreach programs which are just rolling in. We're going to have an International Energy Storage Project Database which will have essentially list all the projects in the world, subject to consent, so that anybody who wants to build one of those can check out who else has built something, with what technology, of what size and for what application. We are working an Energy Storage Handbook in partnership with EPRI and NRECA. This is actually a follow- up. We already did one with EPRI a few

years ago. It's time to update it. It will have updated information from 30 or so manufacturers so that we have current prices in it. It will be a thick thing. And it will be available on the internet, so you won't have to pay $10,000 to get a copy.

This will be available on the internet, and it will be a compendium of just about everything we know about storage at that moment. We have also put on our Sandia storage web site a tool, an energy storage selection tool. This was developed by KEMA, and it allows anyone with fairly simple input to get an idea of how storage would work in their situation.

The interesting thing, to me, is it doesn't give you a number. It doesn't tell you if you can buy storage for this price you'll get those benefits, et cetera, because it's never possible to really tie this down. So the answers, essentially, are given in terms of probability distributions. It tells you, you've got to be within these limits if it's going to work out. I think this is an excellent approach and this will be helpful to whomever wants to get involved in storage, and there are more and more people like that. We are building a storage guidebook for regulatory officials -- PUCs, basically -- because PUCs are being hit by all these publications or will be hit by all these publications for installing storage and they have no experience. They have no idea what to do with this, and we would like to provide them with all the guidance we can so that they can avail themselves of this, and of course, with linkages to where they can get more.
We do this with a panel of an advisory committee, which is composed of industry and government experts, to help us in putting together something realistic.

Another thing that it's about time for -- because we're getting enough technologies involved and with things like the self-generation legislation in California more and more technologies are going to try and enter the market -- is to develop a standard. Well, a full IEEE standard takes a long time, and we need something fairly soon. So this is only going to be an interim standard, but this will involve EPRI and many of the manufacturers of technology to develop this pre-standard for the industry so that the vendor can put down exactly how their storage units perform and the user can have some assurance that what is stated will actually be what he will get because you can write performance statements in a wide variety of different ways. You know, is the PC included or not, for example. We just had a kick-off webinar February 28th, and EPRI is on board, as I said, and it's going nicely. We're also collaborating with the Clean Energy States Alliance, and this has two purposes. First, it is to get the states informed and involved. There are a lot of states in the United States, and they all have energy offices, and, except for California and New York, most of them know relatively little about storage.

So by working with the Clean Energy States Alliance we are doing a whole series of webinars involving the states and with very good response. I mean, we get 180 people or so usually. And we did storage and portfolio standards, renewable portfolio standards. We did storage and federal regulation. We are going to do storage and states and the organizations like TESA, SISA and ESA, the local storage associations next.

But besides that, we are also launching a request for information. We would like to get a number of smallish energy storage projects going around the states and with heavy involvement of the states. So the idea would be that DOE, say, provides one quarter of the funding, the state provides a quarter and the owner provides half of it. That way, nobody has a serious burden, and we will be able to kick off interest and not have it led by a federal entity but actually to involve the states. I used to do a lot of this before ARRA, working with California Energy Commission and NYSERDA, and that was very successful because you have local experts who know the local scene and it's also an educational effort. This is rolling and the kick-off was on February 29th, lots of

interest. Some of those projects may come from ARPA-E technologies. Some of them may come from NRECA. Others will just materialize locally.

Mr. Cowart thanked Dr. Gyuk and asked for questions or comments.

Mr. Nevius stated that his organization has developed a generating availability data system, and we track the performance of generating equipment, and we just recently added a feature to do that for wind generation. He asked if you are working with EPRI on this performance measurement, and if so, is that something you want to interface with NERC as well and the folks who are collecting data on other types of generation equipment.

Mr. Gyuk replied okay.

Mr. Nevius said they have had a number of years of experience doing this, probably over 30 years now. So it's something that we may be able to provide some assistance.

Dr. Gyuk said thank you for the excellent point.

Mr. Cowart asked Ms. Wanda Reder to present next.

Ms. Reder acknowledged Dr. Gyuk's excellent report. In your benefits reporting from the stimulus projects, I assume you'll be summarizing the economics and the applications where there are crossover points so that you're recommending go-forward technologies in different scenarios. Can you expand upon that a little bit and what you see coming out?

Now in many cases, we have access to those companies because we have known them from before ARRA existed. And we already have, for example, the PNM one with the lead carbon batteries. It's right next to Albuquerque. So Sandia is going to work extensively with them and with the University of New Mexico to dig into those data and find useful things.
But it will be a struggle to actually get those data to be as fully useful as I would like them to be, but we'll get a lot of information out of them. I mean no doubt.

Mr. Sloan asked if there were projected dates for when your storage guidebook for regulatory officials will be available -- I noticed that you've got a draft being reviewed -- and the Energy Storage Handbook will be redone?

Dr. Gyuk replied the Energy Storage, well both of them, are in draft form. They should come out in the reasonably near future.

Mr. Sloan asked if that meant this year or next year.

Dr. Gyuk replied that he thought it would be this year.

Mr. Sloan asked if the draft was available.

Dr. Gyuk replied no, it's an internal draft at the moment. But as I said, we have an advisory committee, and if you know people who would like to participate in the process, we'd be happy to bring somebody new in.

Mr. Cowart asked a question about sort of your definition of storage because you started off talking about energy storage, but all the examples seemed to be grid-to-grid storage.

Dr. Gyuk replied exactly. It's the Office of Electricity.

Mr. Cowart questioned if he had excess wind generation at night and wanted to store it to use the next day to run air conditioners, could I have a compressed air or battery system to do that, or I could make ice and use that to lower my cooling load in the same way. And that's a form of storage.

Dr. Gyuk said absolutely.

Mr. Cowart asked Dr. Gyuk when talking to decision-makers about storage it seems to me to be important that DOE be sort of technology-neutral or agnostic on different ways that capabilities for delivering services across different time periods are neutrally and holistically represented somewhere in the policy realm. So this isn't the first time I've seen presentations about storage that seem to be all about grid-to-grid instead of a broader view of capabilities for integrating renewables or dealing with demand peak problems.

Dr. Gyuk agreed and stated he used to run the Thermal Energy Storage Program at the Department of Energy. So thermal energy storage has a warm -- or, as it might be, cold -- place in my heart. And, I keep track of efforts in thermal energy storage, both abroad where the Scandinavians have adapted many of our technologies that we developed umpteen years ago and which were closed out by DOE and Congress, but here in the United States as well. We have a number of companies for both heat and cold, but particularly for making ice, which are quite successful. And the reason why they are successful now is because they have caught onto the fact that they should not be selling to the individual homeowner but to the utilities, basically. The individual homeowner may buy it, but the utility will make terms that will make this useful. And then the utility will have benefits because if they have 80 of those in a particular area where the marginal price is very high, then that's money in the bank for them. Yes, it's a perfectly valid technology, but it's not in the purview of the Office of Electricity. DOE should certainly be concerned about it, but at this time it's not in what we're doing.

Mr. Cowart apologized for being ignorant because it seems to me it's providing a solution to an electricity problem. But it lives in some other department?

Dr. Gyuk replied that it actually is a building system, but not from this point of view, which is the one that's valuable from my point of view.

Mr. Masiello asked if he could join Imre on this.

Dr. Gyuk said the technology is very mature.

Mr. Masiello asked if it was a policy problem.

Dr. Gyuk confirmed yes.

Mr. Masiello replied that is why Imre is saying the utilities have to get involved because absent very stiff time-of-use rates a homeowner has no incentive to do this.

Mr. Cowart said unless the utility is involved. Terry Boston talked to this group, and one of his comments was there's enough hot water heaters in PJM that equal the size of their entire pump storage fleet.

Dr. Gyuk agreed, but it's not a research-y topic.

Mr. Cowart understood.

Dr. Gyuk agreed.

Mr. Cowart said he was not assuming hostility, just wondering if we're discussing delivering policies to regulators, that we need to deliver them in a way that reminds people that there's a whole suite of answers here.

Dr. Gyuk stated the draft of the PUC document is not closed, and I've been playing with the idea of putting thermal storage into it as well, where it might pop up.
And, when he does presentations to other groups, I usually include the slide on thermal storage, with high praise.

Ms. Grueneich echoed that if you can put a little something in the draft report for the regulators on this it would be terrific because when it's a state regulator trying to make a decision on whether to approve money, they typically -- well, not typically, but they may look at a full range of alternatives.

Dr. Gyuk agreed.

Ms. Grueneich said to have something in there that at least says this could be an alternative, pluses and minuses -- I don't know what you'd say -- that would help the state regulators.

Dr. Gyuk said yes, done.

Ms. Reder asked if he could comment a bit on the tools and models that are available and where the gaps exist to truly bring this into the planning domain for users.

Dr. Gyuk replied that the outreach projects that he described, at least some of them, are definitely gaps. They will not only bring people together, like EPRI and DOE and so on, and the regulators and others, but they're intended to be hands-on tools. Now we have also -- and I've mentioned much about it. We have an analysis group both at Sandia and at PNL, and there are a lot of people who use analysis to either prove or disprove that storage is useful. Companies like KEMA, for example, are very competent to do this kind of thing. There are companies of this type that we have been working for quite a while, and they do responsible work, et cetera.

Again, to be candid, I am not absolutely sure how convincing analysis ultimately is. To me, actually having things out there and having them work is the proof of the pudding. You know, you can analyze it to death. Unless you build one and it works, it won't work.

But nonetheless, we have these analysis efforts, and the people involved in those have done a presentation to you. And I think your analysis aims and our analysis aims for the future and present are fairly congruent. You know, we have the same sort of thing in mind. The trouble is, of course, funding. With a $5 million cut in funding for fiscal year 2013, some of these things will get shorter thrift than they would otherwise get. That's why I'm trying to scrape money together from the states -- because we need to widen the financial involvement as well as the educational involvement.

Dr. Meyer asked in general terms if you have sketched out a future of expanded deployment of these technologies. So I want to ask you, to what extent should these people be thinking of storage as what other people call a disruptive technology, or at least some of them -- some of these technologies, disruptive? And if so, what are some of the policy-related challenges, institutional challenges that ought to be anticipated and addressed?

Dr. Gyuk acknowledged several strands of thinking. First of all, storage is, of course, not the only solution offered to a lot of these things. We always have to -- I mean, I talk about storage, but I fully realize that demand response is in there too. A greater degree of intelligence on the grid, not in the smart meters but actually on the grid, is an important thing. A certain degree of transmission expansion, although probably not all that much if I read the signs right -- but there's a whole suite of solutions, and storage is one of those. And even the electrical and thermal storage work hand in hand. Nonetheless, the idea of having storage in a major way on the grid is a disruptive technology, similar to the invention of banking or even the invention of money because basically the electricity world is still in the hunter- gatherer stage, where you eat what you catch, like immediately. Otherwise, it will rot. It took a whole transformation, like inventing the pot where you can store things. The pot is fundamental because if you don't have a pot you have what you can hold in your hands. If you put it on the ground, the ants will eat it. So invention of ceramics, pottery, was fundamental in the transition from Paleolithic to Neolithic.
Well, in the electricity business, we're going from Paleolithic to Neolithic if we have storage. And storage can now be -- with storage, electricity can be warehoused. There are all kinds of financial instruments that become available. There are all kinds of dangers as well, of gaming the system and what have you.

If you look at the policy world, in terms of storage, it is in absolute infancy. There is no real fixed set of rules and regulations applying to storage as yet. FERC is beginning to dig into that. It will go hand in hand with having more storage because it's pointless to think of elaborate regulatory structures when you only have a few examples. So they will have to grow together, and all indications are that in fact they are growing together, both on the state level and on the federal level. So yes, disturbing, but I hope not too much.

Mr. Cowart replied that it is hard to beat that answer.

Dr. Gyuk passed the microphone to Mr. Masiello.

Mr. Ralph Masiello informed that his presentation was short and that Tom and Brad and Wanda also helped. First we reviewed the work -- the draft work plan with DOE some weeks ago, and with ICF and these were the line items that survived that review after redundant activities were dropped. There's a legislative requirement that this group prepare a report to Congress, biannually. So we're a year or so late with the second one. And I'll go through an outline of what we're suggesting will be in that report this year.

Second -- and Gordon is the strongest advocate of this -- an analysis of the need for truly large-scale, meaning pumped hydro-scale, storage deployment needs to be done, and there's somewhat of a perception that the focus has not been here. So again, there's an outline of that. And, third, for which we don't have an outline yet, is an analysis on the regulatory issues, especially around valuation and cost recovery. After hearing Imre's presentation, I think it's apparent we've got some work to do to align this third work item with what the alliance is doing and what Imre is sponsoring as a regulatory guidebook.

On a large-scale storage, on the left, you've got the headline and the outline, and on the right, the outline. There is, by the way, a document from the ISO/RTO Council submitted to FERC 18 months or so ago, on the notice of inquiry about accommodating variable resources. It's very comprehensive as of that moment in time. That would be a resource.

And, identifying the policy issues which, as with all storage, include business models and cost recovery, and some of the consequences of inadequate storage in a regime of very high renewables penetration and then surveying some of the technologies. Richard, you see thermal storage is indeed on the list as are gravity systems, offshore and so on. There's actually one proposal out there, by the way, to have sort of an inclined railroad and you use electricity to run the train up the mountain and then let it regenerate as it comes down. So gravity storage is real.

Mr. Masiello replied no, he indicated he liked the model railroads as a kid, but never thought on that scale. And then, for the report to Congress, this would subsume many of the other individual items we had thought of, but it's reviewing the technologies and applications, and I think the novel contribution would be an independent statement of the market readiness of the different technologies. It's required to review the existing DOE programs, and we would look at FERC and NERC activities and standards activities. This was alluded to earlier, but existing IEEE standards are really written around lead acid. And the industry has complained that in the details some of the standards are not reflective of lithium ion or sodium sulfur or other technologies. And EPA impacts -- for instance, a lot of data center operators are starting to look at replacing back-up diesel with storage. And then specifically called out are the goals, and the first one here needs a little discussion, and I think our group is to blame for this. In the 2008 report we said ah, DOE should finance the study of the materials, genome or otherwise called the periodic table. And this was an idea put forth by Donald Sadoway at the time, at MIT, that said you should go look at all of the electric potential of different chemistries possible across the periodic table and identify the high potential ones. I think, Imre, that's probably not on the current research list and may indeed be a recommendation that we can take the blame for and say this wasn't such a good idea.
The detailed RPS studies regionally, which are being conducted as we speak, the demonstration projects, certainly, and there was a recommendation for storage research centers probably subsumed now by the budget request for the energy storage hub and so on. So that's the work plan. This is really the full committee's work plan so it should be discussed.

Mr. Cowart called on David Meyer to speak.

Mr. Nevius asked Ralph to go back to the next slide under benefits. Did we decide that we were going to include the effect or the benefits of transmission -- in other words, the deferment or replacement of transmission as part of the benefits?

Mr. Masiello noted that he would add that in. After this morning's discussion, we might want to add black-start.

Mr. Cowart welcomed Sonny given his presentation.

Mr. Sonny Popowsky asked Ralph, under the third one, the cost recovery –

Mr. Masiello agreed.

Mr. Popowsky said that he guessed it was on the prior slide. Have you looked at the difference between how you value and recover costs in a regulated, traditionally regulated market as opposed to the restructured markets?

Mr. Masiello said they only got 10 minutes. These are personal opinions not necessarily reflective of the group, and people might take issue. If a merchant developer is looking at let's put storage in to do ancillary services, right, or a wind farm developer is saying let's put storage in to avoid congestion curtailments, they're big folks; they know how to value that in the wholesale markets. And that's kind of well plowed ground. On the other hand, if a distribution utility wanted to go to the California PUC and say, we're going to deploy 200 KW batteries along our feeders to mitigate the variability of photovoltaic, the planning tools don't exist, the basis for the economics don't exist, and then there's a subtle problem that says that utility in California isn't allowed to pocket the time arbitrage on the value either, should there be one. Your question is like turning over the first of a tier of rocks, right. And then if it's a municipal, obviously, the rules are different. And if it's not in a restructured environment, different again, right.

Once you move away from wholesale, unregulated market-based applications, the cost recovery issues are complicated. When American Electric Power put their sodium sulfur unit in Presidio for deferring transmission expansion, to improve reliability at the end of a single line, interveners came and protested: You're charging that thing with cheap power and discharging expensive power, and you're not allowed to do that. In that case, I think they were overruled. But as I said, you've just turned over the first rock, and that's why we want to talk about valuation and cost recovery in the report, to just identify the issues.

Ms. Grueneich gave a report then that the EAC subcommittee drafts and prepares.

Mr. Maiello asked if it was for the full committee.

Ms. Grueneich said yes. And as I understand it, it's due in part because on the briefing we just heard most of the work that's going on within DOE is on the smaller scale, and so this is filling the gap and saying let's really look at the large scale.

Mr. Masiello noted that Gordon raised the issue because the big renewables integration problem is a day that the sun doesn't shine and the wind doesn't blow. And today, the answer is gas turbines. Large-scale storage meaning thousands of mega watt hours.

Ms. Grueneich said that she was thinking of the audience for the report. She may have been considering if this will be a recommendation to DOE that in its round of R&D funding or grants, that it includes some funding for the large scale, or is the audience to the state level via DOE? It is a little bit unclear.

Mr. Masiello agreed.

Ms. Grueneich asked at the end of the day, what would this report be recommending?

Mr. Masiello said he thought they would be pre-judging the outcome of the discussions. Some people would say yes, that's one of the conclusions. But it could be that in looking at it projections show enough smaller-scale storage will be deployed to obviate the need.

Ms. Grueneich said okay.

Mr. Masiello said he didn’t want to pre-judge it.

Ms. Grueneich said that she's looking for reports that are both the costs and benefits -- we may want to have a little bit not just the benefits but maybe risks, however you would characterize it.

Mr. Masiello said risks or costs.

Mr. Roberts said we've had this big focus on distributed storage, and so in the last 20 years there have been some major improvements in pumped hydro due to variable speed drives on the pumps so that they can do more functions, pumping and discharging. And I think we tend to forget that these big opportunities exist. There are some siting requests out there for some big pump hydro. One new plant just came on, 400 MW. It doesn't appear to be getting any attention or consideration, and it really should not be just dismissed or we're just focusing on distributed stuff. I think it's good that it kind of reappeared in this report because it wasn't discussed in the first big report we did to Congress.

Mr. Cowart replied that it was a very good point. And asked the question whether the term, large-scale storage, is intended to mean individual projects of large scale.

Mr. Masiello agreed.

Mr. Cowart questioned, as opposed to a distributed, many small distributed things that are connected by a policy or a price signal or a signal that turns them on and off.

Mr. Masiello agreed, he didn’t want to but one thought was a gigawatt-scale storage facility can be a direct participant in the wholesale market on a straightforward basis, and that's the case today in New England and New York and California. Fifteen hundred KW units can't be. So there are inherent difficulties in managing those for firming wind.

Mr. Roberts asked if there was a definition of large. Do we need one?

Mr. Masiello replied that he guessed it to be the case.

Mr. Roberts clarified, was it needed to define it and offer breakdowns?

Mr. Masiello replied okay.

Mr. Roberts clarified; you can build a 100 MW battery plant.

Mr. Masiello said yes, but if it's got one interconnection point, it's large. Good point.

Mr. Cowart replied that he was still scratching his head. I get it, that there's an interest in looking at this topic, but it would seem to me that maybe it's just dealt with somewhere else.
There's also an interest in figuring out how to allow a demand response aggregator to gang up 1,000 customers and have them connected through the internet or through a wire signal to respond to the load.

Mr. Masiello replied with due respect, that's Wanda's problem.

Ms. Reder said thanks Ralph.

Mr. Cowart said okay, I just think from the point of view of this committee that characterizing things like what they do and what capabilities they deliver to the grid is the way we ought to be going as opposed to coming up with some other way of thinking about it. Okay.
So we're in agreement that from the point of view of the grid these things might be equivalent, but you just want to direct attention to one part of it, one category of it. Is that right?

Mr. Masiello said he just wanted to focus on this particular aspect.

Mr. Cowart asked for this one report?

Mr. Masiello agreed.

Mr. Cowart said we would take pains to point out –

Mr. Masiello replied not to the exclusion of all other possibilities, right.

Mr. Cowart agreed. But he was conscious of the fact that we're now looking in PJM, for example, at the need for dealing with greater integration of renewables, and they dismantled a huge water heater control program that they used to have. It's sort of a crazy policy world in which we undo load management and then we say we need storage.

Mr. Roberts said back to -- one of the original drivers is if you believe in the vision for major expansion of wind, okay, which typically blows mainly at night, when using that energy becomes more and more difficult, wisely, trying to capture it for delivery is the issue.

Mr. Cowart replied absolutely. We're in agreement on that. Mr. Cowart said maybe there's a cause-effect relationship there.

He officially asked whether there's any member of the public who signed up to address the committee. There were none. Mr. Cowart indicated that we have concluded our business for today. The meeting concluded at 3:05 p.m., and the proceedings were adjourned.

Adjournment

Mr. Cowart asked for any closing comments.

Mr. Roseman reminded committee members of the Dutch treat dinner that would be taking place at 6:00 PM EST, and told them to leave their tent cards in the room.

Mr. Cowart adjourned the meeting at 4:45 pm EST.

Respectfully Submitted and Certified as Accurate,

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Richard Cowart
Regulatory Assistance Project
Chair
DOE Electricity Advisory Committee

5/1/2012

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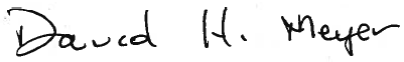
Date



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David Meyer
Office of Electricity
Designated Federal Official
DOE Electricity Advisory Committee

5/1/2012

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Date