Electricity Advisory Committee Meeting

8:41 a.m. through 4:23 p.m.

July 12, 2011

National Rural Electric Cooperative
Conference Center
4301 Wilson Boulevard
Arlington, VA 22203

OLENDER REPORTING, INC.
1100 Connecticut Ave., NW, Suite 810, Washington, DC 20036
Washington: (202) 898-1108 / Baltimore: (410) 752-3376
Toll Free: (888) 445-3376

ELECTRICITY ADVISORY MEMBERS PRESENT:

Richard Cowart, Chair
Regulatory Assistance Project

The Honorable Lauren Azar, Vice Chair
Wisconsin Public Utilities Commission

Rick Bowen, Alcoa

Frederick Butler, Retired
Salmon Ventures Ltd. and
New Jersey Board of Public Utilities (Ret.)

Ralph Cavanaugh
Natural Defense Resources Council

Lisa Crutchfield
National Grid USA

The Honorable Robert Curry
New York State Public Service Commission

José Delgado, Retired
American Transmission Company (Ret.)

Roger Duncan, Retired
Austin Energy

Robert Gramlich
American Wind Energy Association

The Honorable Dian Grueneich
Morrison & Foerster
California Public Utilities Commission

Michael Heyeck
American Electric Power

Joseph Kelliher
NextEra Energy, Inc.

Edward Krapels
Anbaric Holdings

Barry Lawson
National Rural Electric Cooperative

ELECTRICITY ADVISORY MEMBERS PRESENT:
(Continued)

Ralph Masiello
KEMA

David Nevius
North American Electric Reliability Corporation

Irwin Popowsky
Pennsylvania Consumer Advocate

Wanda Reder
IEEE Power and Energy Society and
S&C Electric Company

Brad Roberts
Electricity Storage Association and
S & C Electric Company

The Honorable Tom Sloan
Kansas House of Representatives

The Honorable Barry Smitherman
Texas Railroad Commission

Richard Vague
Energy Plus Holdings, LLC

DEPARTMENT OF ENERGY:

Patricia Hoffman
Office of Electricity Delivery and Energy Reliability

David Meyer
Office of Electricity Delivery and Energy Reliability

ENERGETICS:

Peggy Welsh

Cami Dodge

GUEST PRESENTERS:

Ake Almgren, Chief Executive Officer and President and Director, International Battery, Incorporated

Terry Boston, Chief Executive Officer and President, PJM Interconnection

Mike Hogan, Senior Advisor
Regulatory Assistance Project and
Former Director, European Climate Foundation

Honorable Cheryl LaFleur, Commissioner, Federal Energy Regulatory Commission

Larry Papay, Chief Executive Officer and Principal, PQR, LLC, and Member of the National Academies of Science

PUBLIC ATTENDEES:

John Shenot, Associate, Regulatory Assistance Project (RAP)

Austin Montgomery, SEI

Kevin Messner, Vice-President Government Relations, American Home Appliance Manufacturers (AHAM)

Caitlin Callaghan, American Association for the Advancement of Science (AAAS)

Jeff Roark, EPRI

Jim Glotfelty, Executive Vice-President, Clean Line Energy Partners

John Howes, Redland Energy Group

Holmes Hummel, DOE

PUBLIC ATTENDEES:
(Continued)

Beth Ransel, BLM

Sam Baldwin, DOE

Praveen Kathpal, AES Corporation

Lot Cooke, DOE

John Holt, Senior Manager, Generation & Fuel, NRECA

Maria Wallace, Senior Analyst, GAO

Laura Henry, Analyst, GAO

Larry Camm, Policy Analyst, SEL

Travis Reed, Associate, Lewis-Burke Associates

Gil Bindewald, Program Manager, DOE

Terry Williamson, CCO, PJM

Kurt Longo, Technical Advisor, FERC

Brian Nicholson, Electricity Storage Association

Kathleen Hamilton, Policy Director, Electricity Storage Association

\- - -

C O N T E N T S

C O N T E N T S
(Continued)

P R O C E E D I N G S

MS. HOFFMAN: So we're going to go ahead and get started if people can take your seats.

MR. COWART: Good morning, everybody. Whoa, that's loud. I'll put that further away.

Welcome. I'm glad to see you all here. I think, as usual, what we'd like to do is begin by everybody going around the room and introducing themselves, including the guests on the side. And I'll just start right here actually and say I'm Richard Cowart from the Regulatory Assistance Project.

And let's go this way.

MS. AZAR: Lauren Azar from the Department of Energy.

MR. HOGAN: Mike Hogan from Regulatory Assistance Project, colleague of Rich's.

MR. PAPAY: Larry Papay.

MR. VAGUE: Richard Vague, Energy Plus.

MR. BOWEN: Rick Bowen with ALCOA.

MS. CRUTCHFIELD: Lisa Crutchfield, National Grid.

MR. CAVANAGH: Ralph Cavanagh, NRDC.

MR. CURRY: Bob Curry, New York Public Service Commission.

MR. DELGADO: José Delgado.

MR. DUNCAN: Roger Duncan.

MR. GRAMLICH: Rob Gramlich, American Wind Energy Association.

MR. SLOAN: Tom Sloan.

MR. ROBERTS: Brad Roberts, Electricity Storage Association and S and C Electric Company.

MS. REDER: Wanda Reder, IEEE Power and Energy Society and S and C Electric Company.

MR. POPOWSKY: Sonny Popowsky, Pennsylvania Consumer Advocate.

MR. LAWSON: Barry Lawson, National Rural Electric Cooperative Association

MR. KRAPELS: Ed Krapels.

MR. KELLIHER: Joe Kelliher, NextEra Energy.

MR. HEYECK: Mike Heyeck, American Electric Power.

MR. BUTLER: Fred Butler, formerly

Honorable, now recovering Regulator.

MR. MASIELLO: Ralph Masiello, KEMA.

MR. SMITHERMAN: Barry Smitherman, two days Texas Railroad Commission.

MR. MEYERS: David Meyers, Department of Energy.

MS. HOFFMAN: Pat Hoffman, Department of Energy.

MR. COWART: And then I suppose it's -- this is an opportune time to note that we've had two sort of transitions since our last meeting. As everybody knows, Lauren is our -- has a new role at DOE. And Barry has a new role at the Texas Railroad Commission. And we're happy that you're still with us notwithstanding these transformations.

Our guests, please? Could you identify yourselves? Stand up, maybe.

(Audience introductions without microphones not transcribed.)

MR. COWART: All right. Thank you very much.

If there are members of the public here who wish to address the Committee, our procedure is that you need to sign up for that, and at the end of the day we reserve some time for comments from the public.

I will remind all the Committee members that they're a -- this is an official public meeting. A transcript is being taken of the meeting, and when you speak, it's important to speak into the microphone. And I've learned from past experience -- actually, it's working right now even though I see three phone -- three mikes are on and that mine is still working. Sometimes if there's too many mikes left on it doesn't work. So if you're not speaking, it's good to turn it off.

There is a wifi access in this room for people who'd like to use it. And I just put the note away. I think it's -- what's the password?

(Discussion off microphone not transcribed)

MR. COWART: We'll tell you what the --

what's the password for this room? Do you know?
(Speaking off microphone not transcribed.)
MR. COWART: Well, I was -- I was about to announce it. Right. I was. It's NRECA4301. There it is. All right. Thank you very much.
Our first agenda topic is to turn to my right to Lauren who is going to talk to us about priorities at DOE for --
MS. AZAR: And I'm going to stand up there if that's okay.
MR. COWART: Yeah, please come. That's right.
MS. AZAR: All right. I'm assuming this is already on, and it is.
So Barry has me beat. This is only his second day. This is my 21st day in my new position. And what I'd like to do is give a little bit of an overview as to what I am hoping to do at the Department. These are the priorities of the Secretary with regards to transmission and other types of infrastructure.

I'm sure he has other kinds of priorities, but these are the ones that I hear about so that's all I can give you right now since it's my 21st day. Probably in a few months I'll be able to give you the overall priorities, but I don't have those yet.

There are really -- I can give you two broad categories, and then there's -- and a number of activities that are going on underneath those and then some other categories of activities that I'll be working on which are not quite as broad.

The very first one is identifying and hopefully facilitating the removal of barriers of infrastructure development throughout the nation. And we'll be focusing on the institutional barriers. Obviously I am not a scientists so I'm not going to be looking at the R and D barriers; however, I am hooked into the R and D folks. So to the extent -- as I'm talking with people, we hear about technology challenges. I will be articulating with the R and D folks where those technology challenges are.

And you're probably thinking, well, what the heck does that mean, institutional barriers to the development of infrastructure. I think all of us in our different roles has a good idea of some of the institutional barriers that you witness every day.

And let me just start with the western interconnect. And when we think about building o out transmission in the western interconnect, three letters come to mind. And I say this only because I remember going to NARUC meetings and having the western commissioners utter these three letters like they were four, and that is BLM. And that the level of frustration with regards to federal siting in the west, I don't think the pitch could have gotten any higher.

So, one of the very first things I've been working on is a rapid response team for transmission siting. And this is a multi-agency endeavor. It tags onto a multi-agency MOU that was signed -- Pat, when was that signed? Two years ago? Okay. Yeah, I think 2009, which I know Pat worked hard on.

And I'm not saying BLM is the -- is, you know, a bad character. We all have to look in the mirrors and figure out what we can all do, but the idea of this rapid response team is we're going to set up a dashboard on the DOE website. We are going to track a certain number of transmission projects. Every single federal permit that's necessary for those projects is going to be put up on the dashboard. The project team manager for the different federal agencies will be up there with contact information with deadlines. And DOE will make sure that those are being essentially updated regularly.

We are also going to try to coordinate calendars, which we're early in the process with regards to this. And that's essentially -- if you've been involved at all in transmission siting, you know one of the challenges is that the different approvals come in at different times, and sometimes an approval that comes in late ends up undoing the approval you've already received. And we don't want anybody in those -- in that situation. So part of this is to see if we can coordinate the calendars, first among the federal agencies that are involved. And ultimately, I'm already starting to work with the states to try to get the states involved as well.

So to the extent we aren't seeing progress in the moving through of these approvals, my understanding -- and, Pat, you can jump in or, David, if I get this wrong -- but my understanding is CEQ will be stepping in to assist in delivering the message that these applications need to be moved through in a rapid way.

So that's really good news. I have -- so that's the federal side. We're -- right now we have -- will be meeting with the Secretaries of these agencies at the end of the month. We're going to be recommending six lines that we will be targeting to be the first six lines on the dashboard. Ultimately we're going to bring in more lines and then more lines after that, but these are the six test lines to see -- to work out the kinks and see how that works.

We do have the six lines identified from an internal group that we'll be recommending to the Secretaries. Hopefully your pet projects are on there, but if they're not, come and talk to me and we'll see what we can do with regards to the next series. And, yes, Susquehanna-Roseland is on the list in case anybody in here is wondering.

The state aspect of it -- and I'm going to be talking actually at NARUC with regards to this. You know, when I was a state regulator, one of the things I wanted to do was develop a multi-state siting process whereby when you had a -- multiple states involved -- a multiple state line, one of the things to do would be to have a hearing -- essentially one hearing for the siting part of the line. The need hearing would still have to be state specific, but to make sure, again, that the lines -- right -- the routes matched up to have a coordinated hearing with regards to the siting.

I've now talked to two states -- and I won't disclose them because I still -- I'm trying to track down the utilities to talk to the utility about it. But I've got the commitment of two states where we have a pretty significant challenge with regards to where they meet up that are willing to do some kind of coordination on their side. So this could be the test case for the federal-state coordination of calendars.

So that's the rapid response team. That's an example of, you know, identifying institutional barriers, going after it. And, you know, as the Secretary has recently said, the good news is the DOE has close to no authority in this area. The only thing that we can do is facilitate, put the right players in the room together and suggest that we all work together. So that's -- that's the good news.

MS. HOFFMAN: Before you jump on the next topic, one of the things to keep in mind and -- and, Dian, I know we've talked about in the past is there is some very transparent websites for siting processes and being able to say what information is due when, time lines. And we should probably should do a round of looking at some of those best models. And so that was something I was thinking about as you were talking.

MS. AZAR: Good. If you know of those websites, please let me know because we are developing the dashboard right now for the transmission components.

Tom?

MR. SLOAN: You may know that the Council of State Governments has a compact on interstate transmission siting, basically trying to develop, we'll say, model legislation that states can sign on to do what you're doing. So --

MS. AZAR: That's outstanding.

MR. SLOAN: -- that's a group that may want to coordinate with you.

MS. AZAR: Outstanding. Great.

Other examples of institutional barriers that I'll be taking a look at -- I think I've already spoken to some people in this room who have identified some institutional barriers that may exist within RTOs in the eastern interconnect. And I'll be working with the FERC. Again, we don't have the authority, but I can work with FERC to help identify where those areas are and suggest to FERC that these institutional barriers be something that they -- they take a look at. So that's one of my big categories.

My second big category right now are the power marketing administrations. Everybody in the west knows what they are. Folks in the east probably scratch their head and say, is TVA a power marketing administration. And the answer is no, TVA is not.

But there are four power marketing administrations, or PMAs. And they sell the power out of the federal dams in the west and part of the eastern interconnect. And this is BPA, WAPA, Southwestern, and Southeastern.

The power marketing administrations have

-- each has their own set of statutes, so there's not a one-size fits all as far as how the department interfaces with them.

But let me tell you about two authorities that currently exist that can be utilized to help build out infrastructure. *My own real* goal with the power marketing administrations is to ensure or facilitate that they continue to be or become leaders in their service territories for the transformation to the new energy economy. And so I'm going to do everything that I can to help strengthen their staffs and their expertise to move forward in that way.

They, right now -- at least I'm going to focus on WAPA and Southwestern -- have borrowing authority or 1222 -- essentially authority to move forward with the development of new infrastructure. These are new funding mechanisms that they have never had before, and I'm helping them, trying to move through the applications that they currently have but also looking forward, trying to figure out where they should be moving and what sort of deals they should be looking at, again, with a sense of looking at their entire footprint and figuring out what role they should be playing in that entire footprint.

WAPA has the largest service territory of the PMAs. It also has both of those funding mechanisms, namely the borrowing authority in Section 1222. And so right now my focus is trying to help WAPA. And I've been -- every day a large chunk of my day is spent on WAPA.

My goal ultimately -- besides to sort of -- if I can facilitate these guys to move towards a leadership position -- is also to build expertise within the career staff of DOE. It may not be surprising, but my -- though this is my 21st day, I know my time at DOE is limited. And so to the extent I can build expertise in the career staff so that they understand how the PMAs work, what the DOE oversight of the PMAs are and how we can best partner with the PMAs moving forward, I think it the best thing that I could do with regards to that. And to that end I'm establishing a PMA team within the DOE whose task will to get up to speed on different areas. We're going to do division of labor, so some of them will learn rates. You know, other ones will learn transmission build-out, things like that. So that's my second big bucket.

Yes, Ralph?

MR. CAVANAGH: Lauren, just a word on the second big bucket -- and it's great that -- it's great to have someone at DOE focusing on the PMAs with your background. I just -- for a parochial perspective, having walked into NRDC in 1979 and been assigned to Bonneville Power Administration, you will find there -- and I'm sure you're - this is already clear to you -- and extraordinary level of expertise --

MS. AZAR: Absolutely.

MR. CAVANAGH: -- in terms of both renewables integration and energy efficiency. And if I can just express the hope that if you can simply try to make sure that what Bonneville now does superbly well -- and among the leaders in the whole utility sector -- gets transferred aggressively to the other PMAs and possibly even to the Tennessee Valley Authority which is making some strides but has a ways to go. That will be a huge accomplishment. And I just wanted to weigh in with a vote of confidence in the BPA folks.

Now Weedall will show up at some point, hopefully, as a member of this Committee. I don't think he's here today, and he probably wouldn't have great difficulty with what I'm telling you.

MS. AZAR: Yes. No, and as you noted, BPA wasn't on my list of where the focus is going to be. They are -- I've had some suggestions on how they can improve because all of us can improve in whatever we do, but as far as potential for growth, I think that we have -- there's more bang for my buck and other of the power marketing administrations.

Anything else on that big bucket?

(No response.)

All right. Now there is some tangential buckets, and they're not really tangential, but as you can imagine, if I can accomplish those first two buckets, I'm good to go.

And the second -- the third is DOE efforts on R and D. I think I've already indicated that we -- we have quite a lot of R and D actually occurring in the -- what they call here as the grid space. It's like what does that mean? It's essentially within the area of grid technologies, some of which are far along and ready for deployment; others are not. And again, I think it's going to be a two-way communication to the extent I see areas in which new technologies can help the build-out of the grid.

For instance, if we drive down the cost of AC/DC converters, things like that. I'll be communicating them into the Department, into the R and D areas. And they will be communicating out to me what's available.

Ultimately, my hope -- at least with regards to regulators -- is to help educate the regulators as far as what is available so that when they're meeting with their utilities, they have a good sense as to, you know, what's a relatively risk-free kind of technology that may leap-frog -- right -- what their utility is currently saying they want to build. So they can ask the, you know, educated questions of their utilities to ensure that the rate payers are paying for something that's very forward thinking versus something that may be just incremental.

David? Did you -- no? You were just flailing? Yeah. All right.

The last area -- and I'm putting this -- I was trying to think how to how to describe this. These are areas that I'll be watching but not actively driving. And the first one, I'm sure, is probably near and dear to a number of people in this room is the EPA's -- EPA's new rules and how it's going to affect reliability and what sort of responses the feds need to take to help with that. I mean, what is our role? And how can we help prepare the nation for that -

- the turning of the big ship that's going to be turning as a result of the EPA rules?

And it's related but not directly. As you probably know, FERC is taking a look at the interface between electricity planning and natural gas planning. I'm sorry Gordon isn't here because he would probably be standing up and cheering right now because I know that's one of his pet issues. But that's something that I'm going to be keeping a close watch on.

I've thought for years that we really needed to do natural gas planning and that we hadn't been doing it. And so I'm looking forward to FERC's docket on this issue.

So that's all I'm intending to work on. I haven't counted my total number of days that I'll be at DOE, but I do intend to do that so I can see how my progress is going and where my milestones are.

Yes, please?

MR. KRAPELS: Lauren, one of the things that would benefit from your attention is in the eastern interconnect is the ISO relationships with one another. As a person who has developed a couple of ISO to ISO projects, it's really tough.

MS. AZAR: Uh-huh.

MR. KRAPELS: And I think some -- other than FERC some federal DOE-like oversight or review of just how difficult it is to connect *PKM* to New York or New York to New England -- would, I think, be very helpful.

MS. AZAR: Thank you. That's good.

Yes, please?

MR. HEYECK: Just on your first bucket of impediments -- just can't over emphasize the issue of the -- what FERC action will be taken on the right of first refusal.

MS. AZAR: Uh-huh.

MR. HEYECK: Now, AEP is for elimination of the right of first refusal on a reasonable sense here, but if it gets implemented, there may be litigation, appeals, and things to delay if the rules by which you'd assign are not very clear. So that could become an impediment if the rules are not very clear.

MR. AZAR: Thank you. And since it's actually in -- I have -- I will have absolutely no input to the FERC rules on that just so you know. So, if I were you, I would find somebody at FERC to whisper in their ears on that

MR. HEYECK: Well, and we are.

MS. AZAR: Okay.

MR. HEYECK: There's no --

MS. AZAR: Good.

MR. HEYECK: -- question that the industry will. I'm just identifying that as an impediment that the law of unintended consequences may come, and someone needs to look -- peel the onion back to take a look at that.

MS. AZAR: And, frankly, even if they're crystal clear, there's still going to be litigation.

Yes. All right. Pat. Then Barry.

MS. HOFFMAN: I just want to add something to the R and D discussion. One of the things that we've been struggling with is how long does it take to get new technologies within the utility sector. And as we look at rate recovery and methods, is there a way to learn faster from technology demonstrations so that we can actually get more synergistic cooperation among utilities, among people that are looking at the demonstration, share the information, and so we can accelerate that deployment of technologies.

So what can we do within the regulatory structure as well as the sharing of information to really get the technologies into the marketplace? So that's something we've been struggling with because everyone wants to do it in their territory. Everyone wants to have their own demonstration. And so how do we look at some flexibilities to learn some things, allow some mistakes -- you know, some lessons learned to be made --

MS. AZAR: Uh-huh.

MS. HOFFMAN: -- but still allow the

regulatory and institutional structure to accept that so we can move forward?

(Mr. Nevius arrives.)

MS. AZAR: Yeah, I -- thanks, Pat. I mean, you know, as a former regulator I'm really sensitive to how risk-adverse regulators can be vis-à-vis spending (unintelligible) dollars. And I'm struggling with how we can do exactly that because if you sort of look at how quickly we have to make this transformation, there's going to be potentially -- we're going to need to come up with different mechanisms than we have ever used (unintelligible) as far as deployment goes.

So, I think Barry is next and then Rich.

MR. SMITHERMAN: Lauren, great to see you again. I'm tempted to respond to Mike's comment about the right of first refusal because I have a strong opinion on this issue but what I really --

MS. AZAR: But you're not going to?

MR. SMITHERMAN: But I'm not going to.

MS. AZAR: Okay.

MR. SMITHERMAN: Because that -- that was in my old job. Yeah, that was in my old job.

Tell me a little bit more about this FERC initiative you mentioned in your last bullet, the interconnectedness between gas pipeline infrastructure and electricity. It's one of the issues that we've sort of teed up for discussion later this afternoon.

I don’t want to repeat any work that FERC may be doing, but I want to make sure we're covering that issue.

MS. AZAR: You know, I have not read the scope of work for the docket. They opened up this docket, I would say, two months ago. It was for the purpose of investigating the interdependencies between the natural gas infrastructure and the electricity infrastructure.

And, as you know, if -- again, if Gordon was here, he would talk about the 2006 episode where they were having to choose between generating electricity and heating homes. And as we transform -- I'm sorry?

MR. SMITHERMAN: We had a similar incident on February 2nd, 2011, in Texas -- similar.

MS. AZAR: Yes, I understand you are now on the bleeding edge of this issue as well.

And as -- again, this brings into the EPA rules as we end up sort of maybe fuel switching or retiring units and building new CC units to accommodate some of the EPA regs. Everyone is predicting that there is going to be more reliance on natural gas and taking a look at the natural gas infrastructure to make sure that it's being built out in a deliberative and rational way, I think is keen on everybody's minds.

I -- Barry, I can find out what the docket number is if that would help you and get that over to you. So -- unless there's somebody -- is there somebody at FERC here? I didn't hear any FERC names. Okay. We'll see what we can find out and get it to you.

Who do we got? Rob and then José? José.

MR. DELGADO: Lauren, you have a daunting list of items you have put in front of yourself. I know you have a lot of energies, but --

MS. AZAR: But I'm crazy.

MR. DELGADO: -- you know. But, you know, the opposing forces in lethargy are tremendous. I suggest that the item that you mentioned about the coordination of federal agencies in reviewing transmission project -- I would really like to see that pretty high up.

What appears to be so simple to do and it's such a humongous roadblock -- it should be simple because the fact is that they all work for Uncle Sam. And you would think that it ought to be possible to be coordinated at Uncle Sam's side, but it's frustrated the heck out of us. We do very well on the state level.

MS. AZAR: Uh-huh.

MR. DELGADO: And we have been able to get states to realign (unintelligible) processes. It should be do-able. It would have a humongous impact. I think most people won't even notice that you have done it, and yet at the time that you're trying to site something, it would be a tremendous help in cost and -- well, time and cost for us. So I urge that the -- among the do-ables, that seems -- sounds like one that you could just, you know, really push against because it would be a tremendous benefit to the industry.

MS. AZAR: I appreciate that. And also hearing that it's going to save money is a good -- a good message to the forces that be. So -- Rob and then Dian.

MR. GRAMLICH: First, this is -- a lot of this is music to my ears. It's great to see the focus on deployment and getting things built in the near and midterm.

One thing I would suggest that I didn't see on the list is using the grid more efficiently. We all want to use the grid as efficiently as possible, not necessarily to replace new infrastructure, but even then we should always try to use the existing grid more efficiently than today and squeeze everything out of it that's possible.

And so along with maybe the grid R and D it's really not -- from our perspective it's not an R and D issue. There's -- you know, the technology is out there, but the range of grid operations techniques from the most advanced grid operators to the least advanced is extraordinarily wide. That gap is very wide.

And one thing DOE has done effectively in the past and in certain situations is help with that -- that improvement. And so I would call it best practices facilitating and spreading best practices. Whether or not they are part of the DOE family, so, you know, PMAs have a role and can help, but also in the rest of the industry it's -- and mostly thinking of the non RTO areas where the grid operations methods are very challenged and we could use some help there.

MS. AZAR: Great. If we could talk about that off line, that would be great because I need more information on what we've done in the past that's worked. And if you've got specific areas that we should focus on, I'd love to hear them.

Dian?

MS. GRUENEICH: Hi. Great -- great to see you again. And on the effort that you're going to be making on facilitating, as I understand, transmission permitting, trying to coordinate better, I guess, from the federal agencies what their permitting processes are and match them up with the various states.

One of the things to think about is the interaction with the permitting of the actual projects themselves, the -- at least in California, the renewable projects that there's as much activity in California on coordinating the various state, and federal, and, frankly, local reviews for the renewable projects as there is for the transmission.

So I'm wondering are you also going to be covering the projects themselves and not just the transmission lines?

MS. AZAR: There is a rapid response team identified for generation. And, in fact, in California I understand they already have a model set up for that.

MS. GRUENEICH: Yeah, they're very active, and they're all embedded and they live in California and talk all the time.

MS. AZAR: Yeah, so what's happening right now is that team is trying to -- they're in database collection mode rather than project-specific mode.

There's been recent discussions about moving them more quickly into project-specific mode. I can't give you the answer on whether that's going to happen in the near term -- I mean like immediately or, you know, in a few months, but yes, there is a rapid response team.

We will ultimately -- I suspect that once we get the transmission thing up and running, if it works, we'll then try to meld them. If we have other institutional barriers within the federal government that, you know, once we get sort of this vision codified, if it's still not working, then I'm going to continue to drill down into the transmission stuff because that means we

have other issues that are preventing the
coordination from happening.
So the answer is yes, but I can't give
you a time line on that one.
MS. GRUENEICH: Sure, okay. Because a
lot of the permitting is actually going on and as
permits are being issued.
MS. AZAR: I understand, yes.
MS. GRUENEICH: And then what about the
interconnection? Do you anticipate that you'll
have a rapid response team on the interconnection
issues?
MS. AZAR: And when you say the rapid --
what do you mean by the interconnection issues?
MS. GRUENEICH: Well, you've got the
permitting of major transmission lines.
MS. AZAR: Yes.
MS. GRUENEICH: And then you've got the
permitting of the renewable projects.
MS. AZAR: Yes
MS. GRUENEICH: And then you have -- at
least in California -- the CAISO's process for

the --

MS. AZAR: Oh, the interconnection --

MS. GRUENEICH: -- (unintelligible) very big issues in terms of bringing projects on line. And so I'm wondering if you're also going to focus at the interconnection issues and --

MS. AZAR: Here's how --

MS. GRUENEICH: -- timing and finance.

MS. AZAR: -- I have been talking to our folks about it is that transmission takes a heck of a lot longer to get built than the generation. And one of the problems is ultimately we need to fold in the coordination of those activities because developers don't look at these as transmission or generation, right? They look at these as a whole thing. The cell transmission rights, you've got to have a generator on the other end and customers on one -- you know, one end, generators on the other end. Ultimately, we're going to have to address that, but we have to walk before we run. And so completely on my RADAR screen, and one of the things I want to do is to try to get folks everywhere to think about it as a developer thinks about the infrastructure build-up rather than how we think about it which is permit by permit. Right?

And so in order to actually, I think, streamline these things, we need to figure out what decisions the developer has to make and in what time lines and respond to that rather than just looking at our permits and coming up with coordinated schedules there. So, again, we got to walk before we run. And I'm still in -- I'm still am trying to get us to stand up before we even walk.

Did that all make sense? Did I articulate that okay? Yes? Okay. Yes?

MR. KRAPELS: As a developer of transmission, if I had to rank the number one impediment to building transmission, I'd say it's the interconnection problems and the ISOs. They are --

MS. AZAR: So the cues?

MR. KRAPELS: To a large extent I think

they're dysfunctional and --

MS. AZAR: The cues are dysfunctional? Oh, great. All right. My list just got longer.

Anything else? Perfect timing, Pat. See that? I'm all done.

MR. COWART: Thank you.

MS. HOFFMAN: I just want to extend my thanks to Lauren and actually to all the members of the DOE team because I think we're actually moving forward and gelling with capabilities of bringing expertise in the Department that we are like -- can dive down and start tackling some projects. As was noted, I think by José, there is not enough hours in the day to tackle everything that we need to tackle in this area. So as we continue to build capabilities, we're going to try and actually get stronger and get more depth into some very specific issues that we need to go after and address. So, thank you.

MR. COWART: All right. Thank you, Lauren. It's nice that -- to see that we -- this committee has not lost you altogether. And I expect we'll be intersecting with you regularly.

Our next topic is what I would call as -- and hope will be a stage-setting topic. And that is to examine and sort of take a long-range, long-term, fairly geographically broad look at where electric power systems need to go in the next generation in order to enable, if possible, the dramatic re -- decarbonization of society in North America or in Europe in line with what scientists tell us needs to happen in order to address climate change.

And I've asked Mike Hogan to make a presentation to us this morning. And we're going to have some -- I also have a respondent, Larry Papay, making a -- some observations about it because I was really struck by the -- sort of the results of the modeling that occurred in this broad European project called Roadmap 2050. And I thought that in -- we've been trying to get this -- in front of this committee the results of the U.S. study, a similar study being done at NREL. There have been a number of other analyses along the same lines.

Looking forward to 2050, what do we need to do? And what do we need to start doing now in order to get there? So, in a minute I'm going to ask Mike Hogan to speak with you about the results of the really extensive stakeholder work and modeling done in Roadmap 2050.

But to give you an idea of Mike's background, Mike was the project leader on Roadmap 2050, sponsored by the European Climate Foundation and supported by a stellar group of leading European utilities and other stakeholders.

Mike is now a senior advisor at the Regulatory Assistance Project I'm happy to say. His background is rather different from most of the rest of us at RAP, which we love. Mike's comes from the industry. He began his career in 1980 with GE Power Systems and in 1988 helped to build the J. MaKowski Company into a leading private power developer.

After selling MaKowski, he and some other partners founded the power developer InterGen. And then Mike spent seven years in London developing, I think, a total of something like 8,000 megawatts of Greenfield power projects throughout Europe, also in India, Egypt, and Turkey, I think.

And later then returned to North America and worked for InterGen and then Centrica and has been pretty much on the project development side for a long time. About three years ago, I think, he was recruited to head up the European Climate Foundation's European office, power program office. And among other things developed this project, Roadmap 2050.

Mike has an MBA from Harvard and a Master's in Planning from MIT. And he's most proud of his B.S. in Aerospace Engineering from Notre Dame.

Mike?

MR. HOGAN: Thanks, Rich. And, yes, we're looking for Notre Dame to get back into the national picture this year. So that's -- you're right. I am most proud of that.

I've met some of you and some of you I have not, but I appreciate the chance to talk to you today. As Rich said, at the time that I was involved with this project I was actually at the European Climate Foundation as the Director of the power program there.

So I'll just set the stage. The political context -- and this project was very much a political project as much as anything else. This project was inspired by senior officials at the Commission right around the time that the European Council committed to -- Europe to an 80 percent reduction in greenhouse gases below 1990 levels by 2050. They --

MR. COWART: Excuse me, Mike. It was the European --

(Speaking off microphone not transcribed.)

MR. HOGAN: Well, the -- it was the Council in July (unintelligible) and then -- and then in October they -- they upped the ante a bit and said 80 to 95 percent.

The Commission, who we were -- the officials of the Commission who we were talking to were excited and terrified by this because no one had yet sort of sat down and done a very robust piece of work to figure out how you would actually get there.

And just among us, many of them were very concerned that the answer was going to be that the only way to get there was a massive new-built construction program for nuclear in Europe. And while the Commission is not fundamentally anti-nuclear, they also knew that a new nuclear construction program on the scale that would have been required for that is probably a non-starter politically.

So, we just happened along and had a little bit of money and the freedom to do what the Commission had wanted to do, which is to select blue chip consultants and go like a bat out of hell for about 10 months to produce a new piece of work that looked at -- really looked the grid and reliability issues and said, you know, you can stack up resources. You can do -- you know, you can sort of say I can -- you know, if I had this much wind, and this much solar, and this much nuclear and I add up all the kilowatt hours, I can actually get, you know, the amount of kilowatt hours over the course of a year. And we all know that that's not really the answer because, of course, the power system needs to be balanced from one minute to the next.

And so, while we did some interesting work -- and I'll go through it -- with McKinsey and others on the resource portfolio, the really interesting piece of work from this -- and as our friend, Dr. Felix Matthes from the Ergo Institute likes to -- likes to remind me, the one thing that we did in this project that was new and interesting was the grid piece.

And I see Ralph Masiello from KEMA is here. KEMA and the Energy Futures group at Imperial College London did and continue to do some really remarkable work on how to address the reliability issues around these questions.

So, we had this inspiration from the Commission and we had a political process that we expected this project to be plugged into. We wouldn't have spent the €3.4 million we spent on it if we didn't think it would have a political impact. So the process was that we knew -- because the Commission told us so -- that they were likely to be coming out announcing their own 2050 roadmap project sometime in the summer of 2010. So, we, again, drove like a bat out of hell to get this thing ready to launch about two months ahead of that. And we succeeded.

We are now involved in the Phase 2 of the project, which I won't go into, but that is also designed very much with the -- in collaboration with the officials at the Commission to come out about two months or about six weeks ahead of the Commission's announcement of its first draft of its 2050 plan. So we are very much plugging this into the European political process very intentionally.

As I said, the project was from the outset intended to have an impact well beyond what one would call the usual suspects in the clean energy community. So we decided to work with some very expensive blue chip consultants. And as Rich has often pointed out to me, RAP is not listed on this slide, and I haven't corrected that yet, but RAP was involved in this.

But as you can see, we had McKinsey as overall project manager for better or for worse. We had KEMA running the -- along with Imerpial College London -- running the grid analysis and reliability work. We had the Energy Research Center of the Netherlands looking at technology feasibility. We had Oxford Economics doing some macroeconomic analysis, and then we had some creative work from Rem Koolhaas' shop in Rotterdam, the Office of Metropolitan Architecture, which had a lot more impact than I would have expected being a die-hard engineer that I am. And then we had a policy analysis from E3G and RAP supporting the project.

As Rich said, we also recruited a number -- a surprisingly large number of blue chip European energy industry along with NGOs that we work with. And this was, again, in large part because of the political context and also because of the quality of the consultants that we had selected.

Most of the big energy companies in Europe quickly decided that they wanted to be part of this process rather than allow it to sort of come out without their input. So it was a -- it was a -- it was a delicate dance. It became a lot less delicate towards the end of the project because we tried to keep everybody on board, but we did with one or two exceptions.

So you'll see some very recognizable names here of groups that were involved right along through the final report and continue to be involved in Phase 2.

We started the project -- the project started in the very first instance from the 80 percent economy wide target. And we leveraged

McKinsey's global greenhouse gas curtailment cost curve to quickly try to winnow down the challenge for the sector that we were likely to be most interested in which was the power sector. So you'll see here a sector-by-sector analysis again using the cost effective reductions available in each sector. And the bottom line is that the challenge for the power sector is to achieve a zero or a near zero carbon emissions or greenhouse emissions by 2050.

This is an interesting slide, and we could spend a lot of time on it. It talks about the overall level of abatement. Within sector really refers to efficiency improvements within the sector. And then fuel shift refers to shifting from high carbon sources of primary energy to lower carbon sources. And we'll talk about that in a moment. But again, the sectors that really have the greatest potential to deliver greenhouse gas reductions are power transport and buildings. Waste is there, but waste is a relatively small wedge.

It is interesting to note -- and we'll talk about this -- that transport and buildings much of the opportunity for greenhouse gas reductions in those sectors turns out to come from electrification and specifically electrification with low carbon electricity supply, although not -- obviously not entirely. There are other options, but electrification is -- turns out to be a very economic option for a large proportion of that.

We sat -- this was a back-casting exercise. And that was for a number of reasons -- Dave, David Meyer, and I were talking about this last night. Many of the forecasting efforts that had been done -- Phase 2 large constraints. One is forecasting exercises by their nature tend to look at incremental decisions along the way. And that, by definition leads one to an incrementalist approach to change. And many of -- if not all of those had come to the conclusion that using that as an approach, getting to the 2050 objective, would either be very expensive or would turn the lights off. And that was a concern.

The second straightjacket that the back-casting methodology allows you to break out of is that it is in the nature of most forecasting exercises that they seek the least-cost solution at each step of the way whereas a back-casting exercise allows you to escape that constraint and look at other possible solutions which may not necessarily be least cost. And then the question is how much more costly are they, and is the difference in cost significant enough.

And we -- rather than setting a carbon price trajectory, which, of course, Europe does actually have a carbon pricing system. Rather than setting a carbon price trajectory and using that to try to drive a least cost optimization approach, we assumed no carbon pricing to look at what the differences in costs of various pathways would be. And then we could go back retroactively and look at what that implied for what carbon costs, carbon prices needed to be.

I -- well, let's -- woo, what did I do?

The other thing to point is that the back-casting exercises was based on two non-negotiable outcomes. And 2051 is the 80 percent target, and the second was that the power system needed to deliver the same level of system reliability that it delivers today.

We also set some critical constraints which were driven by the fact that we wanted -- as one of the partners at McKinsey likes to say, we wanted to ask people to believe as little as possible in order to buy into the solutions. So we did not assume any imported electricity for, for instance, solar from North Africa. Great idea. I think that's a great idea. A lot of people think it will never happen, so we didn't ask them to believe that it would happen.

We also didn't assume any fundamental technological breakthroughs, no magical mass power storage or energy storage technology comes onto the scene. Interestingly, no vehicle to grid storage option, although many people would argue that vehicle to grid is going to be an economically viable option.

And the third thing we assumed is no big changes in lifestyle. So people are still eating meat, and people are still driving cars on holiday.

So then the question was what kind of -- what level of demand do we need to decarbonize. And you'll see here a big role for efficiency -- a very big role for efficiency as a foundational assumption. This -- the level of efficiency built in here actually goes beyond the current trajectory that is targeted in European legislation. So the European legislation targets a 20 percent improvement in efficiency through 2020. This actually targets basically all cost-effective efficiency measures identified in the McKinsey cost curve.

So, achievable? Yes. Challenging? You bet. But it's in here. We then built back in fuel shift, and specifically fuel shift to electrification.

This was not a transport study, and I don't want to spend any time on this, but many of you will be interested in that it does affect -- it did affect the demand projections. When we looked at transport, these were the assumptions we built in for fuel shift and transport. So you'll see there is a lot of electrification of transport in there, but it's not all electrified.

I could show you a similar slide on electrification of building heat, but I won't. But if -- that's there for anyone who's interested in it.

So, we looked at three pathways. And basically we were just -- simply started out -- we said we wanted to test three pathways and see whether they were feasible, what the costs would be, and whether one could deliver today's level of reliable service from those pathways. So we looked at the 40 percent -- a pathway based on 40 percent from a portfolio of renewables with the balance coming from nuclear and fossil with CCS. That is essentially the pathway that is consistent with current European policy.

The current 2020 legislation in Europe is intended to deliver, in effect, 35 percent of electricity from renewable sources by 2020 in Europe. So, if you just go out to -- from 35 percent in 2020 to 40 percent in 2050, you're basically talking about hitting the 2020 target and then treading water pretty much for the next 30 years.

The 60 percent renewables target -- self-explanatory. Eighty percent renewables target -- we actually did, in response to concerns from the NGO groups and the core working group, test a 100 percent renewables case. We did not go into it at any great depth. It involved -- we ended up breaking some of our rules. It involved imports of electricity from North Africa, and also, we brought in a couple break-through technologies like enhanced geothermal. So these were the pathways we decided to test.

I won’t go into this. This is the allocation of production from the various technologies that were used in the three pathways plus the baseline. The baseline is basically current -- is current policy with no changes.

I would also mention that the baseline used a -- well, I'll get into this later. So this -- what did we find?

Well, the surprising result to everybody, including the members of the core working group, who nonetheless have accepted that this was the legitimate result of the analysis was that there is a surprisingly small difference in total cost --levelized cost of electricity between the three pathways or among the three pathways. And all three of them are, you know, yes, higher levelized cost of electricity than the baseline but not dramatically so.

There are a couple other interesting things about this slide. You'll notice that the back-up balancing and security costs in the levelized cost of electricity -- and most of you won't be surprised that they're a relatively small component. What's surprising is that they're not that much larger in the decarbonized pathways.

The -- we'll see in a minute the level of transmission build-out that is assumed, the level of spinning and non-spinning reserve additions that are required, and the operational impacts of having to maintain larger amounts of spinning reserve and so on and so forth are all built into here. And Ralph can probably go into that in chapter and verse if we wanted to do that. Doesn't actually add huge amounts of cost to the system.

I mean the basic message is transmission is bloody hard to build, but it's a very cheap solution if you can do it, compared to the alternatives. And the alternative being, in this case, building a lot of renewables and then curtailing them for 12, 15, 18, 20 percent of the time. That's a very expensive alternative and one that transmission can solve very cheaply.

We also tested these for various sensitivities. These are the various pathways and the spread of outcomes based on various sensitivities -- carbon pricing, fossil fuel prices, level of technology learning, and the renewables technologies, so on and so forth.

Interestingly, you'll notice that the blue, which is the range of uncertainty on the baseline case is wider than the range of uncertainty on the decarbonized cases. Very simple reason for that. The range of uncertainty, the 90 percent confidence interval for fossil fuel prices dwarfs the uncertainties in just about every other area -- carbon pricing, technology learning, so on and so forth. So, the -- you can end up with a very high number or a very low number for the baseline depending upon what you assume about fossil fuels.

We assumed, by the way, in the baseline the IEA's world energy outlook 2009, the 450 ppm scenario, which ends up producing a relatively conservative forward projection of fossil fuel prices because, of course, fossil fuel demand is down because the world is achieving a 450 ppm trajectory.

So, the baseline numbers are based on a relatively conservative projection of foreign fossil fuel prices which the peakists in the world don't particularly appreciate, but there you have it.

This -- I won't get into this slide -- time consuming. We tested it another way. Tested sensitivity is another way which was Euros per year per household based on range of outcomes in technology learning and fossil fuel prices. Very hard to move the numbers dramatically in one direction or another. A range of -- ranged from €250 per year per household higher to €250 per year per household lower from the most extreme ends of each set of assumptions.

So the -- how did we get there? How did we get these results? This is what happens to the existing fleet of generators in Europe. There are no -- well, I'll say there are no early retirements here. Some of you may take issue with that, but basically the fleet disappear --

the plants in the fleet disappear as they reach the end of their economic lives. And we made -- and we collectively made various assumptions about the useful economic lives of various existing technologies.

We modeled the European grid based on nine of what are called centers of gravity. They -- and again, Ralph can probably go into this in more detail, but the system is modeled to balance at the centers of gravity it looks at inter regional and intra regional transmission requirements -- reserve requirements, spinning reserve, non-spinning reserve, et cetera. And those are the technologies we looked at.

A lot of transmission. No surprise here. And the big number, the one that everyone tends to focus on is the amount of new transmission required between the Iberian peninsula and the rest of Europe, the Iberian peninsula being one of the two super rich areas for renewable energy in Europe. The other being the North Sea.

And so, you know, the transmission

challenge exists. Lauren was talking about the work that's going on in the U.S. The big difference in Europe is that there are not distinct interconnects in Europe. There's one big interconnect, so there's no -- there are no areas that are not synchronized. So the analogy, roughly, would be the eastern interconnect in terms of geographic size and in terms of the fact that it's -- that the entire area is synchronized.

So, Europe, as many of you will know, is constantly in search of a more cohesive identify and a greater recognition of Europe as an entity. So we thought we'd give it to them. This is the energy union of Europe based on the backbone of the grid.

So we also took advantage of the diversification in the portfolio. This is the 60 percent renewables pathway across the course of the year. And, of course, there is a fair amount of non-correlation among the various sources, which is a great benefit. The larger geographic area over which these things -- this energy can be distributed, the easier it is to balance the system.

One interesting thing about this is you'll see that there is some nuclear and some coal with CCS. Along the bottom of that resource stack which is operating the way one would like to see nuclear and coal with CCS operate if one owns those plants, that's a surprising result to many people with 60 percent of the energy on the system coming from renewables, most of that being variable or intermittent resources. And again, the answer is a lot of transmission, a lot of demand response, and you can actually operate the system quite reliably.

That's -- fun picture again -- something from OMA. It shows the -- Europe looked at from the perspective of regions of particular different -- different particular kinds of renewable resources.

Another thing that -- another way that this -- these results were achieved -- and this was also a surprise. Not only is a greater interconnection and integration of larger balancing areas beneficial from the supply side, it's surprisingly beneficial from the demand side. As you integrate the nine regions, the gray lines of the nine regions -- the red line is the U-27 aggregated -- there's a surprising reduction in volatility of demand across Europe. In other words, the demand in the regions is surprisingly uncorrelated. And that has a great benefit. And that, I think, would translate directly to -- to certainly the eastern interconnect.

A sharing of reserves, again, no great surprise here. The surprise might be the quantity. And I wouldn't dwell too much on this. These were rough estimates. We're trying to refine these in Phase 2, but there were very significant benefits in sharing your reserves from greater balancing areas.

But again I would emphasize, if you remember back to the price slide, that the cost of additional reserves just isn't that significant a factor here. It's good to save it. It saves capital investment, but ultimately, you know, you can -- you're going to have a big difference in the amount of reserves required and not make a huge difference in the localized of electricity over the period.

Demand response played a big role. And we're finding in Phase 2 that it actually will play -- can play an even bigger role. We assumed just for the sake of the analysis that up to 20 percent of the energy that's required in the course of a given day could be moved around to whenever you need it to be consumed in order to most cost effectively balance the system.

And as you can see here, this turns out to be a day sometime in -- probably in August or a week sometime probably in August. The challenge in many cases -- and this is very untraditional for demand response. The challenge is as much, in many cases, to mop up surplus production as it is in other cases to avoid peak demand. And that really speaks to a need to change the paradigm for demand response to something that is much more dynamic, much more finely controlled. In other words, Brad and I and Wanda were talking about this last night. You know, the things that we certainly know we could do if we just go out and do them, like ice storage, like hot water storage -- French do it already. That's the way they balance most of their nuclear fleet is with hot water storage tanks stuck all around the country. It's actually a very viable solution and we don't need new technology for it.

This is a dense slide, and I'm running out of time, so I'm not going to spend much time on it, but basically what it says -- the key message here on the right side is when you do all these things, you end up with an extraordinarily low curtailment rate for (unintelligible). And that's enormously valuable. If you're going to go out and build this stuff, which has a very high capital cost up front, you might as well use it. And the solutions -- demand response transmission and some additional spinning and non-spinning reserve capacity are incredibly cheap compared to the option -- to the alternative of not doing it and curtailing renewables 10, 15, 18 percent of the time.

There is a significant shift towards a more balanced investment in wind and PV. This assumes learning in PV. One of the discussions that has taken place over time since the project was launched was some people say, oh, well they're making very -- you know, really aggressive assumptions about PV learning.

Actually, no. Much less aggressive than the solar industry makes and actually even less aggressive than the IEA makes. We assume a 15 percent learning for each doubling of commercial experience on PV. That's considerably less than what's been experienced consistently over the past 30 years. May not happen but saying that it's going to be zero is also pretty unreasonable.

Big -- no surprise here. We're talking about basically a tradeoff between capital investment up front and operating costs -- primarily fuel costs -- over the life of the system. So a big ramp up in capital investment.

Although, interestingly, in Phase 2 we're finding that ENTSO-E which is the Association of European Transmission System Operators has a plan, a 10-year plan, through 2020. And we've analyzed that plan. And if that plan is implemented, that would be sufficient to deal with the transmission required through 2020.

Now there's -- it needs to keep going after that and the rate starts to ramp up as you get towards 2030, but we were surprised to find -- well, pleasantly surprised, as was ENTSO-E, that their planning seems to be adequate for what would be required.

While there's a big ramp up for investment required, this just shows that it's a relatively small -- I might even say tiny percentage of the capital -- annual capital investment in various sectors in Europe. So it's not -- it's certainly not not do-able.

And in terms of the economic impact, macroeconomic impact, we didn't find that it is massively beneficial or massively destructive of growth in the European economy. It's slightly negative in the first few years and slightly positive as one goes out through 2020 -- through 2050, which I think is good news. It's -- you know, two percent increase in European GDP in 2050 is not insignificant. We're not saying that the world's going to become -- you know, we're not going to be dancing in the streets nor are we going to be eating dogs. Basically the world carries on more or less the way it is.

The economy is much less energy intensive, and this is primarily because of fuel shift towards electrification and transport and buildings. Electric heat pumps -- state of the art electric heat pumps and electric drive vehicles are just simply much more efficient at converting primary energy to energy services than the alternatives that they replace; but there's also a lot of underlying efficiency built into this. So basically the economy was going to become less energy intensive. Under these decarbonization scenarios it becomes much less energy intensive -- also much less reliant on imports of coal and oil.

And so, finally, these are the challenges that the EU faces in delivering this future. And that's what it would look like.

Thank you. I ran a little overtime. Sorry. Larry, over to you.

MR. COWART: Well, I wonder if --

(Speaking off microphone not transcribed.)

All right. Let's start over here.

MR. HOGAN: Dian? Let's go around the table.

MR. COWART: Oh, sorry.

MS. GRUENEICH: Okay. Very, very interesting.

What was the mix between -- on the

renewable side between the large utility scale and, say, distributed generation if we're using maybe a 20 megawatt cut off for the smaller size?

MR. HOGAN: We didn't take a really detailed look at that. The assumption was -- the only assumption one could say was built into this was that 50 percent of the PV was assumed to be rooftop, so, therefore, distributed; and 50 percent was assumed to be utility scale ground based PV. Obviously all of the solar thermal is utility scale. There wasn't that much of that in there simply because if you constrain yourself to continental Europe, the practically feasible amount of solar thermal you can do is pretty limited when you take into account landscape issues, land use constraint issues, and just insulation rates.

So, we didn't look at -- we didn't look in great detail at the decentralized versus centralized question. It is interesting to note, however, that once you get to these levels of penetration of renewables in 2050, that issue becomes less important from a transmission perspective. It's very important from a distribution perspective, but the transmission -- once your renewables production in various areas exceeds the consumption in the distribution area at various times or if you looked at it differently, if you're going to put one big solar plant in a distribution area or a whole bunch of rooftop solar panels at these levels of penetration, the transmission system just sees production in that distribution area. And production that either needs to be supplemented from some hours or exported in other hours.

So, it's -- the decentralized question is a good one from a political perspective. It's a good one from a distribution system cost perspective. And it's a good one from the perspective of retail regulation. It doesn't really affect the transmission solution all that much.

José?

MR. COWART: Are you going to go in

order?

MR. HOGAN: I'm just going to go around the table.

UNIDENTIFIED SPEAKER: All right. Even though --

MR. HOGAN: Rich, is that okay?

MR. DELGADO: I was late ON reacting.

As I look at this, do you do any work on the potential feasibility -- there appears to be a need for very unusual unity of policy among European states to make this happen. We know how difficult it is to conflict between states in the U.S. when it comes to energy policy. And, you know, we are one nation under God, indivisible.

And my question for you is can you address that? Have you given any thought to the level of integration that will be necessary or the probability that you're going to throw in this?

MR. HOGAN: Yeah, we gave a lot of thought to it. In fact, a lot of the Phase 2 discussion is going to be about the level. I mean, that's one of the -- you know, one of the things that gets discussed in this as you present it to various parties is there is a level of planning -- and not member state planning but regional planning implied in this that is ambitious certainly relative to the current level of integrated planning.

And there's kind of -- you know, you can't get around saying that that would be the ideal. You're probably not going to achieve the ideal.

What's -- what we're seeing and what we speculated would be the most likely scenario is different regions on their own -- member states in different regions on their own at various paces are coming to the conclusion that they do need to work together. At some point does that all become knitted together in an EU-wide effective planning process? In some places it already has. ENTSO-E is an EU-wide and ACER now is the -- is the European Association of Regulators.

The two of them are working together to do -- to come up with a European plan for transmission that goes out at least 10 years. And ENTSO-E is developing a 25-year plan.

How one gets the member states' governments to sit down and actually implement those is a challenge, but I think the -- the conclusion of our study is that it's a challenge that could pay tremendous benefits for just about every member state if they were to do it in avoided capital cost investments and improved reliability given the fact that they've already committed themselves to build -- I mean, one thing that you've -- if you look at this is Europe and many states in the U.S. are already committed to adding a quantum of intermittent renewable resources that put you well -- well, you've already crossed the Rubicon.

You're already into a situation where there are really some pretty dramatic re-thinking that you have to do about the architecture of the system, about the way that you plan and balance the system on a daily basis, about the size of balancing areas that are appropriate.

And so you're kind of like, well, you know, you've already -- you may not have realized it, but you've already committed yourself to the need to do this. So you can either choose not to do it in which case it's going to get very expensive or do it. And many of the member states in Europe are gradually coming to that conclusion on their own. And they'll start to aggregate, and hopefully, at some point it will become a more effective EU-wide planning process.

Bob?

MR. CURRY: Mike, it's Bob Curry.

Obviously a great deal of the work that you-all did was prior to the time of Fukushima Daiichi and the resulting political decision in Germany to change its perspective on nuclear. Conversations I've had with people in Germany indicate that in the -- at least through the initial stages while they're not going to build any new coal plants, they're going to try to upgrade the ones they have.

To what extent have those events adjusted, or changed, or deflected some of the conclusions you've reached on your -- in your assumptions column of your initial presentations? And do you think that there is a relatively short time frame in which these assumptions will be impacted, or do you see it extending over a longer period of time?

MR. HOGAN: The long term and short term. The long-term answer is that -- and this is an interesting and a little -- somewhat surprising result is that as we go through Phase 2 with the core working group members, they are almost unanimously now of the view that the 40 percent renewables pathway, which involved 30 percent nuclear and 30 percent from fossil with CCS, is probably no longer viable primarily because of Fukushima Daiichi. And so -- which is a dramatic shift because at the end of Phase 1 most of the -- many of the core working group members were quite anxious to point out that in their view the

60 and 80 percent scenarios were nice to look at but the 40 percent scenario is the one they wanted.

Now they've actually almost unanimously concluded that whatever -- what they might want doesn't really matter because post Fukushima they're not going to get it which means that they're uniting behind a scenario that says that Europe needs to get their 50 percent renewables by 2030 to be on a trajectory to the level of at least 60 percent renewables by 2050. So that's the long term.

The shorter term impact you can say in one word which is gas. You know, Germany may do some things in coal. They're certainly planning to do a lot of things with gas. Most of that will probably be based on Russian gas still and Norwegian gas. There's a lot of -- more -- there's even more controversy in Europe over shale gas than there is here.

And the question for the system is how much gas is good. What kind of gas is good? If you're to reach the 50 percent renewables in 2030 to be on a feasible trajectory, clearly there's going to be a lot of gas but perhaps not as much gas as Shell and Gaz de France would like to think. And it's going to have to be a lot more flexible than a traditional gas-fired CCGT. Gas-fired CCGTs traditionally have been relatively flexible, but they're not flexible enough to do what they're going to need to do between now and 2030.

The good news is that the manufacturers, GE, Siemens, primarily -- I haven't heard anything from ABB, but they may be -- are coming out with revisions to their standard offerings that offer greater flexibility in terms of ramping rates, start-up times, higher efficiencies of low turndown rates, a number of things that would be greatly beneficial.

At the end of the day you can't avoid also -- you know, that's nice, that will cover the middle of the range. You're still going to need to install some new OCGTs in various areas to address the gas problem that Lauren was talking about and that Gordon van Welie talks about clearly our regulators need to get comfortable with the idea that those OCGTs need to have the ability to operate on dual fuel, so they should have distillate oil storage facilities nearby.

And we should look at the possibility of taking steam plant that otherwise would be economically unviable and extending its life while at the same time imposing restrictions on the number of operating hours because a lot of this back up that we talk about is -- some of it's, you know, spinning reserve. Some of it's non-spinning reserve that needs to come on in two or three hours. Some of it is non-spinning reserve that will have 24 to 48-hours notice and may have to run base load for a week or so at a time.

You don't need OCGT for that. You could use it, but you could also use 35-year-old coal plants or oil plants to do that.

MR. COWART: I'm going to interject a -- we're hoping to move on to the next presentation and --

MR. HOGAN: Okay. I'll move quick.

MR. COWART: And so first, I'll urge the questioners simply to confine yourselves to clarifying questions. And I'll urge Mike to look for one-sentence answers.

(Laughter.)

MR. HOGAN: You know how hard that is for me, Rich.

Ralph Cavanagh?

MR. CAVANAGH: Mike, you said that the decarbonization scenarios implied a doubling of capital investment. And I think that was not just for transmission but a combination of transmission distribution generation.

If we were doing that in the U.S., utilities would have a central role either through their own investment or through long-term commitments that would allow others to finance the necessary facilities. Can Europe do that?

My sense was that Europe was moving toward a more minimalist view of the utility role.

MR. HOGAN: No, I mean, Europe can do that, and Europe is actively discussing doing that. I mean, Ireland and Spain already have -- and the Scandinavian countries already have some form of a capacity market. The UK is considering one. Germany is considering one. We're actively involved -- very actively involved with almost all those governments talking through the options.

And I sat through a presentation from Gordon van Welie. Sorry, Rich. I sat with Gordon van Welie a few weeks ago. He made the point which we're trying to make which is, you know, the problem isn't necessarily the amount of capacity on the system. The problem is the system's capabilities in terms of ramping, start-up and -- fast start-up, security reserve, you know, non-spinning reserve that can start-up, again, 24, 48 hours at a time.

The system has -- you know, PJM has a 30 percent reserve margin -- or sorry. ISO New England has a 30 percent reserve margin, 24 percent. And Gordon van Welie's terrified. What's he terrified of? Most of that 24 percent reserve margin can't do what he needs it to do.

MS. CRUTCHFIELD: Mike, thanks.

I could add a bit about economic regulation in the UK and how National Grid, the company I work with, has been very successful in doing long-range planning for transmission investment in part because its economic rate plans last for eight years. So it gets real long -- long-term rate stability and is able to finance the investment. And National Grid, as you know, foresees a significant -- billions of dollars of investment in its UK infrastructure over the next 20 years.

Quick question -- and the question is: What are the challenges -- that slide before this one identified challenges in energy efficiency. Can you just highlight for us why are there challenges and what -- and how are they going to be addressed?

MR. HOGAN: The challenges are the same as they are here. I mean there are market failures all over the place in energy efficiency. Some people would argue that that's not the case. I happen to -- I mean, our friends at Sierra tend to argue that these aren't market failures actually, that efficiency is expensive. I don't agree with that. We don't agree with that.

So they're looking at -- you know, we're -- we've been working very closely with the Irish government to put in place deep retrofit programs in Ireland. The UK has a green investment bank now that is looking to finance big efficiency programs there.

You know, and PJM and ISO New England we allow efficiency to bid in as a resource to capacity markets. That's nice. Every time you do a capacity market, you should let that happen, but that's not the way you're going to get most of the efficiency because most of the efficiency's going to come through programs. And certainly Europe is going that direction as well.

MR. SMITHERMAN: Thanks, Mike. Great presentation. Quick observation and then two clarifying questions -- one.

Do you-all look at the role of competitive markets and dispatching on a security constrained basis, zero marginal cost, wind energy first? And if so, is that reflected in --

MR. HOGAN: Yes.

MR. SMITHERMAN: -- in any of your work?

And two, I'm sure you're going to watch the ERCOT model which is really a laboratory --

MR. HOGAN: Yeah.

MR. SMITHERMAN: -- which is pushing the envelope on many of these issues.

Tell me again your natural gas price assumption through the planning horizon. And here's my second question: I see that you have CCS for gas. And I'm wondering if we can't break this into phases, the first phase being gas without CCS because the carbon footprint is 40, 50 percent of coal. And then later on as the technology matures and the price comes down, layer on top of that CCS.

MR. HOGAN: Yeah. The answer to your first question -- and if you want to find out more about the security constrained economic dispatch, you can turn to the guy to your left. He'll tell you all about how KEMA modeled that.

And we're looking much more detail at that in Phase 2. Phase 2 we've actually got 57 balancing areas, not nine. And we're looking more at price impacts. And the results are pretty surprising.

So the gas price -- I mentioned -- I'd have to look to give you the precise number, but as I mentioned, it's 450 ppm scenario. It's around -- it's around 10 to 12 -- 10 to €12 per million BTUs. You know, real over that time frame. But don't quote me on that. I'd have to look. It's a fairly kind of middle of the road projection of gas prices.

And Europe -- you know, Europe is not going to see the same price -- the current expectation is Europe will not see the same price impact from -- from a conventional gas that we've seen here partially because at the moment it looks like Europe is not sitting on the size of reserves that we have here. And also, there's a question as to how much of what they have they'll develop. So they're going to continue to probably be, you know, a step higher in price for gas in Europe than we are here.

And the second question was? Oh, CCS.

MR. SMITHERMAN: Yes.

MR. HOGAN: Yeah. Yeah, we assumed -- we did assume that in terms of CCS for gas, that really only comes on after 2030. And it's going to be a lot of retrofit.

MR. COWART: Moving right along.

MR. HEYECK: I'm on the EPRI transmission committee. In the last five years we visited Europe and the grid operators in Europe, and ENTSO-E's relatively new --

MR. HOGAN: Yeah.

MR. HEYECK: -- and they are making great strides. Actually, it's pretty impressive what Europe is doing, but there's going to be some rationalization coming up.

They really have great national grids, very weakly interconnected. Spain is about -- Spain and Portugal's about the size of ERCOT with 1,400 megawatt tied to France, maybe 3,400 in the next five years.

What's striking about Europe and very different than the U.S. is their reserve margins. Spain is 100 percent reserve margin. Ireland's about 50 percent or 60 percent reserve margin. And I just think the feed-in tariffs, the subsidies for photovoltaics, and the capacity payments for these folks to sit idle, there's going to be an issue or a rationalization coming.

MR. HOGAN: Yeah.

MR. HEYEK: What is also remarkable is they're not doing as much in storage in Europe, which they could benefit from. And that -- that really is an opportunity.

MR. HOGAN: Yeah, I mean, you're

absolutely right. I mean, and you cited perhaps two of the most extreme examples. I mean, the Iberian peninsula is for all intents and purposes an island, electrically, in Europe.

And the Chairman of Red Eléctrica, which is a Spanish grid operator, will tell you as he has told me that at the moment because of the lack of interconnection with the rest of Europe, they need the 100 percent reserve margin. If they had sufficient interconnection with the rest of Europe, they could cut that down to probably 25 or 30 percent.

Ireland, the same thing. And as I said, I mean this is -- you know, these reserve margins and/or the curtailment that goes along with them is expensive. And transmission is cheap, you know, relatively. The Europeans get that. I think Americans get that, but it's -- it's easier said than done.

MR. KRAPELS: Yeah, it's a related question, and that's how you finance interregional connections. In the United States it's very difficult to get financing for interregional connections because neither side wants to pay. Have you guys looked at that in Europe? Are they considering different paradigms than what we have here?

MR. HOGAN: They are. Well, they are considering a somewhat different paradigm and I think -- and, you know, again, a long way from talk to action, but at the moment they are looking at what they call projects of European interest. So, you know, they recognize that, you know -- that this level of transmission expansion is not going to be done on a national basis, and it's not going to be done on a merchant basis. And so they are looking at ways to socialize interregional projects across the grid.

MR. COWART: Sonny?

MR. POPOWSKY: Yeah, I think you may have already answered the question I was going to ask you about the natural gas. And I was surprised to see so little reference to natural gas in your discussion.

And it did seem to me that the one slide I saw that the prices were still pretty high, and I wondered if maybe with lower prices and greater supply there may be, at least in the near term a greater reliance on natural gas.

But also, I wanted to ask about transport. There was no reference, I think, to natural gas vehicles and a great reliance on electric vehicles. And I wondered if that's -- how realistic that is in Europe and whether you might, in fact, see more of natural gas vehicles and at a lesser cost.

MR. HOGAN: On the first one, in 2050, you know -- again, this was a 2050 look. Now, Phase 2 is looking at 2030, so you're going to see a somewhat different picture because it's a transitional period.

In 2050 the role of gas is going to be smaller because if you want to get to an 80 percent reduction economy-wide and a near zero emissions from the power sector, there's just not that much space for gas in that solution either in the power sector or in the building heating -- space heating sector.

But you're absolutely right that over the next 20 years or so -- between now and 2030 -- it's likely that there will be -- and we are projecting this in the Phase 2 analysis that there will probably a much more significant role for gas. But as I said earlier, it's a complementary role. I mean, if -- you know, even the members of the core working group are coming to the conclusion that to be on a feasible trajectory we need to be at about 50 percent renewables by 2030, which means probably at 30 percent from gas, remainder from nuclear and coal. That's a significant role for gas, but it's -- it's gas generation that's going to need to be more flexible, therefore, the gas system will need to be more flexible and/or -- and complemented by dual fuel operations and perhaps operational oil and coal-fired steam plants (unintelligible).

And --

MR. COWART: Mike, what's your last word?
MR. HOGAN: Last word. We can do this if we want.
MR. COWART: All right. Thank you very much.
Our respondent -- I'm hoping we'll have time for additional conversation in a minute. Our respondent is Larry Papay, who is currently the CEO and principal of PQR, LLC, a management consulting firm.
He has a very long background in the electric power and other energy areas. Previously he was the Senior Vice-President for Integrated Solutions at SAIC, was Senior VP and General Manager of Bechtel Technology and Consulting, was the Senior VP at Southern California Edison over a 21-year career.
Dr. Papay received his B.S. in Physics from Fordham and his Masters and a Doctorate in Nuclear Engineering from MIT. He's a member of the National Academy of Engineering, and he serves on its board of councilors. And he just

completed a term as Chair of the California Council for Science and Technology.

We're really happy to have him here to comment in reaction to what you just saw and also to sort of put in front of us his experience and thoughts on some similar studies that have been done in other places.

And you're going to stay seated where you are?

MR. PAPAY: Yeah, I'm going to do it right from here.

MR. COWART: Okay. Thank you.

MR. PAPAY: In thinking about how to go about responding to a rather detailed study I thought maybe the best approach would be to look at two studies that have been done in this country in the not-too-distant past. And I picked these two out because I had something to do with them. And that makes it a lot easier to talk about them.

And the first was America's Energy Future which was done by the National Academies, completed in 2009. And I'll just give you a website for that. If you haven't seen it already, it's NationalAcademies.org/energy. You'll find it listed there.

And the other one is California's Energy Future, Reducing Greenhouse Gas Emissions 80 percent below 1990 by 2050. And lo and behold, it has very similar goals and objectives to the study we just heard about. That was done by the California Council on Science and Technology, and it came out earlier this year.

It goes back to a conversation I had with the then Lieutenant Governor about -- with AB 32 in California, talking about 25 percent reduction by 2020, and the Governor's Executive Order talking about 80 percent reduction by 2050 -- how in the world we're going to do this.

So we've done a similar study. It's a back-casted study where you set the goals in 2050 and work backwards. So what I thought I'd do is just with a few slides is do a comparison among the three studies in different aspects of it and then maybe some lessons learned that come out of it.

If we look at the goals -- Mike told you about the goals of RM 2050. America's Energy Future was really a technology forecasting point of view looking at the estimates of contributions and potential for new and existing supplies and demand technologies, impacts and costs focusing on the next two decades. It does go out to 2050, but its focus was mostly between 2010 and 2030 or 2035.

And California's Energy Future was to look at AB 32 and the Governor's Executive Order which gets you to the 80 percent mark by 2050.

In terms of scope, again, I'm not going to say too much about the European study since you've heard about that. But the scope of America's Energy Future was number one greater energy efficiency, alternative transportation fuels, renewable natural gas and advance coal, both with CCS eventually in terms of the question that was asked earlier, and advanced nuclear and the T and D aspect in control and storage.

We probably spent a little more time on the transmission side of things than a couple of the other studies, but we didn't do the economic scenario forecasting that we've seen in the other studies.

And the CEF was to look at energy efficiency and demand side management as number one in both transportation and in electric power. And in transportation look at electrification and hydrogen for a vast majority of the California fleet of vehicles. Decarbonized electricity, balance load, and decarbonized transportation fuels.

The methodology, again, Mike went through it for RM 2050. For America's Energy Future we looked at three time buckets, 2010 to 2020. In other words, what could you do now? What could you do in the next bucket from 2020 to 2035? And that sort of had a little blur to it between 2030 and 2035 because there were various studies out there which used either one of those dates. And then the last bucket which we didn't spend too much time on, which was what would happen beyond 2035, which is where really advanced technologies would have a chance to play.

For California's Energy the methodology was an existence proof. Can it be done, and what needs to change to allow us to get there and focus on technology, greenhouse gas emissions, and other impacts -- not really heavily on the economics of what you would be doing.

I won't go through the conclusions from RM 2050. I think Mike's gone through those quite completely. So I want to focus on a little bit more on what the conclusions and recommendations coming out of the other two studies were.

America's Energy Future had eight recommendations coming out of it. The first one was sort of the all-encompassing one in terms of being able to meet goals and objectives if you're looking out to 2050. The second one deals with the electricity sector and transportation in terms of being able to switch to a higher percentage of renewables to be able to switch to carbon capture and sequestration on coal, natural gas, and biomass, and nuclear technologies.

I might point out that in terms of biomass we looked primarily at biomass being a substitution for fuels, less as a primary source of fuel for the power generation sector. The reason being, its value is -- would be greater as an alternative transportation fuel than it would in the power sector because there were other opportunities in the power sector which you would not find in transportation.

And in terms of petroleum as a transportation fuel, there is a time delay here. And mainly it was to deal with the question of infrastructure of how do you build out -- and I'll get back to this a little later. How do you build out the infrastructure to be able to support alternatives? And this applies to the electric power sector as well, as we're well aware, but it is of greater importance, I think, in the fuel sector because of the infrastructure from well head all the way to gas tank that's involved in this.

Energy efficiency was the obvious first choice I think in all three of the studies because it's money saving that can be accomplished. The biggest problem -- if I can put the word problem in quotes -- with energy efficiency is it's done mostly by the user and not by the supplier. And as such, there are economic alternatives for the use of a dollar whether you're talking residential, or you're talking commercial, or business. And the question is how do you incentivize people to take that extra dollar they have or the first dollar they have and spend it on efficiency rather than enjoyment so to speak or increasing productivity in terms of other methods or advanced technology in a manufacturing facility.

So the biggest -- the biggest one there -- the biggest issue there is how do you get energy efficiency to become even more of a mindset. And it can be done through standards and other approaches, but it's still a big -- a big job to be done.

Now in terms of supply, my role there was to chair the renewables panel at America's Energy Future. And we really looked mostly to 2030, 2035 because you can talk about 2050, but if you don't overcome the inertia and get the momentum going in terms of renewable technologies and build an industry, there's no hope of getting there.

And things as mundane as tall cranes becomes very important as you try to build out wind generation. You need a large supply of tall cranes to be able to put towers up. And as the size of wind turbines increases, the demand for tall cranes goes up.

There was also an uptick in the cost of steel for towers simply because of the demand for steel, not only in other wind-related projects but in buildings and so on and so forth. So composite materials or other materials come into play. And that's part of the maturation of a technology of wind and what have you.

Advanced nuclear was always big with the committee as you might suspect, but we'll get back to that a little bit with the Fukushima incident.

And the big deal or big problem with coal or any other fossil is the adequate demonstration of CCS and the extent to which CCS can be absorbed pricewise into our electric generation and supply system.

Five is one which would be of particular interest to this committee, I think, because it deals with transmission distribution and what have you. We did a cost estimate of what it would take to redo what exists out there, in other words, upgrade existing transmission and the expansion of transmission and distribution.

And in 2007 dollars we came up with a figure of slightly under $1 trillion in the U.S. to upgrade and implement new technologies in transmission and distribution. It includes advanced metering as well, but a trillion dollars would -- well, it was 865 million -- billion I mean. But that was 2007, so if we escalate, we're in the billion dollar range. So it's -- you know, the only time transmission really gets it -- gets its fair share is when you build a new generating base load unit away from the load center. Then you put in the transmission to locate -- to connect it up with your existing transmission system. We tend to bootstrap ourselves on transmission otherwise. And this was part of what we were looking at.

What would it take, really, to just upgrade? U.S. actually is behind other countries because we didn't suffer from World War II so a lot of our transmission 100 years old and still in operation.

But within the transmission subcommittee of America's Energy Future we talked about what needs to be done for 21st century Smart Grid. Now, Smart Grid means different things to different people, but we talked about -- and number one is communications control, facilitate improved reliability and security, more efficient use of distributed generation sources over much wider areas, deploy advanced metering, which is being done in the U.S. today, accommodate higher penetration of -- we called them intermittent. I tend to call them variable resources such as wind and solar. And increase dispatch-ability -- dispatch-able energy storage. Energy storage needs to be given more emphasis not only for variable load resources but also in terms of regulation and spinning reserve. If we're using fossil units to do that, your carbon footprint is going to be increased simply by having those units online even if they're in sort of a hot, lower-load condition. And utilize load management and improved ability to control end-use demand. If we can shave peaks, we'll be well off.

Petroleum -- accelerated deployment of new energy technologies, number of barriers -- in fact, when we did the renewables study -- this is a little aside here. Rather than take wind all the way through from source to technology, et cetera, and solar separately, and geothermal, what we did is we looked at the resource base. And in the United States it's a very small -- total fraction of the land in the United States if you went completely wind to completely solar, you can do it. So, resource is not a question. Technology to get started is not a question. We can go for 20, 30 years on the technology base we have and the technologies that are in the pipeline right now near commercial.

The big thing is deployment and, as I said, building up industries that are self-sustaining. If you build up wind and it's going to end, people like Siemens and GE are not going to invest in manufacturing facilities if they don't see the long-term goal out there. So you've got to build a sustainable industry there. So you don't want to build up to 20, 30 percent wind in the next 5 to 10 years and then have it drop off the edge of a cliff. You've got to build up and sustain it. And we relied heavily on the LBL study which was done a couple of years ago looking at 20 percent wind by 2030 as a model for how you build up variable resource -- variable resources.

Let me -- this is the page I want to spend some time on, the conclusions and then where do we go from here. Now we can get to 80 percent. That's not the question. And we can get three-quarters of the way, I would say, using technology which we largely know about today which I said is in use or in demonstration stage.

Deployment will depend more on policy. The renewable portfolio standards have really assisted. Now these are --

(Speaking off microphone not transcribed.)

UNIDENTIFIED SPEAKER: Deployment is really the issue. If you look at --

(Speaking off microphone not transcribed.)

(Brief recess.)

MR. COWART: Okay. Folks, please resume

your seats. We're going to get going again.
MS. HOFFMAN: My presentation isn't that long, so I can catch up on time.
UNIDENTIFIED SPEAKER: I see you command attention.
MR. COWART: Yeah, that's right. That's right. It takes the second notice. All right. Mr. Papay.
MR. PAPAY: All right. I've got --
MR. COWART: Remind us where we were.
MR. PAPAY: We're at the next-to-the-last slide. This is the conclusions, and then my last slide is going to be what have we learned.
The conclusion is you can get about three-quarters of the way there. We want to get 80 percent reduction. You can get 60 percent using the technology which is either commercial today or in the demonstration phase. So, in the next 20, 30 -- 20 years, say, those technologies can lead you that way.
But deployment will depend more on policy. And one of the interesting charts we had

in America's Energy Future in the renewables chapter was the investment tax credit for wind. Whenever there was a delay in the extension of the investment tax credit, the wind development for the succeeding year would drop to roughly a quarter of what it had been the prior year. When the extension of the investment tax credits was for more than -- or done earlier, the wind development just kept increasing monotonically.

So policy incentives are important, but they have to be there not du jour. They have to be there for 5 to 10 years to get the industries off the ground that are needed.

And to get to the final 25 percent of the total to get all the way to 80 percent will take new technology, and innovation, and development.

As I said I've got one more slide, and it's called What Have We Learned. There are no impediments to getting started, but we must get started now. If you don't get started, you're never going to get there, right? Okay. That's very simple. It's easy to say, but we've seen three studies going back over the last two to three years, and if we don't bite the bullet so to speak to allow these industries to build up and reach a commercial level, it's not going to happen.

Now we do have impediments. The impediments are the existing infrastructure. And I'm talking about transportation as well as power delivery or power generation delivery -- is measured in trillions of dollars. So you've got all this investment sitting out there. And a large part of that, the assets lifetimes are measured in decades. So it's not your computer which you can turn over every couple of years. You're talking about housing stock, building stock, and so on and so forth -- and on the transmission side and on the generation side. So you've got the embedded cost and the embedded lifetime that's existing there. And we need to overcome those sorts of things.

Now, number two is there is no silver bullet. There is silver buckshot. So we need a portfolio -- we need a portfolio of technologies from a generation point of view, from an energy efficiency point of view, from a transmission point of view to be able to accomplish this.

And if you look at my Number 5, you're going to find impediments that will come up along the way, Fukushima being the most recent one which may have significant effects. And, as Mike pointed out, the Europeans are looking to shift from the 40 percent renewable to at least a 60 percent renewable future because of that. So the portfolio approach is really important to be able to do this.

Number 3, I think I've already mentioned. Deployment and integration are key. And policy and regulatory actions as well as other incentives will be required to overcome these barriers. We've seen it in the past. We're seeing it today. We'll continue to see it. And that applies to all sorts of technologies and it's -- in one sense it's there in spades in transmission because there are many more jurisdictions involved, but the tax base that comes about by putting transmission in is not as great as dropping a new generating unit into somebody's back yard. So there -- there's NIMBY in transmission for other reasons than a NIMBY in generation.

And I mentioned already about the technology innovation and development.

So, Mr. Chairman, that's -- that concludes my comments as a repartee, if you like, or whatever you want to call it to Mike. It's not rebuttal. It's certainly not a rebuttal.

MR. COWART: Well, it does seem that there's a significant degree of harmony actually --

MR. PAPAY: Yes.

MR. COWART: -- in the results of all the studies we've heard about today. And I guess at this point it's -- we do have time for some more discussion, or some Q and A, or some conclusions that anybody on the Committee might have.

One thing that -- one observation that

sort of came to me as I was thinking about this from the point of view of this group is that the major conclusions of these studies seem to me to call for the policy outputs or recommendations of this Committee in a pretty significant degree. You know, if you look at what's required for storage, what's required for Smart Grids, what's required for transmission, and what is in general required to electrify to a greater extent the economy while lowering the carbon content of the power supply system.

It seems to speak to this Committee quite directly. So that was sort of my take away from listening to the results of these studies.

So perhaps that will -- that kind of observation will find its way into the work plans of the subcommittees and this Committee as a whole.

Tom?

MR. SLOAN: Thank you. As one of the policy makers on this group, you know, frequently when you talk about policy incentives, you're talking about some kind of a financial thing, whether it's a subsidy for the wind industry or the coal industry, or nukes, or transmission, or whatever.

With the economic conditions nationally and at the state level I guess I'd suggest that incentives don't have to be financial necessarily. Now it may be is there a better way to reward first adopters or to, you know, include other factors in cost recovery rate making purposes, what have you.

And I would encourage the group to be focusing more on those options than on who's got more money that they can throw out for, you know, to incentivize whomever. That's particularly true, I think, for the energy efficiency conservation. You know, we have basically provided programs to help people insulate or do other things. I think we're -- be farther ahead at least in the short term if we can find ways to incent the utilities or someone else to be financing those appliance applications or acquisitions and recovering them through their rate structures.

MR. PAPAY: I agree. Actually, just after the power went out, I think I made the comment about renewable portfolio standards as really being to me what really got us going in renewables, which was not a financial incentive per se in terms of a tax break or something like that, but it accomplished what it set out to do.

But consistency in policies is as important as what your policy is or your incentive would be. The policy -- when we do things, we can't do it on a Congressional basis of one to two years. We need to do it 5 to 10 years to be able to provide the stability to an industry which is growing and not have a changing policy base behind it.

But I agree with you that there are things other than straight financial incentives.

MR. HOGAN: And just to add to that, the -- there's certainly quite a lot of discussion in Europe now around the question of the costs of these programs. And in some cases -- and many of you might be familiar with what's happened in Spain, for instance -- it's, you know, in retrospect turned out to be some of these feed-in tariff programs have turned out to be incredibly expensive.

And so there's a lot of discussion about, on the one hand, the need to continue to push deployment for all sorts of good reasons but to make sure that as they do that, that the programs designed to do that are designed to do it at the lowest cost possible.

And so things like what are referred to as digressive tariffs where the tariff is either ratcheted down, you know, automatically on an annual basis or is reviewed annually to make sure that it reflects cost improvements in the technologies or auction programs that effectively amount to the same thing as the renewable portfolio standards in this country which basically mean that you're going to get a certain amount of different types of technologies, but you're going to take the least cost providers of those. And you're going to do that on a periodic basis so that you're always tracking the cost of these things down so that as you push deployment forward, you're always taking advantage of the benefits that you're getting out of the deployment by reflecting that in the cost of the program.

So there is a renewed emphasis on cost in the European programs as well.

MR. CURRY: I guess all these point hit indirectly on the point I was trying to make. And that is in terms of motivation for -- my first point was going to be in looking at transmission and the financial incentives available to transmission, are they pretty much the same in Europe and here.

But taking it a step further, Mike, what you just said eliminates the certainty on the part of the person being asked to make the investment in renewables -- excuse me, in energy efficiency -- and puts it on an auction situation which means that maybe his return or her return is not going to be the same as you get it to the retail level.

Absent from this discussion has been a dollar-driven analysis. Larry referred to in passing some of the incentives available for tax increases in areas where there is transmission -- other tax -- New York, as you-all may know because I think I said it before here. In New York City ConEd rate payers pay a $1,300,000,000 a year in taxes on their electric bill.

But -- and none of these perspectives has been -- yes, there's analysis on how you save money, but how do you incent people with money to do the right thing? And can you give them enough certitude that they will make that investment in a precarious financial climate?

So I'm not sure to whom to address that question, but it's just a general comment.

MR. HOGAN: Rich is the efficiency expert, not me.

MR. COWART: I guess my quick response

would be that I think there's a sweet spot in between what you said and what Mike said with respect to the renewables, for example.

That is, you could -- and European decision makers are now discussing as U.S. decision makers have discussed the notion of, in essence, auctioning off the rights to feed-in tariffs on -- in tranches over time. And by creating competition among the potential suppliers of renewable generation, you can drive the cost down over time.

And instead of having government pick a magic number and put it in place and say, that's the number for the next, you know, forever, when you end up with situations like we see in Spain, you know, to -- with this current perception that the prices are just way too high.

So you can introduce more flexible mechanisms while still giving the investor, who is making a particular project investment, a great deal of security about that investment.

And with respect to energy efficiency,

same thing. You know, we could -- you can deploy energy efficiency resources with the same kind of market based mechanisms that still provide a bankable return to the investors at any given point in time.

Now let's move over to this side and I'm going to try to keep this -- we're okay on time, Pat?

MS. HOFFMAN: Uh-huh.

MR. COWART: Okay.

MR. HEYECK: Just to piggyback off of some of the comments made, there is -- there's only so much a consumer is willing to pay.

In Europe -- I believe continental Europe is about 2,800 terawatt hours per year, and the United States is 4,000 terawatt hours per year. They have about 350 million; we have about 310 million. They, per capita, are about half of what we are, but they pay the same price on average that we do. So we're going to have to work on the equation there, particularly in the United States.

Now, energy efficiency -- if I save a kilowatt hour while I reapply it to comfort -- if I save it and I just want the same amount of money going out. What I'm suggesting here is that there's a little bit more on the cost side of this equation or percent to personal wealth. And I think in Europe -- I think there's an example there of what they are doing. And also, they don't have great penetrations of central air as we do. And if they go into that neighborhood, they're going to be in the same per capita as we are.

So there's a lot of things at play here. And what I suggest is on an economic side it's really the cost the consumer is willing to pay out of their personal wealth that I think determines the dynamic for efficiency and the dynamics for how much we're going to pay for feed-in tariffs and things. Thanks.

MR. COWART: Why don't we get some comments and get some reactions?

MR. POPOWSKY: Yeah, I guess I wasn't

going to respond but I have just sort of a more basic concern which is to follow up on what you said, Rich, which is you look at these studies and you see a consistency in results and what we have to do, but it's just the opposite when it comes to the policy which is there's a total disconnect between the policies in Europe versus the United States.

And the question, I guess -- and it's really just a rhetorical question is why would you spend, you know, billions of dollars on carbon sequestration, for example, if you don't believe that there's -- that carbon has any cost or price.

Or if we can't even discuss in this country the issue of global warming, why -- what's the -- we're sort of living here in a -- maybe a parallel universe in this room as compared to the -- you know, down the street. And I guess, you know, so it's really just a rhetorical observation which is why would we - you know, we can make our -- you know, we can make recommendations as to how to get there, but we haven't decided that there is where we want to be or even that we're willing to talk about it.

MR. COWART: Well, let's hold off responses. Richard.

MR. VAGUE: Thank you, Mister Chair. This is just a comment.

These projections are very useful, and they serve a lot of enormously useful purposes, but I would note that in my business career I've heard a lot of presentations about the next 30 or 40 years within an industry. I can remember hearing presentations from the Post Office in the 70's and '80's that mail volumes were growing geometrically, and it was overwhelming, and this and that and the other was going to happen, and proposals for the creation of electronic mail, which was going to be a federally sponsored system. And if you look at all the projections and predictions that were made in those studies compared to what has happened, there's no similarity. And nothing that has actually happened compares at all to what was expected. And furthermore, most of the innovation that occurred outside of the bodies that were -- that were charged with creating those innovations.

Same thing happened in the banking industry. All the predictions about, you know, again, paper volume of checks was going to overwhelm us. We don't have the capacity to accommodate the volume of checks that are going to occur in the world. We need to create electronic money. And then you look at the types of projections that were made and the reality that came to pass. Again, most of that innovation occurred outside those systems, and the world today is unrecognizable compared to the world that was predicted.

So just a note to temper what I think. It's very useful, but if I were going to bet money, I'd almost bet none of the above 40 years from now.

MR. COWART: Reaction from our panelists?

MR. HOGAN: Larry -- I'm going to pick up on a theme that Larry talked about explicitly which was implicit in the slides that I presented which speak somewhat to Richard's point and also to some of the other points that have been made, which is the importance of diversification -- risk diversification.

You know, one of the things I said we assumed was no fundamental technological breakthroughs, the implication being that, you know, some magic energy storage technology drops from the sky, all of this changes and gets a lot easier and a lot cheaper. We didn't assume that happens.

But more to the point of diversification, which is ultimately an attempt to make the achievability of the outcome that was demonstrated as robust as possible to different futures is diversification. And it goes to the -- the interesting discussion that took place at the end of Phase 1 around the 40 percent, 60 percent, 80 percent, you know, the incumbent energy companies wanted to promote the 40 percent as the lowest risk because it's the least reliant on renewables. In other words, they maintained that it was the most diversified when, in fact, that's not true.

If you do a classic Hirschman-Herfindahl Index analysis and treat the different technologies appropriately as discreet risk pools, far and away the lowest risk portfolio was the 60 percent renewables case. And that's not to promote renewables. It's to promote diversification precisely because we just don't know what's going to happen.

And, you know -- and the nuclear thing being -- you know, the Fukushima -- you know, the -- I won't call it a black swan because it was entirely predictable, but the Fukushima thing is a classic case. And it's one of the reasons we said the 40 percent case is actually not diversified enough because it presumes that we're going to continue to be able to build new nuclear plants uninterrupted for the next 40 years when sadly -- I'm not anti nuclear, but sadly, it was entirely predictable that sooner or later -- and as it turned out, sooner -- we were going to have another Chernobyl or another Three Mile Island. And this time it happened to be in Japan. Next time I would say it would probably happen in China because of the pace at which they're constructing new nuclear plants there. But every 15, 20, 25 years this is going to happen. And guess what? Nuclear construction comes to a screeching halt.

Same thing might happen with wind. Same thing might happen with solar. These are -- you have to make these -- if what you're trying to demonstrate is that this can be done, you have to make that finding as robust as possible to a range of different futures. And you're absolutely right that the more you're relying on certain things happening, the less robust the outcome is.

As far as cost impacts on consumers, we certainly tried to be incredibly sensitive to that. And I guess the one thing I would point out is that one thing our results highlight is that we often forget what the cost of the base case is. And given the degree of reliance of the base case on fossil fuels and the range of uncertainty in future fossil fuel prices, the impact on consumers is actually much smaller than people often think it is. And the risk transfer to consumers is much smaller than people often think it is.

And again, if you talk about carbon prices versus fuel prices, the impact of fossil fuel price volatility on electricity prices is four times the impact of potential futures for carbon prices on electricity prices.

So, you know, whether one considers the very large capital investment required for the decarbonization future is a good investment or not, it depends very heavily on what your view is of fossil fuel prices.

But if you take the we-don't-know-what-the-hell's-going-to-happen-in-the-future point of view and look at, you know, I think the responsibility at least the people in this room have to act on behalf of not only current consumers but future consumers, that starts to look like a pretty good bet to me is to make those investments to make these outcomes more robust against very plausible future fossil fuel scenarios.

So I think these are -- I think these outcomes are not only pro climate if you want to put it that way, I think they're also pro consumer.

MR. PAPAY: I generally agree. And I'm going to use an example. I'm going to use telephony as an example. The first solid state switching system went in in Illinois in, I believe it was 1959, 1960. We didn't discover hockey pucks in electric power transmission until the first hockey pucks came out silicon-based FAX devices 30, 40 years later. And we haven't embraced them with the same speed at which the telephony embraced solid state technology. Now you look where telephony is today.

And I'm not going to predict where power generation could be, but part of the business of a 21st century grid is not simply two-way communication but it's how we -- actually how we handle, and distribute, and utilize the energy and perhaps have two-way power flows.

We talked about micro grids at the break. There's no reason to believe that the central grid would be all consuming or all providing 50 years from now with the distributed generation, rooftop solar, things of that sort. And it may be that the central grid is there for industrial purposes more than simply -- more than for the residential user.

So where the future's going to go, I’m not sure. I think what these studies have focused on is the need from an energy security point of view, from an environmental point of view, and economic point of view we need to evolve the transmission system, and the generation, and the utilization of electricity, and electrify automobiles as a matter of fact as a sort of a side issue here because it's where technology is going to take us. And it's a question of how quickly we do it. And there may be a sense of urgency based upon carbon in the atmosphere or it may be based on energy security or a combination thereof.

MR. SMITHERMAN: May I?

MR. COWART: You may have the final word.

MR. SMITHERMAN: Great. Thank you.

Mike, I guess one of the things that troubles me a little bit is the overwhelming and almost singular focus on carbon reduction because I think at least from my perspective as a Texan and in my new post, I think our country is going to grapple with this issue for quite some time.

Having visited China last November, it would be my opinion that in the hierarchy of needs, reducing carbon over there is at the far bottom of the objectives that I would say they need to focus on in terms of air quality.

So, I realize that we get some of the benefits of reducing the other pollutants when we move toward a lower carbon environment, but shouldn't we also be focused on just cleaning up the air?

MR. HOGAN: Yeah, yes, we should. And I agree with you. I mean, I actually presented the results of the study in Shanghai in October with a number of Chinese officials in the room. And they wholeheartedly agreed with the objective, not because of carbon reduction but because of clean air issues. And they -- they do face -- I mean, the Communist Party in China faces an existential problem with their air quality issues.

So I absolutely agree with that. And carbon reduction is kind of a happy consequence to some extent of the actions you take on that.

I would, I guess, respectfully disagree that there's a singular focus at least in this study on -- on in the studies that Larry cited as well -- on carbon reduction. I would rather say that the focus of the study was to ask the question: Is there a way to deliver society's objectives for affordability and reliability while meeting carbon reduction goals?

And I think what we concluded was yes, there is. It requires some very concerted actions, and it would have other benefits like cleaning up the air and increasing energy security. But the conclusion was it could it be done while maintaining a tri-fold set of what I would call non-negotiable outcomes which is today -- at least today's level of service reliability, affordable to consumers, and achieves the target -- the climate, you know, the greenhouse gas projected set.

And it does have -- you know, unlike in China where we're cleaning up, you know, SO_x and NO_x and particulates are the top objectives, you would also have the impact of reducing those as well. So but, you know, different places are going to have different points of emphasis, and I agree with you.

MR. COWART: Do you have a final comment?

MR. PAPAY: Totally agree. Carbon is

maybe du jour today a little bit, but America's Energy Future not only looked at it from the environmental point of view but also the energy security point of view. And have we reached the end of oil and all of those sorts of debates set aside, I think there is a very strong reason to try and reduce our appetite for hydrocarbon fuels, not because I'm against them but because their value for the chemical industry is greater for other purposes than simply burning them in an internal combustion engine.

So moving off of a hydrocarbon fuel diet has certain economic as well as security interests associated with it. And I think those are also objectives that need to be confronted along with what we're talking about in terms of greenhouse gases.

MS. HOFFMAN: Okay. I'd like to thank the speakers and thank the discussion. As I look at this, I was heading probably towards some of the same comments that Mike was having which is we really need to focus on multiple objectives which is affordability, reliability, cleaning -- cleaning the air, cleaner air quality, and then security from my perspective, not security to reduce dependence on oil but security from a security perspective with respect to contingencies, what would -- potentially could happen with the electric sector. And we're going to talk about that a little bit later today.

But some of the things -- at least balancing those objectives -- we should always keep in mind as we look at any scenarios. I think what the value is is we may not get the scenarios right, but the process of understanding and the discussion around some of those scenarios is very valuable to educate whether it's the policy makers, technology developers, operators on what we should be looking at and what some of the things that potential outcomes may be.

So as I thought about it, you know, I guess I might ask of the Committee as you reflect on these studies is that there is no silver bullet, but what are some of the silver buckshots that we're learning from the analysis? And I'll use that phrase.

And some of the things that I picked up is, okay, there is a role probably in the United States from demand response. Now, the actual percentages will vary, but, you know, there is a range and a value for demand response efficiency. And those are components that should be part of our portfolio.

As you look at it, things to watch out for or things to keep in mind -- as we talked about briefly, the balance between central and distributed. Looking at micro grids or an evolution of the grid system that potentially could be different.

And the other thing I guess I would ask for is lessons learned from these studies that we really should pay attention to as a Department of Energy. And one example that I can think of is really the flexibility of gas generation and looking at -- in the future we're going to need that gas generation fleet to be able to ramp faster and be more flexible. And so some of those were the key points that I picked up. I'm sure the Committee will pick up several more, but things that the Department really should look at and pay attention as we move forward either in doing future studies, lessons learned of how these studies are -- or at least the European study is different from the U.S. situation so we keep that in mind as we move forward.

So those were the things that I would ask for in closing and ask you-all to consider as you think about this. Okay?

MR. COWART: Okay. And now you get to open.

MS. HOFFMAN: And now I get to move into the next topic. So I'm just actually going to transition if we can directly into the next topic.

As a little bit of a background, the White House under the Office of Science and Technology and Policy, National Science and Technology Committee wanted to take a look at

Smart Grid and wanted to take a look at how does Smart Grid fit in the role of moving to a 21st century.

So we undertook -- I would say first and foremost an education process, a process where we actually took a look at the Smart Grid investments, the money that we did with the Recovery Act, and said, where are we going with this. Where is the --

(Interruption not transcribed.)

MS. HOFFMAN: Okay. Gotcha.

So where do we need to focus on as we look at different policies that we want to have in the future.

So once again, the first and foremost part of it is, as Larry talked about, was education. We spent a lot of time talking about Smart Grid. What does it mean? It means a lot of different things to different folks.

But as we looked at it and got through the discussion, it became very clear that as we're looking at the Smart Grid what we want to do is improve the efficiency and the operations of the grid first and foremost. So it's actually improving the operations, how we can get more efficiency and utilization out of it.

Then it became to the point of how do we utilize -- and I guess it should be done via advanced sensing, measurement, and control -- so, information technologies, the use of information technologies to allow us to improve system performance.

As I've talked in various forums, we've looked at near term kind of opportunities as well as long-term opportunities. Near-term opportunities looked at better outage management, better information for responding, and, you know, reliability activities.

Long-term things is looking at states' objectives for demand response and being able to engage demand response as a way to help with the system operations.

So, some of the things we -- we went through a whole discussion ranging from the value of meters to the synchrophasors on the transmission system. And I always say that probably my greatest gratitude is now I can have the White House talking about synchrophasors and not have Star Trek come up as a -- hello?

Okay. So I don't know how I did that, but anyways.

So one of the things that I think as we move forward to keep in mind was an educational process. Talking about the electric grid is a very complex issue. It has a lot of tentacles to it. And so what we wanted to do was actually educate.

So, background. What we -- the framework we looked at -- and right now I just presented our OE Recovery Act activities was part of the framework where we had four and a half billion in federal investments matched by utility and industry. We ended up with 99 investment grants, 42 demonstration grants, 52 work force grants, and one of the things in maybe a future discussion we can talk about work force in general, but I’m not going to talk about it as part of this presentation today.

And then we had the rural utility services for -- under Department of Agriculture and the work that they've done and the loans. And what we wanted to do is actually bring the whole family together and say how can we get the most value out of this investment as we move forward.

So what this council that was developed was an interagency council. It was a subcommittee. Once again, we had multiple agencies involved in this. We wanted to make sure that the federal community was on the same page as we looked at the development of the Smart Grid, the modernization of the electric sector.

It was chaired by myself and George Arnold. George Arnold is the lead for Inoperability Standards at NIST. We spent a lot of time talking to many different organizations -- states, utilities, technologies, farms. We've had three requests for information. So we really went through and tried to get as much input as possible from the community with respect to the Smart Grid.

So the summary -- and if I had to stop here and look at -- but the summary of what we did focused on four things.

First one was enabling cost effective Smart Grid investment. It was looking at information sharing, the innovation that's going, and the documentation of the costs and benefits. So what we really wanted to do was actually -- we have a whole variety of projects that we've invested in. So how do we really show and document the cost-benefits, where some of the value is heading, and then also take that information and share it?

So once again, go unlocking innovation primarily goes after how do we build the platform on which innovation can evolve. And so, what did we need to do with -- especially with respect to the standards process of unlocking innovation? We don't want to constrain the marketplace. So how do we make sure as we're moving forward we continue to allow technologies to be developed and to have access to improve the electric sector.

Informing consumers. That was a long discussion as we looked at education that is required with respect to providing consumers information. We need to go after how do we become more of an energy-conscious society. So how do we continue to evolve with the educational process?

Data access is what type of data do the consumers want to have and what format. What resonates with consumers? A lot of that focused around what needs to be done, needs to be tailored to the type of consumer that you're talking to. It's not a one-size-fits-all -- kind of going back to no silver buckshot or silver bullet; but there's many options that some consumers will want more detailed information. Other consumers will really want everything automated. So we must have a system that's flexible enough to tailor it to the consumers.

And then of course cyber security. As we add more sensing and information technologies, we really need to go after improving the cyber security and make that engrained to the devices versus putting cyber security on afterwards.

Actually I just talked through all this. I’m not sure I'm going to go through these again since I talked through them on the first slide. You're welcome -- I'll just flip through these quickly, and you can -- you can look it and we can just probably go toward the discussion.

The innovation, once again, looking at catalyzing the development through the standards process, making sure that we can look at more options for innovation.

Empowering consumers. Once again looking at educating consumers, providing them the information, making sure that they're easy to use and that they're tailored to the consumers.

And then, of course, cyber security.

So what is the next steps? The next

steps is we're going to continue -- we recognize as the investment grants and as the awards that the Department of Energy released is that this is a continued partnership with the states. States are providing the 50 percent cost share on the investment grants. So we recognize that the Smart Grid will evolve also as state policies, state regulatory actions continue to evolve. So what we are going to do is keep pace with essentially the actions and the activities of the states.

We're also looking at how do we develop an innovation hub as part of the 2012 budget request that was submitted to Congress.

We're also looking at stakeholder meetings to make sure that we understand that regional diversity. So as we continue to evolve the Smart Grid, we're in pace to what the regional assets are but also the regional needs. I mean, there is an objective that, say, Michigan's looking at with respect to electric vehicles, whereas the northeast may really be focused on peak load reduction. And so we want to make sure that the education process and that consumers as well as the utilities and the utility commissioners -- that everybody's on the same page.

We do have to do a report on an implementation of how well we're doing. And part of that implementation is going to look closely at the consumer behavior studies that we have undertaken. We have several consumer behavior studies in which we're really going to look at how well those consumers respond to different rate structures, different signals, different technologies whether it's a home energy management system versus an in-home display and actually try to really pull together a statistically neutral and constructive studies that will provide some depth of information as we move forward.

And then the last point is a point that as we move forward I think becomes the crux of the issue is data, is how do we best utilize the data for consumers to make educated decisions but also the data for utilities to operate the system better. So it comes down to making sure that we're maximizing the use of that data appropriately, given to the right people at the right time with the right protections but also being able to take advantage of all that data that we have to offer and then to go back. Whether it's actually aiding in measurement and verification of energy efficiency, it's providing better educational decisions for consumers, for operations and outage management at the distribution level, to operations and optimization at the transmission level as well. So that's what I have.

And those were, of course, the documents, if anybody wants to look at it, plus the Notice of Intent.

Ed?

MR. KRAPELS: Thank you, Pat.

That -- there's a reference in there to a Smart Grid technology and systems energy innovation hub. Is that something you conceive of a single project that would be somehow competitively chosen by the DOE for development in a particular place? And if so, what's the scale and size of it?

MS. HOFFMAN: The innovation hub will mimic the other innovation hubs that have been released by the Department of Energy so it will be a competitive solicitation. The scope of it is currently under development.

So what we're looking though is really -- I can't say whether it will be a singular or multiple entities, given the diversity of the United States, but how do we take more of a holistic look at some of those scenes issues and make sure we move things forward?

MR. KRAPELS: Are you thinking of it as a 5 megawatt or 50 megawatt sort of applications? Any sense of the scale of it?

MS. HOFFMAN: I don't know actually if I would characterize the scale from like a 5 megawatt to a 50 megawatt. It would be more of a cross -- cross-cutting activity of how we can take a holistic look of security issues as well as demand response issues versus inter regional activities, et cetera.

MR. HEYECK: You know where I'm going? Good report. Just -- we'll talk about it this afternoon, but grid security is more than cyber security, so let's talk about it this afternoon.

MS. HOFFMAN: I agree with that.

MS. REDER: Pat, it's good to see that the consumer piece was emphasized in here. Sometimes I think that we really haven't put enough emphasis on that relative to the success of Smart Grid. And you know, we've seen backlash in many parts if the consumers weren't involved early enough. And I'm just wondering if there was discussion on where the ownership falls for that education.

MS. HOFFMAN: Good question.

And I think the ownership at this stage in the game is really the utilities. And I would say the states and any sort of associations with respect to how do we provide tools that can be shared as well as technology -- I mean information to consumers.

Now, with respect to DOE's role, what we're looking at is how do we do the analytical studies in the framework to actually document, and validate, and verify benefits, which goes back to what the consumers need for confidence as we look at it. As we look at how do we improve outage management, some of the documentation that, hopefully, we'll be able to collect through the grants will show how we've reduced the outage -- number of outages or improved the frequency -- improved the restoration time, excuse me -- the other -- the other metric on that. Okay.

Bob.

MR. CURRY: With apologies to Wanda, and because I represent the New York City portion of New York state, I have all sorts of enthusiasm for the transmission and non-distribution end of this important factor but no enthusiasm at all for socializing the cost across New York state of dealing with people's houses when a lot of my constituency lives in apartment buildings. Just a statement.

(Laughter.)

MR. CAVANAGH: Pat, there was -- DOE had four and a half billion dollars to invest in Smart Grid, and there was tremendous interest in how that was allocated. And, yeah, I think there was impressive geographic diversity in the end. But it's a small fraction, obviously, of what's needed. I think we're talking about an order or magnitude more than that per year to do what most of us around this table want to see done.

Can -- and I think there's some false sense that maybe there is more federal money lurking around the corner. Could we be clear? My sense is there isn't and we need to -- everybody to be very clear about this. That four and a half billion has been invested, hopefully, to give everybody a boost and push the thing forward, but it's not going to happen again, that the investment responsibility now lies with the utilities and their regulators.

With that in mind, what's the most important federal role going forward as you see it? Not as an -- since the investment role is behind us, what's the ongoing function going to be -- the most important one?

MS. HOFFMAN: I think the ongoing function actually will be how do we help prioritize future investments knowing that there is constraints on resources, multiple aspects of what we need to look at with respect to investing in our electric sector.

And when you talk about it, I mean, we are only doing a small fraction of what needs to be invested in the United States. But what's going to happen now is how do we start prioritizing some of those investments.

So as we move forward, we look at the value of what has been achieved with respect to how much demand response and how do we best engage demand response on the system.

The second thing is really how does --

for example, how does the rate design really achieve what the states hope to achieve.

The third example goes back to how outage management can be improved when you talk about SADI and safety measures. So it's really looking at some prioritization as well as the documentation of where the value is.

MR. CAVANAGH: Okay. And if I could just add one more for you to consider, the campaigns of opposition against Smart Grid investment tend to focus on either technical claims about the equipment not working or public health claims about the equipment being dangerous to people. You have as -- and I've been a broken record on this with Fred, and he'll forgive me, but you have access to independent experts. You can marshal them. You can mobilize them. You can make them readily available. And I think that's an important role, too, that if just independent expertise at a time when the utilities are incredible because they're the proponents after all. And there simply aren't that many other figures that people can turn to on these questions for credible information that folks will trust. I suspect there is a substantial DOE role there.

MS. HOFFMAN: There is a DOE role. I know with the health affect there has been numerous independent studies that have been put out and looked at.

MR. CAVANAGH: Right, but that somebody has to be willing to respond to the TV reporter's, the radio reporter's question who understands the issue and actually knows something about how to talk about it in ways that ordinary folks can understand. And that's -- the critical shortage is not -- no, there are reams of studies. EPRI's been putting them out for 40 years.

But if all you have is a utility person saying that there is no consequential and proven scientific technical connection between increased leukemia and these mysterious forces, and that's the way they talk, it's worse than useless.

(Laughter.)

MS. HOFFMAN: Okay. Point made.

(Discussion off microphone not transcribed.)

MR. CAVANAGH: I want to see this stuff go forward. I want to see us responding to this more forcefully --

MR. SMITHERMAN: Can I just respond to Ralph's comment?

MR. CAVANAGH: Yes.

MR. SMITHERMAN: You know, we did a test to meter accuracy in Texas because we got the same sort of pushback. And we tested 5,565 meters. We found two of them to be inaccurate. One was running fast; the other one slow. And we went to the root cause and found that there was an early version mechanical assembly issue.

That level of accuracy is wildly more accurate than the electromechanical meters. And we just kept saying it over. We gave the report to everybody -- reporters, legislators, community groups. I mean, you've got to say this 100 times before people will believe that it is actually more accurate, but after we released that report -- I know Dian's skeptical on this. I see --

MR. GREMLICH: I read the report.

(Laughter.)

I received -- we received zero complaints afterward that the meter was inaccurate.

MR. CAVANAGH: It helped enormously that you were willing to go out there hundreds of times because I heard some of them and keep saying it. And they're just -- let's get a clearinghouse of folks and -- so you don't have to do all of it.

MR. BUTLER: Okay. And let me just point out that Barry's state -- with Barry in his previous iteration did a good job of educating consumers in addition to that -- those meters and the testing of the meters, but you went out and you had those companies going out and demonstrating the value of Smart Grid. And that's the kind of case study that we should be focusing on.

And Ralph's right. We -- the subcommittee did talk about this issue of having -- and recommended that the Department take a larger role in providing the alternative rational, science-based facts out there because if it's a question of listening to any of us around the table or watching Fox News, you know what the majority of this country's going to be doing -- not listening to us. They're going to be watching --

MR. CAVANAGH: Yeah, but Barry can get on Fox News.

MR. BUTLER: Well, see, that's the way we solve the problem.

And I guess we're going to have our turn --

(Discussion off microphone not transcribed.)

MS. HOFFMAN: Rich?

MR. VAGUE: Just a modest comment. I know this is not a big part of what you're talking about, but relative to any consumer research you do, you know, we've been marketing to consumers for 30 years. And what consumers tell you they're going to do in a research project and what they actually do are almost never the same. And the overlap is almost nonexistent. And if you -- if you believe consumers in a research project, they all work out three times a week and they all balance their checkbook every month, and they all intend to do all these things. And what they end up actually doing is very, very different. And, in fact, you know, our view of consumer marketing is that the biggest enemy -- the biggest challenge is inertia. And the real fact is that consumers aren't interested in any of this.

And so, assuming they're going to be interested and willing to listen to education and willing to engage with the product is, I think, kind of a fundamental mistake. You need to make it effortless.

MS. HOFFMAN: So my comment on that is I can tell you one thing with certainty is I know what my son does do, which is doesn't turn the lights off, leaves everything on. And I guess as we start looking at consumers, it's really the educational process of making sure that we educate all the generations so we actually can get, I think, more conscious decision making.

MS. GRUENEICH: I think this is very good. And, Barry, I like the meters, and I've read your report, and you did a good job.

It seems to me -- getting back to what Ralph said -- that the DOE's role as the major investor is in my mind, unfortunately not going to be repeated again at least in the near future. And so two areas come to mind. One is with the budget that will be available going forward, out of all of the projects and programs going on, using the feedback and information from that highlight, where are the key areas of R and D needed that -- to have, you know, a real understanding what have we learned and how's that going to guide the R and D in this area, I think is critical.

The second part is as these programs that are funded partially through the Stimulus are now rolled out, to the extent that more work is done, it's going to be coming from -- for the majority, either state commissions who authorize utilities to recover the money or the private sector seeing that there is a business model there.

And so I think the more that there can be information provided publicly and communicated about, you know, what types of either technologies, or programs, or approaches really are providing benefits. And there are different levels of benefits. That's just going to be a huge need even though DOE, itself, may not be making those investment, you're able to really assemble that information in a credible manner, I think, and do a good job of distributing it.

MR. GRAMLICH: I also wanted to comment on Ralph's idea of what is DOE's best role going forward on this. If the money is spent, it doesn't seem like prioritizing future investments, you know, again, if the federal dollars have dried up, is necessarily the only or best way to go.

So I want to reiterate my earlier point that it's not just technology and buying new technology. The operational practices vary dramatically across the country. And, you know, we've heard from ERCOT folks and CalISO folks and PJM folks. Well, outside of those areas we operate a very rudimentary grid, and there's a little disconnect between this discussion and the earlier one. I'd be curious from Larry and Mike -- I mean, I would assume their study points to things like large balancing areas, frequent scheduling and dispatch, i.e. five minutes or less, when the reality is we're so far from that in much of this county that -- let's talk about deployment and getting things done that we already know how to do.

MS. HOFFMAN: I actually don't disagree with that statement. And I think it is a -- I'll say an evolution that we're going through. And I think you're leading the charge her that ultimately where we will get to is some of those operational practices of what is an optimal size, what is the balance as we look at the future structure of the grid for how we want to operate the grid. And but there are some unknowns in that equation but at least this was a starting building block. As we go forward with any sort of operational decisions, we need more information. We need to understand -- and I think we're building some of those building block pieces to ultimately get there.

Whether we're all talking with that as the end goal in mind, we'll work on that. But in my mind these are just one piece that's going to be built upon another piece to get us to that point. So --

MR. SLOAN: Thank you. Looking at what the Department does and -- does well and may -- may be able to help with in the future.

Going back to the earlier comments one made about we need someone who can talk about health issues. It seems to me that the

Department in conjunction with the CDC or regional health centers can identify core people who are qualified to stand up in front of the media and are willing to do that and talk with them, both from a scientific and medical perspective as well as in the common language that the box viewer can understand.

You and I talked earlier, Pat. I still think that policy makers need to have a better understanding of technology. You referenced the White House and, you know, not necessarily thinking of synchrophasors and Star Wars anymore. And as in the same breath, although Dilithium crystals are still the answer to our, you know, our energy supply issue, you know, and as soon as, you know, Barry finds it in Texas because Texas has everything, but, you know, having commissioners, having the legislators and governors able to ask utilities have you looked at using this, or have you studied this option, as opposed to just reacting to what's showing up, it's sort of a continuation of the status quo, I think is good.

DOE has a number of labs and other committees. The GridWise Architecture Council and others that are doing interesting work both from a scientific as well as from a -- I (unintelligible) say an interoperability process standpoint. Somehow incorporating them more into the public education -- policy makers especially -- I think would be helpful.

Education? I mean, I'm reminded that, you know, I'm one of the few people here who has to stand for election. Although Barry has now joined me, and I think that's a mistake.

But the thing that I struggle with and he'll struggle with are the same thing that the Ford automobile manufacturer or the heating and air conditioning guy or gal in your town does. When will people be paying attention? What message venue will they hear or see? And then what words or visuals will resonate with them?

And so, we can put out all kinds of information, but if my car's not wearing out, or my air conditioner hasn't broken down, I don't hear it. And so it's the repetitiveness as, you know, Barry found out in terms of Texas, but it's also targeting the audience.

Why have the anti-smoking and seatbelt use ads or campaigns been so effective? I'll argue that it's because we got to the kids, and the kid goes home and nags Mom and Dad to put the seatbelt on or, you know, why are you smoking here. You're going to kill me. Then I backhand the kid, and, you know, we go on. So, to me, the education needs to be at the policy maker level and at the kids' level and -- because we have early adopters in any technology. I mean, there are folks who were just waiting to have their house wired so they can, you know, see how their refrigerator is talking to their hot water heater.

(Laughter.)

MR. SLOAN: That scares me. I'm going to have cold showers and warm beer, you know.

(Laughter.)

MR. SLOAN: But somehow I think -- I'm memorable, if not, you know, anything else.

But the Department, I think, as I said, has a role in terms of helping to coordinate with the CDC and other organizations that may be able to respond to the health issues to address a better understanding of technology, particularly on the T and D side and generation side. Because I'm convinced that if the consumer who gets a smart meter and has dumb appliances and such isn't going to get any benefit. They're not going to see any value. Whereas we can demonstrate the value on the other parts of the system and use that with the policy makers and with the public in general.

MS. HOFFMAN: Okay. Thank you. For sake of time, just make sure if you could keep your comments short, and then I'd like to turn to Fred because -- and Barry because they're supposed to have their feedback.

MR. LAWSON: This will be very brief.

I'm glad to hear some of the discussion

focused on consumers. I think in these discussions if we're not able to show consumers the ability to really save on their electric bill, they're not going to be interested. I think we heard some interesting information about research and what really happens, but, you know, without a clear demonstration -- simple, clear information about how they can save money on their electric bill, this -- you know, we're not going to get very far. And if DOE could maybe focus on that some in addition to all the other things, of course, but some focus on that individual consumer savings, I think would be helpful.

MR. MASIELLO: Yeah, to amplify what Tom and Barry said, I've been to several let's call them private conferences organized by people like GE or PJM where some of the participants have been household name consumer product companies. And they have given a very consistent message. Your Smart Grid brand is damaged. And the industry isn't -- and this group -- we're not reacting to that, but you know, they're saying we're telling you as consumer marketing people -- the consumer now has a negative perception about Smart Grid. And they echo what Barry said. You've got to show the consumer why it's good for them.

And Duke has done a very proactive thing -- along Tom's line. They go to the schools with a little Disney -- Disneyland in a box. Here's a village, dollhouses and stuff, and demonstrate the Smart Grid benefits to the kids and then give the kids stuff to take home. You know, and they've had somewhat more reasonably successful program to date.

But that one phrase, your brand is damaged, is something we ought to be thinking hard about.

MR. BUTLER: My reaction to the report is that it was a good overview and it took a deep dive in a couple of places, and that it really needs to be promulgated. I mean, this is the kind of report that ought to be available at

NARUC for the commissioners to have, certainly at the Smart Response Collaborative that meets at every NARUC meeting.

I was delighted to see this discussion about consumer -- care focusing on the consumers because I think that is the keystone here. It -- everything devolves from that if you don't have consumers' buy-in because the brand is damaged. And Ralph is absolutely right. And the person that came up with that phrase is absolutely right.

It's damaged -- not in Texas, but it's damaged in Bakersfield, but Bakersfield is what gets on Fox News, and it's what everyone sees. And when they hear Smart Grid now, they think is this going to give me brain cancer or is it going to, you know, cause the end of civilization as we know it. And they don't understand the benefits. And if they don't understand the benefits, then they're not going to say, gee, this sounds interesting. I know -- have a cousin somewhere that has this for his or her home and I want to know when we're going to have it here because that's where we need to get back to. That's what the goal was originally. And so that whole focus on consumer has to be really beefed up.

The Smart Grid Subcommittee of this group was not intimately involved in the report. And Pat and I have talked about this. And I think going forward, hopefully, there would be some more involvement especially with the regional stakeholder meetings or some attempt to bring together a lot of the studies that have been done elsewhere on this. And then through the EIA gathering of data, this is one of the things the Smart Grid Subcommittee has talked about and how to gather better data on what's going on out there in the various states. And I'll talk more about that in the Smart Grid Subcommittee Report.

MR. SMITHERMAN: I would just add to this. We never talk enough about the reliability aspects associated with Smart meters. And, you know, maybe it depends on where you live, but in my state it's not a question of if we're going to have another hurricane or another ice storm, it's when. And when you're without power for two and a half or three weeks because of a hurricane, and then I say to you afterward, that the utility company really does not know which individual home or business has power. They drive through the neighborhood with their truck looking to see if your lights are on. But with a Smart meter, I can solve that because the utility will know exactly which premises has power or not. That begins to resonate a little bit for people who have experienced that.

But I do agree with what's been said by Fred and others. It's all about empowering the consumer. And a line I like to use when I'm giving my talks is, you know, wouldn't you, the consumer, like to know the true information of your consumption more than once a month because you know the utilities lie to you.

(Laughter.)

MR. CURRY: I've got to take issue with that. Not because I'm backing utilities, but

I've forced ConEd to do a responsible bunch of market research using very high-qualified people who were bound in New York City because of the advertising business. And the only thing that ConEd consumers feel strongly about when they open the bill is they trust the amount in there. They throw all the inserts away and they look at what happened last year. That's the only thing that they trust. And I can say that because I forced them to do it, and they forced me to sit through 15 hours of consumer research stuff.

MR. SMITHERMAN: Well, generally, the response that we get in the summer is, there's no way my bill can be that high.

And so when you have power customers they have to be able to act upon the information. SO they have to be able to either switch away to another provider because they don't like the service they're getting from that provider. And I understand in many parts of the country you can't do that. Or I have to be able to choose an option such as a pre-pay option where I don't have to put a deposit up anymore. I just get billed on my consumption, and the price point is coming down on that to be almost at parity with the old bill and collect method.

Or something creative like the Baltimore rebate program where they established a baseline for your consumption, and they sent you a rebate check if you used less than that. And people seemed to indicate they like rebates more than they like saving money. Right?

My argument was that was who was the first to get to the mailbox. Was it the husband or the wife? I'm not sure.

(Laughter.)

MR. SMITHERMAN: But nevertheless, there was a creativity element to that that I think that we need to be sensitive to.

And then as you get further into those people that are early adopters, the whole concept of provisioning and empowering plug-in vehicles, that doesn't happen without a Smart meter. You have to be able to -- and Roger knows this. You have to be able to know the consumption patterns and ideally be able to pay less at night when I'm at home plugged in with my Volt than my tendency to plug in in the middle of the afternoon, which would be a very bad time for me to do it. So it is about empowering consumers so that they can have a choice, not just more information but a choice.

MR. COWART: This is a great conversation, and I think we're tempted to continue it, but Fred's got a short report, and then we'll break for lunch.

MR. BUTLER: Yeah, just as a segue into that, there is a whole body of knowledge and work out there called behavioral economics that gets to why people make choices and why they do some of the things that they do. And there are numbers of companies out there that are actually giving people more information about their energy bill and showing just because they get those energy reports that usage goes down two to four percent, which is pretty fantastic when you aggregate it across thousands and millions of users -- of customers.

The Smart Grid Subcommittee has been working on a number of deliverables. We've actually delivered one. And that is the review and update of recommendations from the 2008 EAC Smart Grid Report in which we found that most of the things in that have been accomplished and that one of them was an ongoing thing that the DOE has been working on.

Secondly -- and this is what I referred to earlier -- we're working on a review and commentary on what states are doing, and we're actively gathering data. I've gotten a commitment from NARUC to do a survey of states to see what is going on out there exactly with each of the regulated utilities. That doesn't get us to the co-ops and, and I think maybe we should talk about how we can do that through NRECA and maybe get some more data on what's being done.

I have a suspicion that the co-ops may be a little farther along and a little smarter on this -- because they're user owned -- than the investor-owned utilities.

And then thirdly, we are working on a white paper on vehicle charging, electric vehicles and the impact on the grid, electric vehicles and the benefits that can accrue and the roadblocks that might exist so that we can think about how to minimize those roadblocks.

There is an outline of that that's been circulated through the Subcommittee that is on the share site, the EAC Share cite. And I encourage you to take a look at that and give us some -- any comments. We're going to be working on providing a report to this Committee for the next meeting in the fall.

We know that there are other reports out there on electric vehicles. We are going to try not to duplicate and make references to and have links to these other reports, and we've been in contact with the Pew Center which is doing its own report and that we're -- hopefully, we'll do some coordination with them.

And that, Mr. Chairman, absent any questions from the group, is the Smart Grid Subcommittee Report.

MR. COWART: Are there questions on that one?

(No response.)

MR. COWART: Pat, do you think you've gotten from this conversation the results you wanted from feedback?

MS. HOFFMAN: Yes, I think we -- yes, I think we've still got more work to do. I think at least there is some initial thoughts on moving forward on, especially, the data and the benefits and making sure we continue to stay focused on that. As well as I think there's an interesting platform that's developing on vehicle charging and the use of electric vehicles and how the system should look at that. So I think we'll move forward on those.

MR. COWART: Maybe I'll close this session just by asking a question of the Department.

As you analyze the results of all of the pilots that are being looked at, it seemed to me that one of the thing I heard repeatedly here is that the public isn't really interested in the Smart Grid, which makes sense to me. You know, we're not -- I'll hold up my iPhone like everybody does. You know, I'm not interested in the iPhone just because it's smart and cool. I use it because it has applications that I value. It's all about the apps. It's not about the phone.

So it seems to me that if we're going to analyze the success of the Smart Grid pilots, one of the -- one of our objectives ought to be to peer into them and see which ones were sold on the basis of which applications, and did they achieve penetration because those applications are of value by consumers or not.

And, you know, in a long-range perspective it seems that the Smart charging of vehicles will, over time, become a hugely important application. And the presentations this morning sort of, you know, head us in that direction.

If we're electrifying vehicles and we're electrifying buildings, heating as well as cooling, then there's a direct connection to Smart meters and intelligence on the grid.

In the meantime, what are the applications that will drive penetration and drive consumer desire to have something called a Smart meter or something called a Smart Grid in their -- on their system?

So, I guess, Mike, that's in the form of a recommendation and a question actually is -- is -- are the analyses being done of the 90 or so pilots focusing on that as well as on the other dimensions we've discussed.

MS. HOFFMAN: Okay. So the answer -- the answer is yes. And I guess sometimes I struggle because when I look at how I'm defining value is with respect to the consumers is when you talk about outage management, it's what is the duration and how often do consumers see outages.

How fast is the restoration time? So is the near term value, which Barry already talked about, was utilities can preposition as the tornado has gone through, they can call the truck rolls and tell them exactly where to go set up. They can really tailor restoration times. And there has been benefits that have been demonstrated.

Now how well are consumers educated with respect to the impact of those benefits means we have to educate consumers on the basics of the electric system and some of the things that evolve around there. So you look at those values. I think we will continue to show the values, but it's going to be -- the difficulty is do consumers really understand what we're talking about.

I mean, I go back to peak load reduction as we look at when there is a, you know, call for a demand response -- for emergency demand response versus an economic demand response. How well do consumers understand and how well do they understand where the Smart Grid kind of components played into that. I think we need to do a better job, but there are some definite values.

And when I go back to kind of the topic of how we're going to look at with respect to -- I use the term prioritization, but it's really emphasizing where the newer term value added components are.

MR. DUNCAN: Well, a couple of comments. I think one of the problems with damage to the Smart Grid is the definition of Smart Grid is just all over the place. And when you say Smart Grid to an average consumer, they think of numerous different things, mostly the Smart meter.

You talk about Smart Grid in the industry -- I'm evaluating plans of the, you know, utility Smart Grid filings in California. Smart Grid includes everything from the solar on the roof to the electric vehicle in the garage to the battery storage there to the Smart Grid to the home energy display, et cetera. And then we make these claims about, well, Smart Grid will reduce emissions. And Smart Grid will reduce energy consumption. And Smart Grid will do this and that. And the reality is because our definition is so broad, those statements are not correct except for components of it.

I love my Chevy Volt. I've driven 3,000 miles now and used four gallons of gas. It's wonderful. I do not reduce my electricity consumption when I plug it in.

(Laughter.)

MR. DUNCAN: And so forth.

And my second point is that as I look at it more -- and I'm in charge of the Pecan Street Project in Austin, one of the Smart Grid demonstration projects. And we're getting enormous amount of data back on consumer behavior and such. And I think we're also making a mistake when we talk so much about consumer education and the consumer doing this and that. And I've seen the studies, and I know that if you give them the information they'll reduce consumption by two to four or up to 10 percent and so forth. And I question the sustainability of that over time. You know, I want to see the studies after they've had the device for a year. And I think what is -- if I were to prioritize more in terms of the consumer feedback, it's offering them automated capabilities.

And at the last Smart Grid conference I attended there was a whole track on automated demand response and open ADR. And I think this is what we need to do is finding ways to give third parties machine readable access to data so they can offer products that a consumer can buy and program and forget because all of our language is if we provide information to the consumer, they will do such and such. And I don't think that's right, you know. If you provide a product that will do such and such for the consumer and they can see value in it, they will buy it.

So those were a couple points that I --

MR. KRAPELS: Roger is absolutely right,

and I think, Rich, in your terminology the apps of the Smart Grid -- the one that seems so obvious to me, some of us in Massachusetts and the VC arena are working on this, but it's home optimization. It's the optimization of the electric functions of your house and the integration of all of the functions that would make an easy number of choices on the part of the consumer, here's what I would like to accomplish, punch it in, forget about it for a couple of months, and then maybe you reset it once in a while.

And if folks like Johnson Controls and Siemens Buildings need to get down to the home level -- I was very disappointed to see that the Google folks and the Microsoft appear to be pulling out of this arena, but to me, that's the Holy Grail. And people are doing it, and maybe we should try to get informed by them in the -- in the Subcommittee.

MS. HOFFMAN: Okay. Last comment.

MR. HEYECK: In addition to my American

Electric Power role, I am an elected official, Mr. Sloan.

(Laughter.)

MR. HEYECK: We have a City of Westerville, Ohio. It is -- we have 16,000 meters. And I believe we're the only ones that turned down a DOE grant for Smart Grid implementation. And if anyone wants to understand why that is, we could do it over lunch, but it is for some of the -- a lot of the reasons we heard today on the anti Smart Grid to Roger's comment.

MR. COWART: Well, with that intriguing invitation, I think we should break for lunch. And in order to stay on time, we'll be back here at 1:00 o'clock.

UNIDENTIFIED SPEAKER: Are you the Mayor?

MR. COWART: Excuse me. 1:15 is the scheduled time.

(Brief recess.)

AFTERNOON SESSION

MR. COWART: All right. Thank you very much. As I was just saying, we have a terrific panel lined up here. An Energy Storage Technology and Policy and I think we just want to jump right to it. Ralph, do you want to lead off?

MR. MASIELO: Thank you, Richard.

We're privileged to have a very distinguished panel speaking to us this afternoon on policy and financial issues around storage for the grid. Our three panelists are The Honorable Cheryl LaFleur, Commissioner of the Federal Energy Regulatory Commission; Terry Boston, the CEO of the PJM Interconnection; and Dr. Ake Almgren, CEO of International Battery Corporation.

And I think rather than provide lengthy introductions, let's get right to it and let the panel start. They'll each speak for a few minutes on issues they see and thoughts on policies towards storage. And then we'll have a free discussion with the group.

So, Commissioner, could I ask you to lead off?

MS. LaFLEUR: Of course. Thanks very much, Ralph.

Well, I'm very happy to be here. What a distinguished group. A lot of old friends and some new friends. I have -- I'm subbing here today for my buddy, Phil Moeller but was very happy for the opportunity. I have been at FERC a year, literally, this week. So now that I've passed the one-year test, I get to talk about storage because that's one of the more complicated issues we deal with.

I wanted to introduce my Technical Advisor, Kurt Longo, who's sitting behind me. Speaking of technical and complicated, very happy to have him.

Just by way of introduction, it's almost a cliché to say that storage is a game changer. That's in -- I've even said that in speeches. But like most clichés, they're clichés because they're true. Electric energy storage, as this group all knows, is a very versatile technology with a lot of unrealized potential to help customers as an ancillary service, with frequency regulation, reserves, voltage support, as -- in essence, as generation to be used for peak saving much as we thought of pump storage for decades.

And, of course, I read in the press that pump storage is seeing a resurgence. We're seeing a few more cases at the Commission. A lot of the pump storage, of course, going in at the time of the nuclear construction. And now storage is being mentioned often as a complement and value enhancer to newer generation technologies, particularly intermittent renewable technologies as well as demand side resources.

Thinking about electric storage I think it's useful to think a little bit about gas storage. It's almost impossible to imagine what gas prices would be like if we just had real-time gas for everything and didn't have the capacity to store. And if you -- although it's not a perfect analogy, it you imagine electricity storage getting to be anything on the scale of what gas storage would be, the difference it could make in prices and availability for customers is quite profound.

At FERC a lot of what we do is trying to help make our various markets that are run by good folks like Terry and his peers as well as the bilateral markets around the country fare for different technologies to remove barriers to make sure things can fairly compete.

And there's been two things in my tenure that we've touched on storage that Ralph asked me to comment on. First, in February we put out a Notice of Proposed Rule Making that would change the compensation for electric energy storage. And it -- we had proposed to do so in two ways. First, to require a payment for opportunity costs for units that were standing ready to provide storage. So they would be paid for the fact that they were holding themselves in abeyance to come in and provide storage.

And, secondly, a market-based performance payment for the storage when it was provided that would measure the megawatts up and down, sometimes called the mileage payment -- measure the -- how many times and on how closely storage actually matched the signal that came from the grid operator to reward for accuracy and to really properly, fairly compensate the fast ramping storage that was getting kind of lost in the wash of the more simpler compensation methods.

These are resource neutral proposals, but really would considerably affect the participation of fast ramping storage like batteries and flywheels.

We received -- I just did this in preparation for today -- 52 sets of comments in response to that notice. So, not so niche if 52 different groups come in. Most of them are supportive of our proposals, some extremely supportive. And we're considering next steps. And obviously the next step would be to try to bring it to a final rule.

A little further down the path -- and just last month -- we issued a Notice of Inquiry on another aspect of a compensation that relates to storage. This one relates to ancillary services are bought and sold and traded in -- not in organized markets like PJM but in the bilateral parts of the country.

We're hearing from a lot of folks, especially in the west, that they're having trouble participating in ancillary services because of all the restrictions FERC had put in place, like having to do a market power test before you could make those -- participate in those transactions.

So we put out a request asking should we change those restrictions. Are there better ways to protect customers so that we could have a more robust ancillary services marketplace across the country where it's very badly needed?

And also asking or comment -- a little bit geeky -- but on how you count storage in our accounting and financial reports. You know, is it a vegetable, or an animal, or a mineral. Is it its own category? How should we do this in order to have regulators at the state and federal level begin to grapple with how storage should be paid for. We need to first grapple with some of these baseline questions, and we are taking comments on that. And those are due August 22nd. So we don't know what we'll get yet, but again, looking for folks like the organizations you-all represent to share your thoughts.

And with that, I will turn it over to the man I found out on the prep call knows more about storage than me.

MR. ALMGREN: Ake.

MS. LaFLEUR: Ake. And Harry. Either would fit that description.

MR. ALMGREN: Okay. So I'm Ake Almgren. I have a (unintelligible) in transmission distribution, distributed generation, and also some in energy storage.

Sometimes I think we don't see the forest for the trees. And I think coming back to some basics -- I think we always benefit in some cases to take a step back and remember that whatever we do we have four criterias we need to meet: It has to be safe. It has to be reliable. It has to be clean and affordable.

Now I remember seeing more challenges and we saw (unintelligible) discussions in the morning or heard about it, but there is no question we will have more intermittent renewable energy on the grid.

Basically there are two things we will have to manage that in a safe, reliable, clean, and affordable way. One is transmission and the other is storage.

I think there is a portfolio of storage, and we won't -- I won't dive deeply into the different types; but I think in discussing policy and financials related to that one has to look at the different technologies and where they apply. I mean, at the site of generation, the substation, or distributed. Or if it's -- one distinction which tends to be quickly forgotten, what do we really mean with storage. Do we mean energy or do we mean power? It continues to strike me that so many double Es still have -- struggle to make the distinction. So it's -- if it's power, there's some things (unintelligible) which are very good power sources. If it's energy, there are others which are more suitable.

I'm more (unintelligible) from where I'm coming. There's a lot of interest right now in lithium as one of the technologies. It has a lot of merits. There's an interesting -- some may call it a convergence but it's -- we would never have the Smart phones or the laptops if we didn't have the progress in lithium. And that's also expected (unintelligible) to the automotive as well as the stationary aspects.

It's not literally you take a lot of laptops and build a car of it or you take a lot of cars and make a big energy storage -- a little bit more sophisticated than that. And I think if you really (unintelligible) different lithium chemistries are more suitable than others for certain applications.

Another development is the form of the lithium, whether you have it in the flashlight type of cells or whether you do larger building blocks. And, personally, I'm biased in that respect that when we really talk energy, I think we need large building blocks to get the economy of scale. And that's clearly an economy of scale.

Finally, as an illustration, we are involved in a project together with S and C for AP community energy storage. I think is one of the more intriguing pilot projects today. There will be a lot of learning. It's a demanding application. And, again, the attitude here is to do it and remember that this is part of the grid. It has to be safe, reliable, clean, and affordable.

And that finished my comments.

MR. BOSTON: As they load my slides, I'll say I know Peggy quite well. When she asked me to speak, she said she wanted me to follow the four B's, be thoughtful, be bold, be brief, and be gone. So, it -- I will be bold in terms of the policy recommendations, and I want to say I'm a little nervous because Pat says there is no silver bullet, and I titled my slides today, The Silver Bullet: Storage. If we had low-cost energy storage, it would change my world in terms of how we dispatch a power system. And if the slides don't work, I'll talk faster. So -- oh, good.

The point I wanted to make is if we look at the grid operator and what we control, if we could control -- plug in hybrid vehicles, water heaters, and the HVAC system, you're talking about three appliances that are 3 to 4 kw each. And you can optimize the system much better, and I might add, Pat, that high school kids see storage as the red bullet. This is an actual picture of a plug-in hybrid vehicle that high school kids in Philly built. Ake provided the battery, and we provided some funding to encourage the enthusiasm, but they see plug-in hybrid vehicles a little different than the University of Delaware and some of the projects that we've done with the kind of square box type vehicle. So -- the left button The other left button. The big left button. Okay.

A brief commercial message from my sponsor that paid for my ticket to come down here today. PJM is the largest grid operator in North America. We cover 13 states and Washington, D.C. North China grid passed us by in the world last year. They grew 22 percent year over year, in one year. They're forecasted growth is 18 percent. So we will never touch them again. We have about 180,000 megawatts of generation connected to the system. And if you think about a system that has 180,000 megawatts, 145,000 was the forecasted load yesterday. So that's the size of PJM.

We are the largest electricity market in the world, and we have a very broad, diverse payment system that allows storage to play in that market.

We currently have about 4,700 megawatts of wind attached to our system on a learning curve of about 40,000 megawatts under study. And there's 54,000 megawatts offshore that is not in our cue. So, bottom line, if you like wind, you have to love storage. I was so glad to see AWEA had signed an agreement with Brad's group on electric energy storage as late as last week, I think, Brad. So, we're making forward --

This is the actual wind generation on the PJM system as of last year. That's the 8,760 hours in the year. Anybody see a problem and why we need storage?

(Laughter.)

MR. BOSTON: That's one of the whys. Here is another why. If you think about solar -- and, Fred Butler, this is not the sunshine state. Where did Fred go? It's not New Jersey. This is out in Arizona. You think about a nice smooth curve like the middle top curve on the output. On a partly sunny day solar actually has higher ramp rates and faster changes for the grid than the wind. So you're talking about on a partly cloudy day within a matter of seconds, you go from 100 percent output to 10 percent output of the solar. So, there's number two why reason.

And this happens to be the residential load in my hometown, Chattanooga, Tennessee. Anybody see a problem there and why we might need storage? I have missed this. I've worked in this industry a long time. When normally we aggregate the commercial, the industrial, and the balance that you have with residential as such, you don't see a four to one differential peak to off peak. But that's residential load shape. So that's the third reason why we need storage.

I'm going to talk a little bit about what we're doing at PJM on the innovation side trying to get storage into the marketplace. And first of all, I wrote my graduate thesis on the optimization of Raccoon Mountain Pump Storage Plant. It was a 1,700 megawatt plant. Thirty years later I did a market-to-market analysis.

That plant cost 340 million to build. It was worth 1.6 billion going forward after it had paid for itself six times over. There are 5,500 megawatts of pump storage attached to the PJM system. They were attached to integrate the nuclear. To allow the nuclear to run at off peak we installed about 25 percent pump storage for the amount of nuclear we had on the system.

Compressed air energy storage -- if you're dealing with what Ake's talking about, not power but energy, you want to store large quantities of energy. We have a site in Ohio near Akron that I'll talk a little more about that's potentially 2,700 megawatts. And so you're talking about long-term storage. And with the availability of the Marcellus shale gas, I am very optimistic that compressed air energy storage will go beyond the McIntosh, Alabama, plant, Brad, and is something that we can look forward to very large scale.

Flywheels -- Bill Capp has a 20 megawatt flywheel, Scranton, Pennsylvania that's going to hook to our system.

We have tested a battery, EES. This is a lithium-titanate battery on our system -- one megawatt. It did 250,000 frequency response, not deep cycles like you would with the plug-in hybrid vehicles with only a two percent loss of life.

There's a 34 megawatt facility going on Laurel Mountain in West Virginia. Today it will be energized. So we're making progress on the lithium batteries.

That's my Volt. I know we talked about the Volt earlier with the D.C. Public Service Commission standing with me. It was taken a few weeks ago up by that -- if you see the snow in Philly. But the point is one million vehicles is not a lot, but if you had the kind of vehicles and the incentives in place, it would make our jobs much easier in terms of how to handle the regulation for the renewables.

It's going to happen. It's going to happen too slow to go with that wind curve that I showed you early on. So we need to think about fleet vehicles. And I'll talk a little bit about this.

My favorite of all is water heaters. We have -- that's a picture of a 105 gallon water heater in our lobby. Literally 26 kilowatt hours of storage, 60 percent more storage than the Chevy Volt sitting in the parking lot. If we took all the water heaters -- and NRECA has been the leader, Barry, in this. But we do have a problem, a policy problem, in that the over-sized tanks are now against the Federal Energy Efficiency rules. I'll talk about recommendations for Pat in just a second.

This device -- we allow the temperature to go up to 180 degrees, a bi-metallic valve, failsafe. A bi-metallic valve. I use that term being a -- having a nuclear background, I use that very cautiously, but -- and allow the temperature to rise in the tank, in a 105-gallon storage.

And this is a actual frequency response

of that device on our system. The red curve is what the control system regulation asked it to do. The blue curve is what it did. The point is 50 milliseconds after we asked it to do something it does it. And you don't get better than -- faster than that. And the pay-for performance is coming out way with the FERC regulations. So very good device.

If we took the 53 million connected water heaters, converted them to storage as France has done because of their nuclear fleet, 70 percent of the water heating is done at night in France. So if we had a Smart Grid to do the controls and the water heaters, most of our problems on regulation go away. That would be about 30 gigawatts of potential storage -- more than the 24 gigawatts of pump storage we already have connected to the system.

Compressed air energy storage -- this is a first energy project -- and I am coming back to meet with Chairman Wellinghoff next Thursday a week -- a week from this coming Thursday about this project. It is a large cavern that was a underground limestone mine at 130 megawatts it would have 1,000 hours of storage. So it could be a seasonal -- it could start out as a seasonal storage. You could add capacity and get up to 2,700 megawatts. This is probably in the $1,500 per kw or less, so it may be the most economic energy storage that we have available to us in the system.

A thousand Volts I believe, David, that would be one kV; is that right? We are doing a study with General Motors on controlling 1,000 GM Volts on our system under load frequency control doing both optimization of the charge on locational marginal pricing and a charge. We have published on our website what would happen if there were one million plug-in hybrid vehicles in the Washington-Baltimore area. Obviously there are some transformer pole tops that have to be changed out, but there's no major problem G and T-wise -- generation and transmission -- if you optimize when those vehicles charge.

Fleet vehicles -- this is a quote, and I stole it from Ake, un-lease us and tether us from fuel, General Petraeus in Afghanistan. If you think about the electrification of our fleet vehicles and -- what does gasoline cost on the battlefield? It's between $50 and $400 per gallon. A good average is probably in the $300 per gallon range. So you have some flexibility in terms of the pricing to get electrification of the medium duty vehicles.

Ake has actually done a fast attack vehicle as well. So, very quiet going in, tremendous acceleration.

DOD has money. That's a real good thing. So being able to work with some of the military bases to do a fleet conversion here is something that PJM is working on. There's 194,000 non-attack vehicles that might be in a program.

Okay. Quiz. What am I? 480,000 vehicles in the U.S., 66 miles per day they drive. They get 7 miles to the gallon. Park 12 hours, same location.

UNIDENTIFIED SPEAKER: School bus.

MR. BOSTON: Available for full-time work. 90 gigawatts. If we converted the fleet to -- the school but fleet to -- and this one was taken here in Washington, D.C., I believe -- a picture. But there is 90 gigawatts of potential. The counties do not have money. We -- so that's a problem going forward.

Okay. The how -- and be brief. I'll focus on that now.

Policy issues -- we need a water heater standard for storage water heaters. The --

MR. VAGUE: What would the payback be for those buses -- how many years?

MR. BOSTON: The payback on the batteries without the transportation part has been -- in our market has been three to four years. So it's not a -- it's very do-able.

On the water heaters, let me talk about that. The efficiency standard the Secretary signed eliminated our ability to do over-sized water heaters. I went to Home Depot in preparation for this meeting. And it's about $1,800 for a heat pump water heater. It does have more efficient -- the question is: Which is more important? The efficiency of the device or the efficiency of the system, especially in Chicago. We have large negative prices where wind has to be feathered at night.

In Ontario where they have a feed-in tariff they had 1,000 hours of negative prices. So we need a water heater storage standard. The Secretary is the only one that can tackle that for us in working forward.

Cost allocation -- Cheryl talked -- storage looks like transmission. We moved it from generation to substations at EPRI. We need a way that we can lower the risk a little bit and have some cost recovery that is guaranteed and perhaps longer-term capacity markets than our one-year market three years out is a possibility, perhaps, a regulation market that has a price that are now for longer periods of time. We've got to work together.

Cheryl has already mentioned this pay-for performance. Speed matters as we showed in the battery and the water heater example. And I might add Rick is able to do a load frequency control with his pot lines, and we're doing that in a test mode at this time. So load -- when I started my career, I was writing optimization software for generators to follow the load. Now I’m writing optimization software for the load to follow the generators with the variable solar and wind that's added to the system.

Predictable cost recovery for storage -- longer-term markets, incentives for community energy storage. With a digital economy, just the cost of the power outages on the distribution system puts community energy storage as a very good tool, a UPS for the subdivision that can do load frequency control for the system as the renewables integrate.

Fred Butler and I were in a panel discussion or on a kind of group discussion on the integration of plug-in hybrid vehicles. We took a relatively complex subject in that panel and made it incomprehensible. It --

(Laughter.)

MR. BOSTON: I was amazed at -- as we were talking about each owner of the Volt had to pay for the transformer that had to be recharged -- replaced in the system.

It's pretty simple. If you look at it, we need some type of real-time pricing and some type of time-and-use pricing at the state level, Sonny. And we need to not make it so complicated that we can't integrate these cars as they come on the system. The cars are one of the best things that we can do for national security and for economics.

I got an e-mail for my Volt that said, your electricity cost was 4.3 cents per mile last month. So it's pretty neat to see that integrate. But we've got to simplify that so that we don't get it so complicated that we can't handle the distribution changes that have to be made.

Fleet conversion -- as I said, we need some loans or the paybacks are pretty good. Post Office we've worked with. They don't have money, clearly. You know what e-mail has done to the Post Office, so -- but DOD may be the first place that we can test that in a very large scale. The school buses is just a real opportunity.

And I challenge the group -- as we built pump storage to enable nuclear, we need to build storage to enable wind and solar. So, if we could have some kind of ratio storage required to go and integrate more renewables into our system, I think we will have a much more successful integration of those renewables.

And Mike and I went to both Spain to see how they were integrating 20, 22 percent energy, and we also went to Ireland. And they're running 50 percent at night in terms of wind energy. But that's seven policy issues that might hit us into an enabling of storage. Thank you. Ralph.

MR. MASIELLO: Great. Thanks very much for three very engaging discussions, culminating with the perfect conclusion in Terry's seven point.

Let's open it up for some general question and answer and discussion. Ed?

MR. KRAPELS: Those were wonderful presentations. Thank you.

And, Terry, the capacity payment is a cure for a lot of ills. It's also a difficult regulatory issue, Commissioner LaFleur, but when I look at the energy market, you notice that there's a bilateral market that can be long term. And there's a day-ahead market, and there's a real-time market. In the capacities sphere to help pay for some of this, why don't we have different time periods? The one year, three years out, Terry, you -- I can't build anything on that. I think you know that. Are there other opportunities for some major changes?

MR. BOSTON: I guess the simple answer is yes. The market rules that we have in place now were established as we're going forth. And of the issues that I have faced in the last three and a half years at PJM, the capacity market has been the toughest, but as Sonny can point to, we've had much more impact on demand side playing in the market since we had capacity markets. We have demand resources and energy efficiency both clearing that market. Storage would be another area that would clear that market if it has adequate energy to substain [sic] the capacity.

MS. LaFLEUR: I would certainly agree with Terry if your question is can the capacity markets be improved and made more -- differentiated for different types of resources, the answer has to be yes. I mean, just about all the capacity markets in the country have been in the shop for repairs most of the time I've been at FERC. So they're clearly in a state of evolution.

The capacity -- I mean, the last 20 years has a history of taking something we used to think about as a really simple thing, electricity, and kind of stretching it out to all its little components where we have, you know, 50-page cases about reactive power and all these little elements that we stretch out and sell separately.

And the foreign capacity markets are just pricing one increment. What do you get three years in the future if you bid now for that? Some resources have a longer lead time. Nobody's going to build a nuclear plant based on a forward capacity price. And some have a much shorter reaction time. So, whether it's in -- whether we call it capacity markets or not, there's different ways things can be traded as new types of technologies bring different things to market.

MR. MASIELO: Okay. Wanda, is that your sign that's up? Yeah.

MS. REDER: Yeah, I just wondered if you guys could comment on the planning piece. You know, storage really challenges the paradigms that we've grown up with and none of you have really talked about planning tools that really needed in order to facilitate the adoption.

MR. BOSTON: I can touch on it a little

bit. And Laurel Mountain will have a storage project, 34 megawatts of lithium-ion batteries going in, as I said, this week. And kind of in the planning process we had to put it there because of the cue process and the time that it took, but if storage can be located Center City like the community energy storage that Ake's working on, it would allow us to use the transmission at night where we're not heavily loaded to make the transfers and improve the planning.

So -- and I know in Texas AEP, I believe, Mike, had a project that ended up because of its benefits two transmission, it was put totally into the transmission tariff for cost recovery. So storage can -- just like politics is all local, storage is very local. And you can put it in Center City. We're looking at the Naval Base in Philadelphia as an ideal place to have storage because it would allow us to use the transmission and improve our utilization factor in the planning of transmission. So it's a very good point, Wanda.

MR. MASIELO: Any other responses to the planning question. Okay. Brad?

MR. ROBERTS: This is mainly for Terry, I think.

You mentioned the 5.4 gigawatts of storage of pumped hydro, I think, in your --

MR. BOSTON: It was 5.5.

MR. ROBERTS: Yeah, 5.5. And there's 22 gigawatts in the country. And that's stuff that's been around for a long time, fully integrated. And it seems to be fully integrated in the system.

And then we talk about these new projects, and it's like -- we're just like why do those seem -- how are those fully integrated today? What's different about those?

MR. BOSTON: The one thing on pump storage today -- and we actually had to write an environmental impact statement on Raccoon Mountain 34 years ago. Pump storage today takes as long to site almost as a nuclear plant.

You're talking eight years minimum, 10 to 12 -- and you don't get recovery so -- but they got integrated into the system driven by enabling the nuclears to run base load.

And now they're -- let me put it this way: Raccoon Mountain ran 38 percent in the generate direction. That means 85 percent of the time it was either digging or covering up. It was either pumping or generating. So the differentials were there.

Gas prices make it a little more complicated because you don't have as high of peak day price as you had, say, three years ago when the gas prices were $14. But the storage that was built is fully integrated in the markets. It's the best thing that's ever happened to a load coordinator and dispatcher in terms of emergencies, speed of response; but the capital cost of pump storage combined with -- the civil costs have gone up a lot since the '70's. But there are some western projects that are being permitted, but I don't see pump storage being a huge going forward in our market at least. Even though the Allegheny mountains have huge siting potential.

MR. ROBERTS: Well, that was not the issue I was trying to get at. It's storage being effective today in the system. And it seems like that effectiveness would have a more -- a better effect on wanting more storage, and it doesn't seem to be happening like that.

MR. ALMGREN: Yeah, it may be that the value proposition of the pump (unintelligible) is very, very clear, very distinct. It's in the wholesale system. It's energy storage. It acts basically as a generator.

Some of the new value propositions are more complex. I mean, they -- when you try to combine in one type of equipment back-up power (unintelligible) storage, (unintelligible) deferred, it gets, by definition, more complicated.

MR. ROBERTS: I agree. I just -- it just seems like we have two percent of our nation's capacity is in storage today and it's deemed to be very valuable. And trying to pull that number up seems to be a really difficult task that everybody's struggling with when we know it's going to be successful.

It's just a comment.

MR. MASIELLO: Okay. Tom?

MR. SLOAN: Thank you. And all three panelists, do you see your organizations or, you know, if you want to speak just for yourself -- do you think that storage should be considered as that fourth element -- you know, transmission, generation, and distribution -- or should it be part of the function it's serving for investment recovery, rate-making purposes, regulatory endeavors?

MS. LaFLEUR: Well, I'll start. I guess I'll answer on two levels, from a strictly regulatory -- and I'm only allowed to speak for myself, but how we have looked at it at FERC is primarily on a case-by-case basis.

So if somebody comes in and says, as Brad said, I'm building a pump storage that's going to really, like, store energy and discharge energy in the real time energy market, it's treated more like generation. And other people -- there have been a couple cases where people made a storage proposal wanted to be treated like transmission, and it got FERC approval to do so.

So thus far we've really been doing it on a case-by-case basis. We'll see what this new docket informs in terms of what we get.

But philosophically, I think to the best of our ability we try to design markets fairly to be resource neutral because you mentioned generation transmission. There's obviously distribution. There's also demand resources which some people say look like generation, but they can also be in the ancillary services market. And I think -- I would see storage -- it's not so much that I see storage unique as if the others are all well defined and storage is just an outlier, but I like to think all of them are -- have interchangeability in different ways.

And it really comes down to what Ake said, you know, what's cheapest, what's safest, what's more reliable, and try not to think in sort of the defining categories I mean as -- because I think these things are becoming more elastic and we're seeing -- the capacity market, I don't think most people when they were doing the early design -- and I was only involved in New England -- were really thinking, this is going to be all -- we're going to see so much demand response. It was much more about making sure we had generation there, but you get results that you don't necessarily anticipate because these things are substitute-able.

MR. BOSTON: Let me add a little bit.

I think a balance of the two may be where we're going. Cheryl had mentioned gas storage and what it does to prevent on a cold winter day having extremely surcharge pricing in the market. It may be a balance between in the night we need load on the system with the wind and the nuclear base that we have. And wind and nuclear don't play together as well as gas and nuclear do, for example, in the integration of the system. So there may be a balance between variable speed drive, load frequency control device, power electronics that can control voltage and frequency at the same time that would be a fixed cost revenue return for a project.

And then the cost of the storage -- the kilowatt hours and storage would be played into the market by players. In the case of gas storage you have a capacity charge you pay for the right to use the storage, but it's your gas after you put it in storage.

So it may be policy-wise we need to get a balance between is it transmission, is it an enabler of renewables, or is it generation.

MR. ALMGREN: Yeah, I think (unintelligible) adjust that to what Cheryl and Terry said. I like this approach being as far -- as much as possible resource neutral. I think developing markets and then let them drive what's the best solution -- that should be the preferred option.

MR. MASIELLO: Okay. Moving around, Ralph, it looks like you're next.

MR. CAVANAGH: Well, let me then follow up directly on that. I'm trying to get clear on what a resource neutral market is in this context because Terry advocated something in his seventh principle, which is not now up on the board, that sounded to me like the antithesis of a resource neutral market. Terry wanted a mandatory standard for a minimum fraction of storage.

And I am assuming -- so, Terry, do you -- I'm going to give you a chance to -- Terry, by the way, you redefine Boston accents for us New Englanders.

(Laughter.)

MR. CAVANAGH: Terry, if -- storage is obviously one of a -- I mean, you've all been talking about it as a portfolio, but is itself part of a portfolio, right? It's one of a portfolio of integration solutions that demand response -- I don't think you were including demand response among your storage technologies, and certainly demand response does many of the things that storage does.

And one would think that the ideal here would be to assemble the full portfolio across the biggest possible system to minimize the cost of reliable and safe service to customers, Ake.

And what I think part of the problem that -- Tom, the reason this is hard is that it's gotten a little big ambiguous as to who has that responsibility. There was a time when it was a classic utility responsibility, and the task of finding the lowest cost integration solution belonged to the regulated utility.

We've got different answers now for different parts of the country, but I would submit that we would all be better off if there were some clarity as to where that responsibility was and if there were some compensation for doing it well, for assembling the lowest cost portfolio of integration solutions or reducing the cost of the existing portfolio, not dictating a particular fraction of any set of technology solutions but having an orchestra conductor who was rewarded for doing that well. And I don't know of any part of the country where we reward the orchestra conductor for doing it well.

And I just -- a collective challenge for all of us. And RAP is -- obviously Rich spent a lot time thinking about related issues here. But what does it mean to reward good performance here? Where is the responsibility fundamentally going to be? And how can we make sure that the good portfolio managers are more profitable than the inept ones?

And I would hope we could try to grapple with that together because I'm not sure we've enough of that.

And, Terry, forgive me for grossly mischaracterizing and simplifying your suggestion, but I'm -- and I bet you don't really disagree with me on most of this.

MR. BOSTON: I actually do, so let me --

(Laughter.)

MR. CAVANAGH: Okay.

MR. BOSTON: And let me tell you why. I was very much a part of the nuclear program when nuclear was going to be too cheap to meter and we were absolutely sure that ERTA, before DOE, encouraged us to build out a nuclear fleet. And from my perspective, nuclear was not too cheap to meter. I was actually in the control center trying to convert oil burners to natural gas when there was a law against using natural gas as a resource. So from an integrated resource plan, we sure missed the price of natural gas, and we continued to miss it. And the best way to get to $8 gas is for us to forecast $3 gas.

But to -- as the market operator, the market puts the risk on the decision makers that are making those decisions. And to Ake's point and Cheryl's point, the market will encourage resources.

The only reason I put a percentage for a portfolio is that if you're going to enable wind that's going to be doing this and solar that's going to be moving faster, you need the system integrator, the market operator, the balancing authority, whoever that is needs the resources to make that resource integrate with all the other resources that are in the market.

MR. CAVANAGH: Right.

MR. BOSTON: So -- but for us --

MR. CAVANAGH: But why --

MR. BOSTON: -- to do an integrated resource plan today, I get you EIA would miss the fuel forecast going forward of what is the -- what is the best resource.

MR. CAVANAGH: But why not -- why set an arbitrary percentage, Terry -- a necessarily arbitrary percentage as the way of getting the integrator to pay attention to what he or she needs to do? Why not, again, just reward good results or try to find a way to do that?

MR. BOSTON: Don't disagree, but we have -- we have states that have a 15 percent by 2015, 20 percent by 2020. That would give you 100 percent by 2100. So, in terms of renewable. So, the question is are you going to move forward with a renewable energy standard that requires the storage to come in.

And storage is not the only way to tackle it. To Ake's point, new gas-fired units -- the way Spain balances their load is combine cycle plants running at 20 percent capacity factor. That's not a good capital recovery for the owner, but it allows you to balance the wind by using the gas resources on a very poor efficiency curve I might add to balance the wind, but I guess I would disagree that we could sit here today and do an IRP for the nation and come up with the right energy balance where the markets put the risk on the market players.

MR. CAVANAGH: So to be clear, I wasn't calling for an IRP for the nation. I was saying let's establish a clear sense of who has this responsibility and then reward them for doing it well. And I don't assume for a moment that it would be one entity or that it would be the federal government.

MS. LaFLEUR: Well, I'll weigh in, although I largely agree with what Terry said.

A couple weeks ago I gave a speech on a panel with John Rowe, something I try not to do unless I have had my Wheaties. And in response to something or other that I said, he said, you can have rate regulation; you can have IRM; or you can have markets. You can't have a combination of all three.

But -- fine. But the reality is we are living with a combination of all three. And in my simple mind with the luxury of just sitting where I have and just having the jurisdiction I have, we see a lot of the states having some version of integrated resource management with their renewable portfolio standards and so forth. Others have performance based rate making that at least try -- some of the state regulators in the room try to reward the efficient, or the clean, or whatever it is they choose to reward. And as far as I'm concerned, that's within their province for the utilities and the customers in their state, but at the wholesale market level to the best of our ability -- at least it's my belief -- we should run resource neutral markets that try to get it fair and try to measure by an increment that we can fairly measure, whether it's the speed of frequency regulation or whatever, and then all of those will play in at the wholesale market, which doesn't make a pretty answer in terms of a single decision maker, but it is an answer that reflects the complexity of the three different systems that we're living with, I think.

MR. CAVANAGH: And a single decision maker would certainly do better if the price signals into the market were accurate. Yeah.

MS. LaFLEUR: That's right.

MR. ALMGREN: If I may expound, not so much on the answer but more on the issue there. I think many of the wholesale -- a big part of the wholesale is market, but we have -- in most of the states on the retail are regulated.

Dealing and trying to capture all these

benefits, the interface between the wholesale and retail is, I think, deserves a lot of attention. And we see that part of demand response how that could be aggregated and then the transmission benefits could be captured in the capacity markets.

I think similar we can see on -- I guess like storage, but we also need from the wholesale markets as much as possible bring the price points in some -- one form or the other into the retail markets And I -- I happen to believe that the consumers given the right information make good decisions. I think technology can support that, and I think in all this talk about the Smart Grid one has to do something smart. And then I think that's -- and any storage that can fit.

And the other thing which a little bit to expand some of the morning's discussions, I think when we look ahead, we miss some of the dynamics. And no one can predict with 100 percent accuracy the future, but I think we are in for a scenario where electricity will cost much more. And then we will need to do these things we talked about -- energy efficiency and all that. But I think that's part of the dynamics which gets lost in this and why do we do these investments.

MR. CAVANAGH: Rich, I'm sorry, can I just -- the one thing I'm not clear on. Do you think that accurate real time wholesale prices are all that we need to deliver the right portfolio of storage solutions?

And if you don't think that -- that is, if you think there needs to be a long-term investment perspective that comes in behind the short-term wholesale prices -- then I think we're all much closer than this exchange suggests.

There was a time when people said that all we need is accurate short-term wholesale prices and the market will get everything right. And I'm just suspecting we're past that now.

MR. ALMGREN: Yeah, I agree. I mean, there's been studies. I mean, it -- if you have only prices, it will work but will be rather brutal and a tough environment. So I think it's socially not realistic. I think it's a combination what you're saying.

MR. BOSTON: But let me add to that. Without real-time pricing or time-of-use pricing with a plug-in hybrid vehicle fleet, everyone will come home at 5:00 p.m., plug in their car, and I will be seeking other business opportunities because --

MR. CAVANAGH: I agree.

MR. BOSTON: -- we need at least some real-time pricing to make some of the storage technologies we have get in the right optimization period for the market. And it can be voluntary. I do not have real-time pricing for my Volt at this time. If there was a rate in my area from a retail supplier, I would volunteer that quickly because the two go together quite well.

MS. LaFLEUR: I thought your question was about accurate real-time wholesale pricing. I don't think it's all we need. Or if that's all we relied on for this long lead time lumpy investment cycle, there'd be social discontinuities that the political system wouldn't accept.

And also, if it's all that we need, I should go back to FERC and get rid of all the people working on the ancillary services in the capacity markets which some of you might think is a good idea, but there's a lot of work being done that we don't need if that's true.

MR. MASIELLO: You know, I can't resist throwing out -- with prices, they're accurate. PJM's prices -- what PJM says it is, right? The question is: Is it efficient? But that little rejoinder aside, Richard, you're next.

This is great. And by the way, we have plenty of time left, so we can go around again.

MR. COWART: Yeah. Right. I am loving this session by the way. Y'all are great.

I have sort of two observations that lead to two questions for all of you.

And the first sort of topic area is that

I've been hearing people talk about is what are we paying for. And it is important to define what we're paying for.

And I think we've learned that sort of naked capacity markets don't get us what we actually are talking about here, that what we don't -- and a term that we've been using in our conversations is that we actually instead of thinking about just paying for capacity, what we really will need in the grid that we heard about this morning is something that you might call capability. That is, we need different capabilities. And in this context we're talking about responsiveness as a capability.

And following up on Ralph's observation, if you agree with that point, would you agree then that perhaps storage, perhaps nimble generation, and perhaps demand response all fall into that category? And we want to create a capability market that would allow the integration of all of those responses. That's the first question. The second point is -- so that's what do you want to buy?

The second one is how do you want to pay for it? We heard from Terry about the pumped storage hydro that was built to complement the nuclear fleet which is -- makes a compelling case in a way, but it's important to remember that we basically socialized that in order to create a resource that would complement the generation mix that we were promoting at the time.

MR. CAVANAGH: Also socialized.

MR. COWART: Yes, also socialized. Right.

And so I guess the -- and my second question is should we be thinking about the capability market in -- that would provide a price signal for storage, demand response, and its competitors in the same way. That is the way we think about the capacity market today. It creates, in essence, a mandatory and sure way of providing funding for the people that are putting those resources on the system. So, those are the two questions.

MS. LaFLEUR: Well, I'll start. I don't know. I don't know if we should redefine a capacity market as a capability market. I mean it's an engaging thought as described. I'm pretty confident that through and well beyond my time at FERC what we value in how we use energy will change. And so the markets will evolve, and maybe that's the way it should evolve.

I would just observe, for what it's worth, if we're pulling out those increments of how these resources behave -- if we're pulling out the fast response and all and saying, okay, those are somehow undercompensated by the constellations of structures, and markets, and bilateral contracts we have now, so we're going to create some weight of marketplace to barter those qualities. There are other components of capacity like the base load and the stability that the old-fashioned generators are providing that are also not defined in the current market.

So if we're going to pull apart capacity, which might be a smart thing to do, it's not just these new nimble things, but there's other parts of capacity that if we're thinking about it have different capabilities that maybe we take for granted because we're just rested on those decisions we liked to criticize 30 years ago.

MR. BOSTON: On the capability market, capability is a little like energy efficiency. Measurement and verification would be very tough for the market operator. And it is -- in energy efficiency it's I like meters, not models, at the end of the day.

But let me make a point. What we need is dynamic benefits properly valued. And if Ake's battery is competing with Rick's pot line, both can have very fast response. His pot line is going to have very limited energy because it will solidify and he'll have to go in with a jackhammer and bust it up. So what we need to do is take the dynamic benefits of storage and make sure the market is evaluating those benefits and weighing them against the man side. And I mis-asked Ralph's question a little bit. We need alignment or direction (phone ringing) -- I'm sorry. We made those. We never closed so --

UNIDENTIFIED SPEAKER: Your car's calling you.

MR. BOSTON: -- we do need dynamic pricing that the wholesale -- it doesn't have to be one for one, but we need an indication of the value proposition so the end-use consumer can play in the game with their storage devices, whether it's the water heating, whether it's the space heating, or whether it's plug-in hybrid vehicles. We need alignment of wholesale and retail prices so that happens.

And Pennsylvania is working with us very hard. So is Ohio to try to align wholesale and retail pricing so that we get the dynamic benefits, that the customer sees those.

MR. ALMGREN: Yeah, I think, as Cheryl just said, it's an intriguing thought. I think going forward -- I think it probably deserves more discussion and (unintelligible 57:41 #3) from -- not from the storage but the other alternative here with transmission in the planning, that when we do look ahead, transmission as -- was pointed out in the morning is an enabler. And I think we've been seeing cases where it's -- where you have strictly reliability (unintelligible 58:03 #3) gives some challenges. So in that respect I think both for transmission and for energy storage one can see the case for -- or the thought for the capability aspect. But it is a complicated topic and will require a lot of discussions because, again, who is inclined to pay for it and how can we justify it as being paid for.

But the sooner we get to something like that I think at the end it has to be some kind of a hybrid model where part is for the common good and socialized and some is where a beneficiary pays.

MR. MASIELLO: Okay. I'm going to exercise the chair's prerogative and throw a few questions out. The first one, Terry, you're showing us these graphs of the vehicle or for that matter the hot water heaters fluctuating very quickly in response to a regulation signal and starting a pilot with General Motors, but I've got a measurement and validation and a settlements problem for you.

If I plug my Volt in in my garage and I want to get the benefit of selling you regulation, the Smart reader on the wall of the garage is good for 15 minute, maybe 5 minute samples. It certainly can't track the ups and downs. So what's the technical proposal to do pay-for-performance on Smart charging if all the Smart meters are not so smart?

And the second question is kind of geeky. And you'll have to -- everybody forgive me.

(Laughter and comments.)

MR. MASIELLO: What?

MR. BOSTON: I would turn that panel into (inaudible).

MR. MASIELLO: Yeah, but this is my -- one of my personal obsessions. We've got a trend going on in all of the market designs in the

United States to do co optimization of everything. We take the offers for regulation, for spinning, for other ancillaries, for energy, and we throw them all into a giant numerical meat grinder and come out with the optimal way to use each resource. But right now the trend with the market protocols filed for storage have been self-scheduling instead.

Where is this going? Is co optimization the right path for storage, and what's it lead to? So, two very different questions. Sorry, but --

MR. BOSTON: I'll take a shot at the metering question. Between meters and models I'll always choose meters in terms of their precision and accuracy, but in the case of are you dealing with fast enough speeds, we are doing prototype testing to see what the response of the AES battery is. We're doing testing of the Delaware with near real time, you know, 50 millisecond time steps. So we're getting pretty good data base there.

Literally in New Jersey pole-top solar is too cheap to meter. It's 200 watts, and you can't afford a meter for 200 watts, so you have to do statistical sampling in that case and measure where the sun's shining to get there. So I think -- and I'm not saying for the Volt you actually have to have a Smart meter. You need a Smart car. And perhaps through OnStar which has a one-third second delay going up to the satellite and back, but that's pretty good for a load frequency control, too. So you have to have good communication, and you have to know the device is responding, but you wouldn't have to measure to the millisecond every response as we have measured with the one megawatt battery.

On your co optimization the question is obviously the market, whether someone is putting something in, the more flexibility that resource has, the more likelihood it can be optimized, but my preference is the owner looks at the market pricing signals whether its ancillary services and is able to determine how to put that device into the market and optimize the various benefits that Brad was talking about earlier in terms of the dynamic benefits of storage, the speed of response, the fact that you can take off-peak energy and transfer it to peak energy, all those -- and that's what happens in the pump storage fleet today.

One thing that Pat has in her studies that might be of value is variable speed drive on the existing pump storage fleet and that that would allow us instead of having s synchronous motor, we could do load frequency in the middle of the night. Right now pump storage has two modes in the pump direction, on and off. And it comes on at about eight seconds. So if you had the ability to vary the input power through power electronics, that would allow you to co optimize if you will.

But I don't like the thought that the market operator is going to take over the storage and optimize it. I really think the owners have to take control of their own livelihood and assets and optimize.

MR. MASIELLO: Yeah, I hoped you were going to bring up OnStar. And you know those petro solar panels on the poles have Smart inverters with communications? Should we be thinking about standards for distributed-in-the-device metering with the financial security standards akin to cyber security? Is that where this is headed, Terry?

MR. BOSTON: I yield to Pat. One thing -- and let me back up a little bit on the co-optimization. Some of the places we're missing the boat, and an inverter converter can do voltage control. The capital cost to allow you to do voltage control is very small. We need some standards that allow us to do frequency control and low voltage, to do low frequency control and voltage control with the DC inversion of the equipment.

In terms of cyber security, we need to get the hardware security wherever possible. And I can tell you what I've told my staff is cyber security is going to get a lot worse before it gets awful. So as we connect tens of thousands, millions of meters, we better get it right in terms of is that a point of entry that can get back to the SCADA for distribution, SCADA for transmission. So I think building cyber security in instead of bolting it on is essential as we go forth.

And, Pat, you might comment on the standards. I'm not sure where NIST is on the standards.

MS. HOFFMAN: I'll have to get back to you on that one.

MR. BOSTON: Okay.

MR. BUTLER: Thanks. Terry, a question on electric vehicles. The question focuses on the capability of batteries, current generation of batteries to engage in this discharge from vehicle to grid.

A lot of the people we've been talking to about electric vehicles and the impact on the grid indicate that the manufacturers right now are not concerned so much with the capability of discharging as much as they are on the capability of charging, staying charged, and giving people the feeling that they're going to get to where they need to go and back to a charger, sort of range anxiety that a lot of people have. Are we not several years away from the type of batteries that you're talking about being able to be storage in all of those vehicles?

MR. BOSTON: Ake can talk about the chemistry. Let me talk about kind of the University of Delaware project. We have been doing a vehicle-to-grid where we actually charge and discharge the vehicle into the grid to do low frequency control. I think we're a long way from getting there with both the owner of the car and the automobile manufacturers. I think it will be grid to vehicle and varying the charge rate to optimize the use.

And much like the water heater, we don't take electricity out of it. We just do load frequency control by controlling by controlling what we put into the device. So I think for the next 5 to 10 years that's where we're going to be. In terms of the life of the battery, let me say the stress of being in a car is much greater than what we've seen as the stress of being there doing low frequency control, but Ake might want to talk about the life impact on the chemistry.

MR. ALMGREN: Yeah, I would say the technology is basically there. I mean, but like anything, you have to use price on judgment. If you deep charge and discharge nonstop a car battery, you would shorten the life regardless of what chemistry. So -- but I think it's -- I don't think it's a show stopper in any respect.

And I think -- I think it would -- the benefit from the ancillary service using the car, I think, is limited for a passenger car. I think you have to look at the fleet vehicles to have a major impact.

But at the same time I would like to point out that in all these discussions about the challenges about putting more cars, plugging cars to the grid, I would -- I would look more at the opportunities. We will have more renewable energy on the system. We will have more energy efficiency. And in some cases the traditional demand of electricity may stay flat while we're still having fees and costs. And this opportunity for electric industry to have another revenue stream at the time where there's no other revenue stream available I think is a big opportunity which far exceeds the challenges to make it happen.

MR. MASIELLO: Okay. Michael.

MR. HEYECK: Gosh, I had a lot of thoughts running thoughts running through my mind, and it was good that we went around the table once.

Let me start with, first of all, AEP, we've got a lot of large projects out there. We have a town in Texas, a border town in Texas which is nearly at UPS status because of its distance from the grid and the Texas Commission allowed us to recover it as a transmission asset.

So the first notion is -- and I think I've been consistent since I started on the EAC. Let's not put these in a box. Let the creativity move forward, and I think it will find its space. Certainly we need some definition, but in each of the -- in each of those parts of the definition let's ask ourselves is there an impediment to growth in this space. So any activity with respect to a storage.

And another point that Ralph made that wholesale prices -- I've been going to Europe. My wife is Portuguese. I've been going to Europe so very often since 1985. And I've noticed that -- I think they're about $10 gas now, and there are more cars, and the cars are getting bigger. So the responsiveness to pricing is curious. What I would say is that the responsiveness is to wealth. And the wealth factor, the personal wealth factor, is what's going to drive the equations on efficiency and what we do with that saved kilowatt hour. It's also going to drive storage.

We found out in the 2003 blackout that a lot of toilets in New York were flushed by electricity. And it's probably likely that that electricity will be backed by batteries like our alarm clocks, like my sump pump.

What I'm getting at is in the future here there's going to be a divergence between the distributed and the central. And the distributed batteries -- let's not prohibit the residential customer from buying a battery to backup their house because I would maintain that SADI should be zero for the 21st century customer eventually. No one's going to tolerate their toilet not flushing let alone their computer not running. So how are we going to accommodate that? Like we have in the past. We backup our alarm clock with a battery, our sump pump with a battery.

So in AEP we've got the big four-megawatt application and we do have this community energy storage application. But I'm wondering if personal wealth is going to come into play here for the residential customer to do more selfsufficiency rather than just emergency backup. And what I'm saying is the bottom line is let's not box these things; let's allow them to foster and then see how they grow and then come up with the definitions later.

I understand that we need regulatory treatment, and we made the argument in Texas, and we got it justified based on deferring transmission investment. So there's some random thoughts out there, but the bottom line is let's not put these things in a box.

MR. MASIELLO: One more I guess. Ed?

MR. KRAPELS: I just met Commissioner LaFleur for the first time, and FERC's work in this area is so critical. And when I think about Cheryl's comment the capacity market's in the shop, that's really true. The problem for those of us who are in market is that we're still driving the jalopy while it's in the shop, you know, so -- and among the things that we find really interesting is that studies are being done by consultants and by ISOs that value transmission and storage as if they're generation. And those studies are very important because they inform mitigation measures whether a resource is in the market or not in the market, the whole docket on capacity and whether bilateral or sponsored capacity can be claimed in the capacity market paradigms.

So as an example of how we're not pricing things very well, DC transmission has different attributes from AC transmission. We can't capture all the value that we've created with the various projects that we've built. And our sponsors can't capture all the value because we're just not pricing all these attributes right.

And a few weeks ago I was at a conference where a bunch of really smart guys and gals all agreed that the energy market project is incomplete. In other words that we haven't figured out the right solution to capacity market pricing especially. And I think this discussion has been one of the best I've ever been in. And to talk about capability as opposed to capacity is conceptually, I think, a good step forward. I think we can do better than we've done so far. And the Commission is the one that can drive this and get us to a better place.

MR. MASIELLO: Okay. Any final comments from our panelists?

MR. BOSTON: Yeah, let me add a little bit to Ed's comment if you don't mind, Ralph.

One thing, if you look worldwide, about 20 percent of the transmission is DC. In the U.S. that's not the case. The controllability and the flexibility that DC gives you -- primarily the controllability, whether it's back to back or long haul, adds value to the rest of the grid. And to some extent because we haven't had the very long lines as would be required to enable the Midwest North Dakota wind, we haven't added the DC as the rest of the world has. And Smart devices without smart prices leaves you a pretty dumb system. So until we get pricing aligned with value, whether it's in the pricing out of the DC or whether it's in the energy market to get retail and wholesale prices aligned, you won't get the smart response. And I would feel very guilty with Mike here in not saying between a Smart grid and a robust grid I'll always choose the robust because it has much more flexibility. The robust may cost more than a Smart grid, so the controllability that a DC line adds is something much like storage, we haven't evaluated properly the dynamic benefits it adds to the other assets.

MR. ALMGREN: Yeah, I think it's good that -- good example, the DC element. I have probably more background in DC than I have in energy storage so I can agree. I mean DC has some of these capabilities which is hard to capture -- I mean the controllability. The progress on the DC technology in terms of cables that it can be buried in the ground fast. It can -- so there are a number of these things. And I think it is a good illustration that there is probably in the discussion going forward room where we should discuss these capability aspects.

MS. LaFLEUR: Well, I just echo that I agree it's been a -- I found it a really thought provoking conversation, and I don't think it's coincidence that it was because we started with the subject of storage because that doesn't fit neatly into the real simple constructs into which we've placed energy pricing, you know, volumetric pricing of certain, you know, kilowatt hours or whatever which doesn't really capture everything energy does or all the dimensions that it has.

So maybe rather than being an outlier this kind of conversation is leading us to thinking about how we price components of energy and the capability of capacity that has implications back into what we might think of as the non outliers. So I think it's been really provocative from that standpoint. Thank you.

MR. COWART: Those are terrific last words for this panel. And I think now we have -- maybe I'd like to just pause and thank you. It's really been terrific. I --

(Applause.)

MR. COWART: And you're, of course, welcome to stay. You don't have to, you know -- you don't have to get up and walk out of the room, although I recognize you're probably all incredibly, you know, busy and have other demands, but you're welcome to stay.

MR. LaFLEUR: Okay. I was going to stay till 3:00, so I'll see whatever's next.

MR. COWART: Okay. So we're at -- Ralph, we now have a little time for a conversation of the Committee's work going forward.

MR. MASIELLO: Good. And I'll be very brief so we can get -- recapture a few minutes.

The Subcommittee developed two reports that were posted on the Committee share point site in April and submitted to DOE. One was a summary of all of the DOE activities in storage as reported in different workshops at a concise level, and another was a summary of -- quote -- other research and development and prototyping activities under way. And they're both on the share point site. Both have been formally submitted.

Second, Secretary Hoffman asked us to tackle the task of a valuation framework for storage. And to that end there are three draft documents running around -- two, I guess. One is with Energetics help there is a document that tried to collect the existing precedents around gas storage, particularly in things like FERC orders. And that I know went to the Subcommittee, will go to the full committee. And it just occurred to me this afternoon listening, Commissioner LaFleur, we might give that to FERC with the invitation to comment on it because the people who put it together are not regulatory specialists and it could easily be we missed some important things. But this is just a background. These are -- the relative precedents --

MS. LaFLEUR: I'd be happy to facilitate that.

MR. MASIELLO: -- for storage and energy.

Then there's the draft document on the

valuation framework, very rough, full of questions of the nature of should we go down this rabbit hole. Should we create an example? So I'd encourage you to look at it and provide some feedback. And, of course, if you're on the Subcommittee, encouragement's a mild word. Please look at it or expect spam reminding you.

And when you do look at it, you'll discover that in the -- let me use the word wholesale bulk power for generation and transmission space. The discussion of valuation is pretty rich. There's a lot of methodology out there that you can draw on in the gas storage space or indeed developing for regulation for instance, and some questions that are already posed as we heard going around the table.

When you look at the distribution space and the community energy storage, it's a completely different ballgame where the -- you know, the literature isn't there that says here's how you do the valuation. And our opinion is this is actually pretty critical because distribution engineers like to do things by the book either with the Westinghouse T and D book decades ago or with PSS/E or SIEM, or Power Factory today. And the T and D book doesn't, and the software tools don't give the distribution engineer the cookbook today. So, you know, that's an area where in the framework, as you'll see right now, we're coming up kind of dry. So that's my quick report, Richard.

MR. COWART: And we should note that your Subcommittees reports along with all of the final reports of the Committee and its subcommittees will be posted on the public website accessible to the public when they're finished.

Did you want to discuss the draft outline of the framework document and what the -- what you expect to do going forward with that?

MR. MASIELLO: Well, we expect the Subcommittee to work on it with a goal at the next meeting we'll have a document ready to submit to the Committee. But it's -- it's longer and inherently more technical in economics and engineering than some of the higher level recommendations, let's say, coming out. And so a good -- you know, one question is how much energy we can put into it to carry it to what level of detail, and another is how appropriate that is as an activity for the group; but if people would look at it and feedback whatever comments, or thoughts, or criticisms we'd welcome that.

MR. COWART: All right. Is it appropriate to ask the Subcommittee to comment on Terry's seven recommendations? I'm posing that as a question to the Committee generally and to the Subcommittee members --

MR. MASIELLO: Well, I'm seeing --

MR. COWART: -- in particular.

MR. MASIELLLO: -- heads nod up and down, so I guess we will.

(Laughter.)

MR. COWART: All right. Thank you very much.

Well, it sounds -- any more comments on this topic? We've definitely had a rich conversation, so maybe this is the time to take our afternoon break. We'll reconvene in 15 minutes. We're four minutes ahead of schedule.

(Brief recess.)

MR. COWART: All right. Committee folk. All right. While we have a moment for announcements, just a general reminder that the -- all of the materials that the Committee is working with are on the Committee's share point site to which you have access -- all the drafts, including the storage valuation outline, the electric vehicle outline, and a -- well, something we're going to discuss in a minute. It's just the memorandum on the interdependence of electricity infrastructure and natural gas, but we're going to talk about that in a minute and also the memorandum on post-ARRA funding issues for transmission planning. All those materials and others are on the share point site.

For the next -- yes?

MS. WELSH: And the final deliverables. Hi. And the final deliverables in final form are on the EAC website and available to the public once they become final. So the share point site is for EAC members only, but all deliverables will be publicly available on the EAC website which is www.oe.energy.gov/eac.

MR. COWART: Thank you. All right. Transmission Subcommittee, Barry, you're up.

MR. SMITHERMAN: Thank you. Well, I was honored to take over this post after Lauren received her new job assignment and then subsequent to that I received my new job assignment, and so to some degree this position is a little bit of a leading indicator of movement.

MR. COWART: Is there anybody on the Committee who wants a new job?

(Laughter.)

MR. BUTLER: It's upward movement, so that's good.

MR. SMITHERMAN: Yeah, I think you're right. Fred, I think you're right.

And I apologize for missing the last

meeting. We had a legislative session -- quite contentious and challenging -- that occupied most of my time this spring as the PUC was going through sunset review, and then we had a special session to work through the budget. And then I got appointed to my new job, but I'm delighted to be working with the team on this particular subcommittee.

Let me sort of break down for you where we have progressed and what we are going to discuss today seeking input and feedback from the Committee. We went back and looked at the deliverables that were identified in the 2008 Transmission Adequacy Report or chapter of the EAC report. And pretty much all of those were either done or in the process of being done. So the Subcommittee had coalesced around essentially one fairly large and important issue which is the topic of interconnection-wide transmission planning, post ARRA funding. And we're going to talk about that in some depth.

You should have received a white paper

that highlighted some of our discussion with five sub bullet points on it, one of which we'll spend most of our time about. And then we had two smaller subtopics which we may or may not want to take any further after we discuss them today. One of them was the security impacts on the grid and Mike was kind enough to take the leadership role in taking a look at that issue, not from a cyber security perspective but rather, from a -- I would call a critical component perspective.

And then my office working with Tom and some others put together in a fairly quick fashion this interdependence of electricity system infrastructure and natural gas infrastructure which I think we'll take up that last.

But first, what I'd really like for the Committee to focus in on -- and I'm going to ask Joe Kelliher and Sonny Popowsky to give us a little bit of discussion on this -- is exactly what should we think about in terms of continuing to fund what have been fruitful work products so far on interconnection-wide transmission planning. We highlight in the white paper five sub bullets. I'll start with the last one first, which was cost reductions. We all agreed that we should do everything we can to keep costs low or lower, including telecommuting, including webinars and anything else that we can do.

And then Number 4 was should we rely upon further DOE grants or funding. And we all sort of concluded that that was probably not a good idea. So I would call your attention to Bullet Points 1, 2, and 3, which are three suggestions, or topics, or choices for discussion of post-ARRA funding. And with that, Joe, I would ask you to sort of take over with some of the discussion as we had it, with Sonny joining in, and then we'll see what the Committee thinks.

MR. KELLIHER: Sonny, do you want to talk about 1 and 3, and then I'll talk about the FERC possible options? How do you want to --

UNIDENTIFIED SPEAKER: (Inaudible.)

MR. SMITHERMAN: Pull that mike up. And

I recall that Bob, you had some definitive thoughts on this as well.

MR. CURRY: I had a few thoughts on the last one.

MR. SMITHERMAN: Yeah.

MR. POPOWSKY: Yeah, I mean, my preference is really the FERC option if we can do it, but I could say why that isn't -- and you obviously could have a lot more expertise on how that might or might not work, but I think the Committee pretty much agreed that it was unlikely that the kind of funding that we saw from DOE to get this process started, particularly in the Eastern interconnection where we've never done anything like this before, it's just unlikely that we'll be able to get that kind of funding.

We also all agreed that, as Chairman Smitherman said, this could be done in probably a much less costly manner in the future. Now that we've started it up I think the process can be done, if it does continue, without as much of the sort of start-up costs and as high of costs as we've incurred to date; but I guess I'm the only one on this Committee who also is on the Stakeholder Board of the Eastern Interconnection Planning Collaborative. And I have found it to be a very positive process. I think you're bringing together people who haven't really sat down together to talk about issues that they haven't talked about before. And as long as, you know, the expectations aren't too high, that, you know, the i.e. that we're somehow going to come up with a grand plan to solve the problems of the Eastern interconnection, I don't think anybody's looking for that. But I think just the process itself certainly with the leadership of Dave Meyer and other folks in DOE has been very positive. And at least I think it's worth continuing.

One of the things, of course, from our perspective, is that it does include funding for people like me to participate because otherwise, my office could not participate in this type of activity as we have two state consumer advocates who participate, and I don't think it's all that expensive to have us go to the -- you know, get transportation to the meetings, but for us to participate for the NGOs to participate as strongly as they do, I think it's been essential to get that kind of funding. I'm sure Ralph would agree. And for the state commissions -- I think it would be very difficult for the state commissions to go to their state legislatures and try to get the kind of funding that they need to participate as actively as they have. So I think it is worthwhile.

I think they've, frankly -- that the -- we don't have -- I mean, ideally you'd want to be able to do something like WECC does, but WECC has always been organized in the west and has been able to come up with interconnection-wide methodologies to operate. And we just don't have an organization, I don't think, like WECC in the Eastern interconnection. We have a collection of what? Six regions, I guess. A number of RTOs and ISOs and then a number of entities that are not part of organized markets at all. So just the very act of bringing all these folks together was a mammoth undertaking. And the question is how to keep them together in the future or how to get some funding to do that.

I think Number 3 that the state regulatory approach is probably too unwieldy and probably a little bit unfair because it would rely solely on utilities that are regulated at the state level which would leave out a lot of entities that participate in the -- that would participate in transmission planning. Also, I think it would be unwieldy to do -- to try to go through the 40 states and the District of Columbia to go through regulatory proceedings even if it were done on a generic basis in each state. You're still talking about 40 proceedings. And it might -- and if you're talking about doing it on a utility-by-utility basis, I think it would be almost impossible. And like I said, in the end it would be unfair because it only would address those entities that are regulated by state commissions.

So I would focus on Number 2, which is some type of a FERC tariff, a FERC-approved tariff at the transmission level. And the model that I like is the model we used for NERC, which, of course, has statutory authority, but basically the costs of NERC are allocated across every -- I mean it's done on a formula called the net energy for load, which basically captures every kilowatt hour in the United States once, but only once.

UNIDENTIFIED SPEAKER: (Inaudible)

MR. POPOWSKY: North America, yeah. And -- well, U.S. and Canada, right.

Anyway, and -- anyway it cover -- it's a very elegant way, I think, of covering these costs. And to the extent that these costs are fairly modest, in the future you'd be talking about numbers that would come -- go to the 8th, 10th decimal place on a transmission tariff to spread the costs of just the ability of getting these people together.

So that would be my preference, but I'll turn to Joe because he has a little more experience at FERC tariffs than most of us.

MR. KELLIHER: Thanks, Sonny.

I mean the question is not just how do state participants, you know, recover the cost of their involvement in planning but also all other stakeholders, the whole universe of stakeholder. And so I've really tried to look at what are the FERC options. And, you know, there are six possible options, but I have to do some more legal research because I think that six could dwindle, perhaps, to zero if you really looked hard at them to be honest.

And I don't think -- I haven't come across a magic bullet, and I'd be surprised if I see one. I mean, the NERC option stands out because it, first of all, there's no one non -- well, there's -- the NERC option doesn't work. It's elegant, but it doesn't work because there's no statutory authority, unlike the NERC option. There's nothing in the U.S. Code that says interconnection-wide planning in the Eastern interconnection gets full cost recovery from everybody.

There's the RSC model that exists in some RTOs. And that's something FERC has allowed in part because -- and that allows for the state participants, the regional state committees to get their costs of participating in RTO policy formation, not just transmission planning, but that's one in part out of commodity to states for commodity towards the states also recognizing that states are not just stakeholders. They are different. You know, they are sister regulators. No stakeholder gets their cost recovery through the RSC model. And also, the RSC costs are nominal. I think in one RSC it's a quarter million a year. Even based on the memo, that would cover two planning meetings, right? So the RSC model could work for state participants. It's hard to see how it works for others.

One thing, even if there were a possible -- a model that arguably worked legally, and maybe there's some legal risk, then you have to ask, well, would FERC assume that risk anyway. And I have to believe that FERC is -- would be uncomfortable with interconnection-wide planning because interconnection-wide planning and cost allocation two years ago, proposals in Congress, caused the great controversy around interconnection-wide planning and cost allocation. There was tremendous political opposition in the Eastern interconnection.

So I'd have to think even if you came up with a possible model that arguably was workable and had some legal risk associated with it, I think there's a good chance FERC would have no interest in pursuing it because they're right at the point where they're going to issue their final rule. That final rule is decidedly not going to entail interconnection-wide planning or cost allocation.

And then on the heels of that to go to FERC and said, hey, do you want to do interconnection-wide planning? It would be viewed by some as camel's nose under the tent leading to interconnection-wide cost allocation. So it -- if I were still at FERC, I would have zero interest in taking some kind of legal risk or even zero legal risk to provide for funding for eastern interconnection-wide planning because I think it just would revive all the political controversy of cost allocation that they've just not put out but put down to a large extent.

There's a model that -- the GRI model. Years ago there was something called the Gas Research Institute. And it's costs were recovered through pipeline tariffs. The theory was sort of a stretch. FERC said, well, this R and D is related to jurisdictional service, so, therefore, the costs of this R and D can be recovered through jurisdictional tariffs. At some point FERC got extremely uncomfortable with that leap of faith and ended up terminating the GRI surcharge.

You know, is that dead? It's dead right now. A group called GTI came in and they recently -- a few years ago -- and said, well, see, we're not GRI anymore. We're GTI. It's a T, not an R. And we want that surcharge back. And FERC didn't agonize over that too much and said no.

FERC does have the authority to impose some kind of adder or surcharge, but they'd have to find that -- I think they'd have to find planning is jurisdictional. Transmission, service. I think FERC has found planning is an aspect of jurisdictional transmission service but to say planning by itself is transmission service is something I don't think FERC has ever found, and they might not be willing to find that.

And also, you'd have to say planning done at some level where maybe stuff that's planned gets built, maybe a lot of what's planned never gets built. The costs of planning exercise are clearly to the benefit of everyone who's a jurisdictional customer, and so an adder can be placed on every jurisdictional tariff in the eastern interconnection. And there are many. Is -- you can see how a lawyer might think that's possible. There's a couple leaps in there. But then, also, no one -- no one's asking for that service. And you could theoretically say if transmission planning is jurisdictional service, you could create a non-profit corporation, which would be a public utility in the parlance of the Federal Power Act. They have a tariff to recover the costs of planning but no customers. No one's coming to them and saying, would you please plan for me. What if no one comes to them and asks for that planning service? No one's asking to be charged the tariff rate for planning. You're telling -- they'd have to -- FERC would have to say their planning, the fruit of their planning can be imposed on every jurisdictional public utility in the eastern interconnection even if no one actually wants the planning to be conducted. And the benefits of that planning are maybe attenuated at least. Right? Because plans don't always get implemented.

Also, you have the problem that FERC doesn't have jurisdiction over the whole grid.

FERC has jurisdiction over two-thirds of the grid. So how would FERC -- to the extent there's parts of the eastern interconnection where there's no jurisdictional transmission owner, I guess if you believe they would e getting a free ride from eastern interconnection planning. Right -- if there's no way to flow those costs through to that third of the grid?

So anyway, I'm -- you know, there's a GRI model, but I have to think that's a long shot, and maybe that's dead on arrival at FERC. There's the RSC model that probably works for states, but it's hard to see that it works great for other stakeholders. One reason the RSC model works is the costs are budgeted, and FERC sees them in advance.

I don't know how you would -- could you really budget the costs for stakeholders not knowing exactly which stakeholders would want to participate in planning and what the level of stakeholder involvement would be? Could you budget that as readily?

You could come up -- there's a scenario where you could come up with the planning entity. They become a jurisdictional public utility. They have a tariff but no one asks for the service. How does FERC impose that tariff on people that aren't asking for the service?

There's a joint board option where states, under Section 209 of the Federal Power Act, states can form -- FERC can refer matters to joint boards composed of state representatives and only state representatives. And they can pursue that matter. To me, the matter is vague enough that in the statute this provision's never actually been used, so it's vague enough where you could say planning is a matter -- eastern interconnection planning is a matter that FERC refers to in eastern interconnection-wide joint board. That joint board could only have state representatives. No other stakeholder could be on the board.

They could be around the board, conceivably. And that -- I think that's a means where you could have a eastern interconnection-wide state board. The costs of that joint board are recovered. FERC could fund that joint board through its budget, not through tariff adders, but that would go only as far as state representatives who are members of the joint board, not the host of other stakeholders who would very much like to be participating in the planning process.

So, anyway, I've looked at six different options, and none -- they're all imperfect. Some are highly imperfect. And it's possible with a little more legal research that six is a much smaller number, maybe even the null set.

MR. SMITHERMAN: Why don't we get some feedback? Bob, I know you have some thoughts on this and then open it up for everyone.

MR. CURRY: Yeah. Just make a couple of comments.

About three years ago when money was a little bit looser than it is now, the Bloomberg administration paid CRA about a $1,100,000 to study alternatives for getting transmission and generation -- getting power into the New York Metropolitan area. The City of New York spends over that every year in electric charges so it had a vested interest. The job was essentially to take every proposal that was out there and try to do an objective analysis using the same data points for each proposal and get and apples to apples comparison. You know, Granny Smith versus red delicious -- I don't know, but we got closer to what we wanted to get to because for the first time in the memory of people far more experienced in this field than I, a customer actually went out and did a study as to what would benefit it the most.

The reports from that exercise were vetted regularly with every conceivable person in the room that wanted to be there, including me. I didn't really want to be there, but I was there anyway. And, you know, I found situations where -- with all goodwill, you know, the same data points were used to justify two totally different conclusions. I mean that much I can understand about transmission. So, you know, we had to keep everybody honest a little bit, but that is now the basis for trying to decide whether or not Indian Point can be taken off the grid because Bloomberg, three years ago, had $1 million to spend on this. And then each major incremental new idea got sort of a change order to that basic document.

So why am I going through all this baloney? Well, for one thing is we in New York don't care about the rest of the eastern interconnect. We're just fine the way we are.

No, we are obviously quite wedded to the rest of the east coast. In some ways this concern that we have now strikes me as being essentially a smaller-scale version of who pays when it comes to transmission, period. Of all the alternatives that -- well, the other thing that this study did is it did give us an apples to apples comparison. We did have the same data sets for everybody. People coming in to try to sell us, the State of New York, the City of New York, these great, wonderful solutions had to work through the standards that we set and the frames of reference that were established. That had certain benefits as, I think, all the analyses that were done by the eastern interconnect and all the modeling that was done there.

So I have to vote as a non-practicing FERC lawyer for Joe Kelliher's last alternative because it's sufficiently vague and sufficiently loosie-goosie that you might be able to sustain it without anybody really complaining about it because -- other than the people in the budget office at FERC because if you said it had to be funded out of FERC's budget I think and not out of any pass-throughs; but if we can keep the costs low as the last -- second-to-the-last bullet point suggested, that might be a good way to go.

It seems to me essential. Even though we don't reach the hoop haze question, it might be a really good idea to know what the most practical and elegant solutions are to the transmission problems. And only if we take things to, I guess, another level will we be able to get there. And then we can fight over who pays.

MR. SMITHERMAN: Ralph.

MR. CAVANAGH: Thanks, Barry. I just -- I think I want to underscore two things. I mean first of all, these interconnection-wide planning efforts are a response to concerns I've been hearing for literally decades about the difficulty of doing genuinely regional interstate work, overcoming parochial objections, seeing the problem whole. This is tremendously important effort. Many in this room are involved in it. It's not finished yet. It has a good ways yet to go. I think it would be catastrophic to chop it off. I hope our effort now is to figure out a way to keep it going. And there's -- the amounts involved in this compared to the value and the build out and the potential lost opportunities, it's a preposterous mismatch.

If we could try hard -- I also would -- I would regret, personally, from what I know of this process -- and, Sonny, you've had far more engagement in it than I have, but I have some, and I know a -- and a number of our folks are working on it.

I think the value of in-person interchange among the state participants, public interest participants, you don't get that over a video conference or a conference call. And I would hope this Committee would be an advocate for this kind of effort, region-wide initiatives that have everybody involved, the states fully engaged.

Finally for once it's not DOE and FERC against the states. It's a genuine cooperative process, I think appreciated by all involved as a good faith effort, which is at a critical stage. We should be supporting it. We shouldn't be talking about cutting it back, and we should unleash the full creativity of Joe Kelliher as I think Bob is suggesting to find a way to do this because the absent -- if we can't do it, we're back in the tribal worlds of completely incoherent permanent federalism wars. We've all been stuck there for too long. This is a way out.

MR. CURRY: They argue from the west?

MR. CAVANAGH: Yes.

MR. CURRY: You get to talk about this, Dian?

MS. GRUENEICH: Yeah, I can --

MR. CURRY: I don't know. I'm very parochial.

(Speaking off microphone not transcribed.)

MS. GRUENEICH: Sure. I was part of the folk -- the group of folks who actually started working with DOE on the original concept of this, so I will echo much of what Ralph said about -- I think looking back, it's an incredibly valuable effort.

When I was a commissioner -- during my full six years I was actually the western commissioner representative on TEPCC, which is this arcane committee within WECC, which is very much a closed group that it has the transmission owners and operators, and then it had one commissioner for the west and one other person. And then it had the other, you know, 15, 20 people.

In contrast, when this whole effort was set up in the west -- and that's all I'm going to talk about -- it was very much stakeholder driven. And I think for both of the planning groups there was a requirement of one-third state entities, one-third NGOs, and one-third other to try to have it be very balanced.

So -- and I can tell having served on both of those what a difference it really did make as far as getting input and having robust discussions. But I do have a couple of comments.

One is that my memory is is that the funding does go through 2013. So we are not -- well -- we're not in danger of this funding going away this year. The two major products are that in September of this year there is a first draft plan, and then in September of 2013 there's a second longer-term draft plan.

The money, at least in the west, was used to fund travel by state officials and by NGOs and to hire consultants. I don't know if it was also used to pay actually in-house staff at either WECC or the Western Governors Association.

I think that some thought could be given -- let's assume that the products that come out in 2011 and 2013 are pretty good products because if not, then we do have a big problem.

If so, then you don't necessarily need the same large budged for consultant work in my mind because in some ways if you turn this into every two years a plan is put out, that just, in my mind, starts to detract from what we'd like to do which is get a plan that has enough agreement that that leads to some transmission being built, and, you know, starts to really work on that area.

So I think that there's almost a moment

in time to stop and take a look at this issue in terms of what's the real product that you would want this group doing after 2013. And like I said, I, personally, wouldn't argue that it's focused on producing a plan every two years. So that's one question.

And as part of that, I then think that maybe the consulting money at least could be potentially far less than what we -- what we saw. So, to me, the real, you know, hub of this is going to be how do you then think about -- if it's a smaller piece -- funding the travel budgets which is what you're really talking about probably for the state commissioners, state officials, and NGOs over some period of time. So I just offer those ideas.

MR. SMITHERMAN: Joe, you want to respond?

MR. KELLIHER: Just a short comment. I actually am not convinced the WECC model can't work because, first of all, I mean, I think that the WECC model and the eastern interconnection means PJM participates. You actually, at one level, have fewer participants in an eastern interconnection planning process -- you'd have fewer members, right? Because you have large RTOs to begin with.

I don't know why you couldn't create an eastern version of WECC that does planning and each RTO participates, and they fund -- they pay dues to fund the effort. I'm just not sure the WECC model can't work in the eastern interconnection.

And if it doesn't work, that means people are voting with their feet and for some reason saying they don't -- they don't see -- you know, it means the RTOs don't see great value in eastern interconnection-wide planning. And if they don't see that value, then that says something.

MR. KRAPELS: There's one reason why that might not work, Joe. And that is that some states in the eastern interconnect are kind of teed off at the RTOs and the ISOs, and you see more and more states -- and I'm sort of the default New Englander here other than our esteemed Chairman, the states of New England are beginning to plan their own energy destinies as if energy is a part of economic development policy. And you see that in New Jersey. I think you see that to a degree in Maryland and in -- even the great state of New York.

I think the NESCO model for New England might be a little bit where Joe is and where Bob is. Here the states have appointed a person to be the representative in a region wide now beginning to be a transmission dialog. And to a degree I think -- and that sort of -- if the best we can get is that, I think you can get New England there through the NESCSO process.

MR. KELLIHER: Can I respond even though I might tense some up?

I think one reason the New England NESCSO I think works, and OPSI works, and OMS work is each of those regions they actually have a sense that they are a region. Right? And I think New

England is a region that's mostly separate from the rest of the eastern interconnection in terms of electricity flows. So I know they're a region. They are tied to each other but not necessarily tied to anyone else. But if you had an eastern interconnection-wide version of NESCSO, how -- how pretty or not pretty would that be? Yeah, I mean, how -- how -- you, first of all, would have a lot of states that don't necessarily feel that they have any electrical connection to each other. Right?

I mean, would Georgia and Maine -- would they feel like they really actually need to plan the eastern interconnection grid together, that they're tied --

MR. KRAPELS: We're worried about Maine leaving New England and joining Canada.

MR. KELLIHER: Yeah, anyway, like part of it is I just think if you did have -- if you did have something like a joint board for the eastern interconnection state members, would that really work? You know do they have the same kind of common end that they would be pursuing?

MR. LAWSON: Regarding the WECC model and the east, I mean, without RTOs, ISOs covering the whole eastern interconnection footprint, I mean, it's -- effectively can't work at least the way it was initially described.

MR. KELLIHER: Unless you have -- well, the WECC model is people voluntarily participate in a process. They pay dues to pay for it.

MR. LAWSON: Uh-huh.

MR. KELLIHER: So my reference to the RTO is sort of, man, well, you get a lot of the eastern interconnect through the RTOs regardless of --

MR. LAWSON: Right. Right.

MR. KELLIGHER: -- necessarily what the members might think about the benefits of interconnection-wide planning And then you're left -- you're right -- with the rest of the eastern interconnection that doesn't have RTOs. Do those transition owners also see benefit in this process and then also agree to pay dues to fund it?

MR. LAWSON: Right.

MR. KELLIHER: Yeah. I agree.

MR. LAWSON: Well, and the other thing, NRECA and several of its members are actively participating in the EIPC initiative and think there's a lot of good things going on there. Obviously we want to see all three, you know, regional planning efforts continue.

One thing that we're not really talking about here is -- you know, we're talking around it, but how much money are we talking about? You know, I mean, maybe we should, you know try to quantify --

MS. GRUENEICH: It was 60 million.

MR. LAWSON: Well, that's what it was before? Or what -- I'm talking about going forward. I'm talking about going forward.

MS. GRUENEICH: Yes.

MR. COWART: We don't -- we don't have a going forward estimate as yet. We could try to develop one, but the 60 million was for all three interconnections for a multi-year effort. So you could come up with a -- yeah, it would be certainly less than 20 million a year.

MR. LAWSON: I think having some sort of quantifying - you know, some number here would be helpful for people to understand the scope and also being more specific about who it would be paying for as far as their participation.

I think, Barry, the document talks about trying to gain some efficiencies in a lot of different ways. I think that's very important. And it doesn't have to be done exactly the way it's been done so far and the way it will be done through 2013. We could -- you know, it could be changed. It could be streamlined. There could be a lot of different ways to get this number smaller but to continue the efforts, no doubt. And we strongly support that.

MR. MEYER: Let me just make a couple of observations here. One is that I think this question is timely, but it's not one that the Committee needs to address right away. It's important to start thinking about this because the money is going to run out. And it's not an easy question to resolve. But if -- one thing to thing about would be to have -- as some of these analytic products get developed this fall, we could schedule panels at future meetings just as we had today where we had key people from the west and the east and ERCOT as well come in and say, here's what we did. Here's what we've come up with. Here's -- here are the highlights or the key points. Here's what we think is important, and go from there.

So think about that. This is -- it isn't in -- most of the players have said, yeah, we learned a lot. We are learning a lot from this process. And the whole idea was let's give a broader set of people a common vocabulary, a common analytic framework to think about long-term electricity supply and transmission issues. Give them a realistic sense of what the options are.

Yeah, I mean, people walk into this

process with ideas about, well, I think this is an option. And then they find out (snaps fingers), hey, this -- there are maybe fewer options than you really thought that would work. So we're not expecting far-reaching consensus on these things, but it -- I think what we're creating is the basis for a much more cogent conversation on long-term electricity policy questions. And that's where a lot of the value is. But yeah, let me stop there.

MR. SMITHERMAN: Rob.

MR. GRAMLICH: Thanks. Well, I didn't realize the funding went through '13. Our wind tax credit expires a year before. So I should probably throw my hat in the ring for that job.

(Laughter.)

MR. GRAMLICH: I'm going to need a lifeline before this process.

And, frankly, I mean, the way things have been going with the eastern process, I'm not sure this is a super high priority to go find a ton of money for. I mean it's good to have people in the room talking who maybe haven't talked before, but I mean, we have been -- our efforts in there have just been battling over what should be objective facts. Right? I mean, people should be entitled to their own opinions but not their own facts. As Senator Moynihan said -- and we've just -- the process --

MR. CURRY: You're in Washington, D.C.

MR. GRAMLICH: I should know that by now. Washington's one thing; the EIPC is sometimes worse.

So anyway, I wouldn't say it's a huge priority just on that basis.

And in terms of what has been, I mean, I think Dian and Barry's point about the funding could be a lot less if the goal is just to get the right people together and have that dialog, then maybe the model is more what DOE has supported in the past in terms of the Western Governors Association's various efforts in the past, or the CD Act, the Clean Endeavors Fide [phonetic], whatever that was. Energy Advisory

Committee? Is that what it was? I don't know.

But supporting those region wide efforts to get the right people together, those are a lot cheaper. It's basically travel costs and some staffing. So maybe that's the type of thing that we should shoot for.

MR. SMITHERMAN: José, then we'll wrap up.

MR. DELGADO: Let me suggest that a long time ago, and perhaps in a galaxy far, far away there used to be 10 or 11 regional reliability counsels of NERC. And believe it or not, what WECC is doing is a result of that. There used to be one WECC then, and there's one WECC now.

And at that time we all did something we called planning. You know, whether it fits the requirements and the opinions of the folks in the room or not, it did. And in fact, it resulted in a network that is rather strong. And it goes from east to west, north and south as economics allowed it. And it was paid by the members. And the members included everybody. And NERC today does include everybody. I mean, the Canadians were there, and they planned with us.

Let me suggest that that could be a model that we can look at. It just happens that that organization is heavily influenced by FERC for good or evil. And that there's a certain amount of -- I think there's a logic that says that planning has always been an intrinsic part of reliability. I mean, none of us would ever deny that.

And that some semblance of joint planning has always been there. We -- I remember in the old Maine, which has disappeared, we used to -- all new transmission was vetted at the region because we wanted to make sure that what we did in Wisconsin did not create a problem in Missouri and vice versa.

So let me suggest that there have been mechanisms by which the industry did joint planning and a result of that a rather -- I mean, for the purpose of the time, it fitted very nicely. A very broad transmission network was built and that it seems to me like that included all the participants. Well, today it still does. We tried to reduce the number of councils, succeeded somewhat with maybe splitting Maine between two of them, but the fact is that we are -- we still have an organization that even though they have changed tremendously in role, still contain the bulk of -- well, actually everybody who is a NERC member is in one of those.

So there may be a possibility to go in that direction and recognize that this used to be a function of the councils and it's likely to be -- continue to be a function of the councils in the future.

MR. SMITHERMAN: Great. Well we've been 45 minutes on this. Rich, you want to -- do you have some concluding remarks and maybe --

MR. COWART: That's sort of where I was headed. It does seem to me that this conversation doesn't need to be resolved today. There have been a lot of good observations and a bunch of options for how planning might go forward, what kind of footprints might be designed for different planning regions and options for paying for the participation of states, and public entities, and NGOs.

And it does seem to me that this is an appropriate live topic for this Committee, and, therefore, for the Subcommittee. So I would say at this point, good discussion. And we need to, I think, further elaborate on some of these options and eventually come back to the full committee with some recommendations either to go forward with answers to those questions or to say, well, we don't have an answer or we don't think it's important.

MR. SMITHERMAN: Just to close the loop on this, in the white paper at the very end we had two recommendations -- one, the topic of our discussion. The second one was did we all agree that we would use cost-saving mechanisms to try to stretch our dollars further going forward.

Do you want us to do anything -- do you want us to take a vote on this or just sort of roll it over as we continue to discuss the whole topic?

MR. COWART: Well, I'm open for conversation on this point, but my thought at the moment was we should roll it over and that --

MR. SMITHERMAN: Okay.

MR. COWART: -- I think there's probably strong support for the cost minimization recommendation.

MR. SMITHERMAN: Right. Okay.

MR. COWART: It probably goes without saying. And that -- but as to the rest of the approaches and which one we or which ones we want to recommend to decision makers, I don't think we're there yet.

MR. SMITHERMAN: I don't either. Okay. More to come.

Thank everyone who participated in this. Mike, do you want to take about 10 or 15 minutes to talk about --

MR. COWART: Just one more thing, I guess I should also note I want to thank the

Subcommittee for the document which I think was very straightforward, readable, understandable, teed up the issue very well.

We have heard in the dialog that there are a number of other options that, you know, could be evaluated as we go to the next step. But still, this is a very good beginning.

MR. CAVANAGH: And, Mr. Chairman, I'm sorry, but if I could, I hope we've also heard though that before we make recommendations that change fundamentally the nature of the dialog -- and I'm happy to save costs, and I suspect that Dian is right, that maybe the consultant costs were one time and don't have to be repeated. But some of the recommendations in the document go to the nature of the dialog that's going on.

And I do think we need, at minimum, to hear from some of the engaged participants in both the west and the east before we recommend that because I don't want to inadvertently -- I am worried that some of our recommendations might fundamentally change that discussion in unfortunate ways.

MS. GRUENEICH: And if I could also just follow up, I would love at our next meeting, assuming it's after September, to get a report on what as the first report from these groups, that irregardless of it being something we want to think about on funding, to me, it's hugely important the work the they are doing and that our whole advisory committee, I think, should be aware of what does come out in this first set of plans.

MR. COWART: Okay. SO I'm hearing two recommendations really. One is about the agenda for a future meeting in which hearing about what's going on in these planning processes and hearing from participants would be valuable.

And second, we seem to be in agreement that we're not ready now to make a recommendation one way or another on how we would support an interconnection-wide or sub interconnection-wide planning process going forward, but that we want to continue to explore those options. And that -

- on the one hand, that's task for the agenda-setters for the next meeting. And on the other hand, it's work for the Subcommittee.

MR. SMITHERMAN: Okay. David?

MR. MEYER: I don't think all three interconnections will be ready to deliver by the next meeting which is in October. WECC will be ready, but WECC -- remember, WECC had a head start on everybody else on this stuff. And so the -- I know the east won't be ready until probably January, you know. And I'm not sure where ERCOT stands on their work.

MR. SMITHERMAN: I can probably find out pretty quickly.

MR. MEYER: So at any rate, I -- I'm delighted if people want to hear from the interconnections on this work, but it -- I don't think it would work out well for October.

MR. HEYECK: For -- I'm assuming everyone's gotten a -- the two-pager on grid security. And I want to thank the Subcommittee for the discussion and also Tom Sloan and Rick

Bowen in helping to produce the two pages.

The purpose is really to raise the issue of grid security beyond cyber security. The discussion around cyber security is in the hallways of just about any place you want to visit in Washington and other places. And -- but the remaining part of grid security seems to be relegated to the stockpiling of transformers, which I think through the EEI Spare Transformer Equipment Program, we got some of that done. But there's a larger issue of grid security which we've broken down into three parts, again other than the cyber security issue.

The reason why this is becoming a hot topic is high-impact, low-frequency events is being discussed by many Congressmen and others as an issue. And the reason why it's coming up now is because of the solar events that are upon us, the solar cycle, the discussions around high altitude electromagnetic pulse is also contributing to these efforts. And I think it -- we think it's really an important topic for the

Department of Energy to coordinate with DOD and DHS to talk about grid security in a larger sense.

We're becoming much more dependent on the grid today. As I mentioned about an hour ago, that even our toilet flushers are becoming electronic. But life as we know it -- food processing -- food distribution. If we have a widespread outage, it will cause harm to our economy.

Now the grid is very resilient in localized sense. When hurricanes come, when tornados come, the grid has been pretty resilient. Certainly there were outages, but those outages were -- those customers were restored, some in weeks, some in days with those events.

This is really something that occurs at a national level. Whether it's a coordinated terrorist attack or an event such as a solar storm.

So the three categories are grid planning standards, asset hardening standards, and sparing of critical components. The grid planning standards -- simply stated, we do have planning standards now, and they're in evolution through NERC. And those planning standards are, you know, n minus 1, single contingency, and double contingency standards. And they fulfill an ordinary sense of reliability. They do not fulfill the extraordinary sense of security.

And that is, if you take the top 20, for example, metropolitan areas, should we harden one or two corridors or build an extra level of redundancy for those major metropolitan centers.

Asset hardening standards, a little micro when it comes to the grid perspective. Asset hardening standards are if you've been following the dialog regarding solar storms and high-altitude electromagnetic pulse, there are things we can do as we replace the grid as we will do in the next 20 or 30 years. The grid today is probably -- about a third of it is getting close to its end of life. And over the next 20 or 30 years a large part of the grid will be replaced.

As we replace it, can we add -- for a modest cost can we add security in that? I'll just give you an example, better insulation for transformers. I was mentioning at lunch with David Meyer that probably the outside of our control center is the smartest thing we have in the grid are control buildings. Can we replace control buildings in a better way to secure them not only physically but from an electromagnetic pulse event?

And lastly is the sparing of critical components. And this we're addressing, as I mentioned, with the EEI Step Program, but are there other critical components that need to be replaced?

Now I've spoken about the grid, but as -- as I mentioned in one event that we had with Congressman Franks of Arizona, we could spare the grid and harden the grid for these events, but if you don't have anything to plug into them, what good is the grid? So I think the Department of

Energy is also in a good position to harden critical load devices such as motor control systems for water treatment or sewage treatment and so on.

So there's a pretty big scope here of the electric grid not only on the transmission and distribution side but also on the supply and demand side as well.

I'm going to stop there and open up for discussion.

MR. SMITHERMAN: Thoughts? Dave?

MR. NEVIUS: Yeah, Mike knows this, I'm sure; some of the others may also, but NERC has established an Electricity Subsector Coordinating Council that developed a strategic plan for critical infrastructure protection. They spun off four different study groups, one dealing with spare equipment, one dealing with geomagnetic disturbances system resilience following severe -- or in response to severe events, and another one that I cannot recall offhand. But I think some of that work can feed into Mike's issue here in terms of the security of the grid and encourage the Subcommittee to follow that closely.

MR. SMITHERMAN: Let me ask you this: We don't want to be repeating any work that anyone else is doing. Is NERC -- are these subcommittees handling this in an appropriate way so that we could go off and do something else?

MR. NEVIUS: Some of it, yes. Not necessarily some of the things that Mike mentioned about hardening control centers and providing additional protection for critical loads, but they are looking at a broad range of critical infrastructure protection issues. So I think the two can complement each other. And we can -- we can make sure that you connect with the right folks who are directly involved in those different studies and in the Electricity Subsector Coordinating Council itself.

MR. SMITHERMAN: Wanda.

MS. REDER: Yeah, just speaking in behalf of support of the three areas that you've come up with, I think from a hardening perspective we've certainly seen situations where we do need to look at hardening, both on the critical infrastructure itself and also on the security part, and some guidelines or direction here could give folks like IEEE, and NIST, and NERC, and others that have subcommittees that are kind of grappling for direction a place to focus. So I think -- I think it could be very valuable, just not necessarily to get into the details but to provide some direction.

And also on the EEI effort for critical spares and transformers, we made some good progress as an industry, but that's only the beginning. So to the extent that we could take it the next step, I think it would be worthwhile.

MR. SMITHERMAN: Sonny.

MR. POPOWSKY: Yeah, thanks. Just a minor point on the document itself, there's reference, for example, to cost recovery. And one of the questions is how can DOE engage NARUC, RTOs, and FERC on cost recovery. And I consider part of my job to make sure that we get consumers in that alphabet soup a couple of times that when we're talking -- especially when we're talking about cost recovery that you will -- that we will add -- if not our association, NASUCA, at least references to, you know, consumer representatives. And hopefully, that will be true throughout the document. Thanks.

MR. HEYECK: It was not meant to exclude.

MR. POPOWSKY: Sure.

MR. SMITHERMAN: Barry?

MR. LAWSON: Just a couple quick things. There's a lot to consider here in this document in two pages, and I think a lot more discussion is needed at the subcommittee level on this. And so I don't want to do much of that here, but I will say that we do have to think about costs. Who is paying for all this? I think we know, and I think we have to be cognizant of that as we -- as we move forward on such a document.

I'm not quite sure where -- ultimately, where are we going with this -- with this issue here? As an EAC what are we -- are we simply trying to advise DOE on things they should be doing, or are we going broader? I mean, we're -- we're talking about legislation may be needed?

I mean, personally, I think we should stay away from that. There's so much going on on Capitol Hill right now in the Senate and the House on legislation. And all of our respective stakeholder groups are involved on the Hill right now. And I think we should be very careful about inserting ourselves into that. NARUC, EEI, NRECA, APPA, EPSA, ELCON -- every three, four, or five letter entity you can think of, we have a coalition that's together right now that is working very closely with all the different offices on the Hill. So I think we should be very careful about saying anything about legislation.

On the -- on the NERC activities, there is a lot, as Dave mentioned, going on at NERC that I think parallels a lot of -- some of what's in here, especially the spare equipment side of things.

The EEI Step Program, while no NRECA members are part of that -- and it's primarily because of -- most coops are RUS funded, and we can't spend money to benefit another party. But the EEI Step Program is -- doesn't include all the EEI members. It includes a good chunk of them, but it's also very scenario specific. It doesn't start -- it doesn't do anything until the President declares a national disaster.

So while it's a good program, we need to be careful about how we're representing it here where we're saying that the EEI Program is on behalf of the electric utility industry. I think it's a good program, and it should be in here. It should be recognized, but we need to be careful about what we're making it out to be.

The NERC side of things, I think, is where a broader industry focus is being brought to the spare equipment, not just transformer but spare critical equipment, long-lead-time equipment -- work is being done, so I think we have a lot to talk about on this, and there's just many, many issues in here, and we can do that more at the subcommittee level. Thank you.

MR. SMITHERMAN: Tom?

MR. SLOAN: Thank you. Several times today members of this table, probably including myself, have raised the issue of the ultimate cost and who's paying. It's the customer.

And I struggle with that because I think we need to be addressing is it more important to be worried about the overall cost to the consumer or more important to be stressing system reliability. I mean, outages get much more hostile reactions than do rate cases, notwithstanding the little old lady who spit in my face one day.

But the issue for me is if we believe that in this case hardening the system is ultimately a larger benefit to the consumer than another nickel on their electric bill per month, then that's what we need to be advocating to the Department, that they make this a priority --

that being an example. I mean, we've had other examples during the course of the day.

So, I guess I -- I would rather we focus more on defining what are the priorities of maintaining an electric system and then working with the Department to establish with other parties time lines or frameworks for accomplishing whatever we're advocating.

MR. SMITHERMAN: Pat?

MS. HOFFMAN: I would have to agree with that and, I guess, poll upon the -- what the Subcommittee probably needs to do is meet with -- and David left, so since David left, I'll put him on the spot -- is meet with NERC and talk to them about some of the things they're working on so we get an understanding of all the activities that are going on in this area.

But I'll reemphasize what Rhonda -- Wanda brought up, and that is where are some of the strategic guidelines, or what are some of the strategic decisions that need to be analyzed, and what information needs to be put on the table, specifically with respect to what are the expectations, security, and cost.

And then I go back to what work needs to be done with respect to hardening -- you know, what work is -- there has been a lot of work looking at the transformers right now with respect to GIC. Maybe we need, as a committee, to look and review all that work and say, what additional work needs to be done, and bringing clarity to the subject, and also providing a little more certainty with respect to expectations.

So the questions are good. I think we need to continue to work on them so that we can actually -- from my point of view it's going back to what further analysis needs to be done and what are some of the strategic questions that, you know, somebody should ask DOE and we should look to consider providing some solutions for.

MR. HEYECK: I just wanted to make a few comments based on the comments already.

First, Congressman Franks proposed the

SHIELD Act that was out there, and there was a conference, and then there's a conference in London in March. So this is getting wide -- widespread interest.

The problem with the SHIELD Act was the time line. As usual, it -- you know, we've got to do everything in four years. And really, the time line would be cost prohibitive let alone you can't get the labor to do it.

So the notion here is to try to develop some sort of, really not cost prohibitive, but as you're replacing the assets themselves, to come up with ways to do it that hardens the network.

For example, the most intelligent part of the grid outside of the control center is the control buildings that we have in each of our substations. We're developing a plan right now to do drop-in control buildings because refurbishment of control houses today are really a hodgepodge. And you could actually do a drop-in control building for half the price.

Having said that, you could develop a

cage approach for electromagnetic pulse for very little cost. You could shield the cables to the breakers -- very little cost.

What does become costly is if in the planning standards we want more redundancy for places like Washington, Philadelphia, New York, Chicago, L.A. That might mean more transmission. But I would imagine the cost is likely to be somewhere on the order of a nickel, as Tom suggests, rather than five dollars.

So as we move forward, there's a lot of efforts going on, but NERC's efforts are still in discussion phase right now. And there are some gaps that they have. And I'm not sure about the DOD, DOE, and DHS role in the NERC efforts. If that's not -- if that's a gap, then that's the effort that we need to fill.

MR. SMITHERMAN: Rich, you want to -- or did you want to summarize?

MR. COWART: Starting. I think Pat already said it quite well, actually, which is that going forward it sounds like the

Subcommittee -- you know, Barry's recommendation that the Subcommittee continue to work on this makes sense. And Pat's suggestion that they do so by sitting down with NERC to see what the NERC committees are doing so that this committee can complement and not substitute or duplicate what they're already doing. And that would be my recommendation to the Subcommittee.

MR. SMITHERMAN: Okay. Sounds great. Thank you for the Subcommittee and the Subcommittee work on this -- more to be done.

I guess in the last seven minutes that we have before public comment, the third subtopic we had -- and there's a white paper on it -- was the interdependence of the electric system infrastructure and the natural gas infrastructure.

Take a look at it. I did talk to Dave a little earlier. He's already left, as we noted. Apparently NERC is doing quite a bit of work on this, and it almost occurs to me that others are doing a lot of this topic, and so unless there is a compelling argument the other direction, we may not want to spend any more time on it, but I’m open for comments. Ed?

MR. KRAPELS: I'd actually like to promote that we be a little bit more active than that because one of the -- I think the issue of portfolio diversity is kind of above NERC's pay grade. They look at specific fuel issues for sure, but one of the things that's always struck me as odd is that in the ISO capacity market designs no value has been placed on portfolio diversity.

So, for example, I know Gordon, if he were here, would be talking about in New England the chances are terrific that we're just going to close a lot of old oil and coal plants and we're going to replace them with gas plants. And the concern about tremendous reliance on gas could be abated if, for example, wind was given some sort of portfolio diversity value that it doesn't get today. But today in the capacity market pricing -- this gets back to our issue of have we designed these markets perfectly -- and we haven't. This question of portfolio diversity is something that, you know, we ought to think about a little bit more. And the gas dependence issue is sort of how I suggest doing it.

MR. SMITHERMAN: Tom.

MR. SLOAN: I'm not familiar with what NERC is doing, but one of the comments that I provided you indirectly was that we need to have, I think, the DOE looking at the infrastructure integrity of the existing pipeline system.

It's not just enough to say, well, there's a capacity to move these many million cubic feet or that we need to build a new line so that it'll serve this power plant. It's -- a lot of those transmission lines have been in the ground for 40, 50 years. And while they are, you know, supposedly annually inspected, we still have to look at what their lifetime expectancy may be.

You know, it was the distribution system that, you know, blew up in California. But it's just as conceivable we could have some significant infrastructure problems in -- on the main transmission systems.

MR. SMITHERMAN: Well, I agree with you. We sort of headed down this direction because of three things: One, I think a general assumption we're going to burn a lot more gas to make electricity in the future, so we're going to be prepared for that. Two, is the existing system adequate and safe? And three, as we discovered in February, when you began to curtail electricity as a result of some weather event, you oftentimes or occasionally end up turning off natural gas-gathering processing distribution system which further exacerbates the problem.

So we have told our utilities to make sure they have very good information about where those natural gas processing, and distribution, and transportation facilities are because they didn't know exactly because so much of it had been developed in the last two years.

So, Rich, this is sort of where we are on this. I mean, it was kind of thrown together at the last moment by my staff. They did a pretty good job to tee it up, but we would look for you-all to give us some further direction.

MR. COWART: Well, here's my thinking on this: Pat and I have been discussing how to move this one forward. Lauren did mention this.

I have two observations: Lauren mentioned this issue as the -- as an issue that she's thinking about and would like some recommendations on. And secondly, as we discussed this morning, there is going to be an increasing reliance on gas for a variety of reasons, including the need to balance the existing penetration of renewables on the grid.

And recognizing that in conjunction with the point made earlier that there have been instances of constraints with basically gas versus electric generation competition in inadequate firm (1:12:28) capacity, it is appropriate for the Committee to perhaps put a couple of recommendations in front of DOE on this.

And my reaction to the draft is the same as Barry just said. I think it was put together well, probably needs to be reconsidered or edited again by the Subcommittee, and come back to us but that this is something we could advance with relatively -- a relatively small amount of work, both at the Subcommittee and at our next Committee meeting.

The basic recommendations here are pretty straightforward.

So I guess I would urge any member of the Committee who's got -- who would like to suggest wording changes or to amend the recommendation paragraphs to just send those in. I have a couple of recommended changes, and I will send them to you, Barry.

MR. SMITHERMAN: Okay. Great. Thank you.

MR. COWART: That sound right to you?

MS. HOFFMAN: Uh-huh.

MR. COWART: Okay. Anything further from

the Subcommittee?

UNIDENTIFIED SPEAKER: Nothing.

MR. COWART: Okay. Thank you very much. I --

MS. HOFFMAN: And I'd also like to thank the hard work of the Subcommittee on this.

MR. COWART: All right. We're at the public comment time on the agenda. And we've got three people who have signed up to address us. And I can invite you each to come forward and sit at one of these mikes so that we can get your comments in the transcript.

The three -- the people who signed up are Kevin Messner, Jimmy Glotfelty, and Praveen Kathpal. I apologize if I got the names mispronounced.

MR. GLOTFELTY: Am I the only one who persevered?

No, here comes another one. Great.

MR. COWART: Okay.

MR. GLOTFELTY: Should I go first?

MR. COWART: Yes. Is Kevin Messner here?

Okay.

MR. GLOTFELTY: Members of the Committee, my name is Jimmy Glotfelty. I'm with a company called Clean Line Energy Partners.

Great discussion today. You all have done a lot of work, and it shows. Interesting that many of the issues that you're dealing with were ones that I dealt with when I oversaw the Electricity Advisory Board many years ago. So -- but y'all are making progress. It's nice to see, and I appreciate your efforts.

At one point in time I think there was a -- the Committee or the Transmission Subcommittee was going to consider looking into opportunities to use Section 1222 of the Energy Policy Act as a mechanism to build infrastructure. That is very high on Lauren Azar's list. It's something that the Department of Energy has gone down the road with even so far as to put out a request for projects in the Federal Register. If, in fact -- and then there really hasn't been much movement after that.

What I would encourage the Committee to do is to actually look at that and figure out if that's something that the Department wants to do and advise the Department on that. It's a -- in my opinion, a very viable statute. It was modeled after the way Path 15 was fixed in California in three years, one that -- a bottleneck that hadn't been fixed for a decade prior to that.

And what it really is is a partnership between western -- or Southwestern Power Administration and the private sector. It cost no federal money. It's all private sector dollars. There are some attributes that have to be met that are in the statute as well as in the Federal Register Notice, but 1222 is not for everybody. It's not to solve all of the transmission or renewable integration issues across the country. It is a tool in the toolbox.

And I would encourage you-all to look at that and to advise DOE that it should be used for the integration of renewable energy. Our projects are DC lines, so we don't really fit in any planning structure. For that matter, we don't really fit in any interconnection structure within the RTOs, but we believe that it is a viable structure. It will allow us -- if a partnership is approved with DOE and Clean Line, we can get into NEEPA now. We've got partnerships with environmental groups across these states. We've had hundreds of public meetings at the local level. And it will mean thousands of jobs in the wind business in the wind belt. Some of the best wind in the United States in Oklahoma, Texas, Kansas -- and that's what we want.

I think that's one of the charges that this Committee is looking or is trying to achieve is to increase the amount of renewables in this country.

So I appreciate the time that you've given me, and if you-all have any more questions about 1222, I'd be happy to give a historical background, but if you would like a presentation on our projects, we'd happy to do that as well, so thank you for your time.

MR. COWARD: Thank you.

MR. KATHPAL: Good afternoon. And thanks to the DOE and to the Committee, especially those of you who stuck around for the chance to speak.

My name is Praveen Kathpal. I'm with AES Energy Storage. We're a group that's part of the AES Corporation headquartered across the street actually. And what we're working on in our energy storage group is replicating the IPP model that was pioneered by the founders of our company, AES, 30 years ago with energy storage project development.

So in doing so we have 88 megawatts of reference projects -- commercial projects that I think are reference points for the industry either in commercial operations or under construction right now. And I think those -- those serve as a bridge to some of the more serious deployments of energy storage that this Committee was talking about.

I think the conversation -- the exchange between Terry and Ralph from NRDC highlighted what one of the key missing ingredients is in really moving energy storage deployment forward, which are the PPAs. And if you look at the -- if you look at the deployments that the IPP sector -- the way that we've brought innovation and efficiency to the generation side over the past 30 years, PPAs were key in doing that from, you know, the early Cogen projects to the wind. Ninety percent of the wind added in the last two years was by IPPs.

And I think a good example of that structure is a project that we've proposed recently. It was an RFP by the utility in Long Island seeking peaking capacity. And we proposed a 400 megawatt project -- 400 megawatt, 4-hour storage project to fit under a PPA structure.

So we believe that's a viable structure. We believe there are benefits that storage brings that aren't counted in the conventional procurement process right now. I think if the

RFPs had contemplated storage before they were written, then there would be better evaluation framework for the benefits that storage brings. And I think that's something that Ralph Masiello mentioned, a pending evaluation framework may be helpful in doing that. Until then our options are to propose that under the capacity and renewable RFPs that are issued seeking PPAs, but I think there's -- there are a lot of places where federal and state policy can act to improve those processes.

And I think the other thing that came out of Terry and Ralph's exchange -- sorry, confusing that we have two Ralphs -- Terry and Ralph from NRDC's exchange -- was that we should be seeking to meet our needs. So not necessarily a resource specific portfolio standard or, you know, however you'd want to structure that but to be resource neutral, the real need that we're trying to fill right now is for clean, flexible capacity. We have had a lot of mechanisms to add clean energy onto our grid, but we're coming up with a shortage of clean and flexible capacity. So I think if there's room to add anything to a portfolio standard, it's to seek sources of clean capacity. Thank you.

MR. COWART: Thank you very much.

Is there any further business for the Committee? Pat, David, Peggy, any announcements? Anything we need to do?

(No response.)

MR. COWART: All right. I want to congratulate you all. And thank all the organizers of today's events for bringing such terrific people to the Committee.

And once again and as always, thanks to NRECA for hosting us. We really appreciate it.

And if there's no other business, I think we're adjourned. Thank you very much.

(Whereupon, at 4:24 p.m., the Electricity Advisory Committee Meeting was adjourned.)