UNITED STATES DEPARTMENT OF ENERGY

ELECTRICITY ADVISORY COMMITTEE MEETING

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P R O C E E D I N G S

(8:10 a.m.)

CHAIR TIERNEY: Morning everybody. You guys are on time and we're starting late. So apologies for that, great to see you all this morning. This was a great meeting yesterday. It's really nice, appreciate so much the work that you guys did to put the panels together, that was great. Pressures on for the next meeting I'd say.

Our first presentation in the beginning of the morning will be the Subcommittee presentations. And as I mentioned yesterday we're having one panel presentation on the MIT study. And then we are very fortunate that Cheryl LaFleur will be here. So with that Anjan, you're up.

MR. BOSE: Okay. This is the grid modernization initiative --

CHAIR. TIERNEY: By the way you get 20 minutes even though we're starting late.

MR. BOSE: Oh, good. I thought I would be done in 10.

CHAIR. TIERNEY: Exactly.

MR. BOSE: Okay. We have been -- this is the working group and we been looking at the grid modernization plan. And the grid modernization projects that are going on. And we are in the last -- between the last meeting and now we been trying to come up with an outline of a report that the EAC will submit to DOE.

And so, let me tell you what we have come up with so far. It's just an outline not quite a draft yet. So first, I just wanted to go through report structures, it's not going to be very different from the usual executive summary introduction. Overview of the projects that are going on right now. And then some words, some section on why the grid modernization research is different from doing component or technology -- specific technology research.

And then finally, recommendations. And the whole idea here is not to make it too large, ten to fifteen pages most. And with an executive summary of two to three pages. So I will actually -- my presentation here is sort of going

backwards. Meaning I'll tell you what the major recommendations were that we came up with yesterday morning.

So the main thing -- we didn't want to go in to saying here are some new things that you ought to be doing. Because there's a large amount of stuff that is being done already. And it's all on target. So wanted to start up the recommendation list by saying, the grid modernization initiative has been taught up for the last three or four years. And have come to the point where a lot of projects are already in place and they're on target.

All we are saying here is some of things we need to maybe do a little bit more of or think about. So the big one, the first recommendation is that I think we should be going towards simulation platforms that can support the large-scale grid simulations. To be able to do research on planning and operational control of large power grids. And this is still kind of a missing piece. And so that's one of the major issues.

The whole problem it's not only just -- I mean there are a lot of simulation platforms doing specific things. Some do planning, some do sort of a transom stability, some do all kinds of things. But there's not one platform to do a big thing. And then the other thing that's missing very much, is that these are usually doing either only transmission or only distribution. It doesn't really have the ICT layer in it, and so on.

So what we're saying is we need a kind of large platform. I'll tell you in a minute why -- the problem is this -- I'll tell you why this is more of a national infrastructure public good kind of an effort here. Rather than somebody who's trying to sell another piece of software is going to build something like this.

So this is for the big grid. Now, where it becomes a little more tricky is that subsystems. So if you're going to check out some new controlled distribution feeders, you can do those in smaller labs. Not only simulation, but

it can have actual laboratories, RTDS facilities. All kinds of things that are specific. So we kind of envision there's going to be a lot of these. This is still not talking about, are we going to test out a new battery or we're going to test out a new controller. That's not it.

This is still systems, but maybe not as big a system as the eastern interconnection, okay. So then couple of other things, smaller impact on the grid of new technology. So this is the thing that we really want to get across, is that there are places in DOE where people are working on storage, on transformers, on different technologies. The thing is the grid modernization initiative is not about those technologies. It's about when you put -- how does anyone of these technologies, if you have plenty of them how does it impact it.

So it's not a question of testing out a battery, we want to know what impact a few thousand batteries are going to have on the western interconnection. So that's a different --

that means that we have to model these batteries, you have to have the equations, you have to develop the testing all of those kinds of things. And then the last one is we talk about the policies are always very much integral to making any of these system wide things happen.

And so, what are the hurdles, what are the -- this is not necessarily research. But it's something that if you're not aware of and cognizant of you're not going to be able to just throw this new idea across the transom and expect it to just to take off. Okay. So that's the recommendations we want to -- that's the last chapter of our report. The previous chapter we would like to sort of point out that grid research is different from component research. Because we're talking about efficiency, reliability, flexibility, resiliency of the large system.

And we're not trying to develop new batteries. We're not trying to develop new windmills, right. So that's the big difference. And so, the systems kind of issues, you know,

appear in planning, operation, control, analysis, simulation. All of these things which, you know, sometimes we lump into this word called analytics, but it's big analytics, right. So once you get into the big grid, there is no way to test the big grid except in simulation.

Nobody's going to let you go and fiddle around with the western interconnection. So you've got to have enough believable simulation capability, that says if you really change this way of operating then it will really be better. Because here's what's going to happen and -- for let's say for efficiency or maybe resiliency of the grid.

So that leads right into our first big recommendation which is the system large platform for doing large systems simulations. And the subsystems are components as we said can we do with hardware and so on. So there will be a chapter on that sort of describes what projects are already going on. You know, there's a mixture of very fundamental type projects. Where

questions that are trying to be answered. Like interoperability and architecture -- new architectures for the control centers and so on.

We will do sort of rough description of all these projects. Just to tee up the recommendations. And then the introductory chapter, you know, there's been a lot of work over the last several years at DOE. Kind of, you know, in the QER and QTR and the multi-year program plan for grid modernization. And coming up to this set of projects that are going on now with the labs.

Our working group actually got quite bit of stuff done on the webinars are people actually working on this projects, briefed us on what they were doing, and so on so on. I wanted to kind of in the early chapters, kind of say that there has been a lot of thinking in this already taken place in DOE. And of course, they'll be an executive summary.

But I wanted to leave you with a couple of thoughts here that we talked about quite a bit yesterday morning when the working group met. And

this idea -- the tone of the report is kind of important, why is this important? The main thing is that the grid is a critical infrastructure and it is a system, it is not a particular thing. And so, the resiliency

(inaudible) efficiency of the whole grid is a public good. And not so much a private good.

Not so much somebody says, well if I develop this gizmo and we can put a few thousand of these on it, then it's all going to be better. Well, we don't know that. We can only tell what the gizmo can be tested. But we can't tell what would happen -- as you know what I'm referring to is that fact that it's still not a very clear cut answer. As to if you have 10 percent solar as opposed to 70 percent solar, how will the -- what will the grid look like. Is the grid even operable if you have 70 percent solar? So those are the kinds of questions we would like to answer in this thing.

So the idea is that the R & D for grid

modernization is qualitatively and quantitatively different from the R & D for component technologies, okay. So and the other thing the last thing I would say, is that the grid modernization is actually quite the research needed, is independent of what is happening to the grid. Or saying it another way the grid will have to handle whatever is happened to the grid.

So 10-years from now somebody's got to operate this grid. Doesn't matter how much -- what the generation mix looks like, how much technology you put into it. What is the cyber security threat, you still got to operate the grid. And so the grid has to have this flexibility and so on. That has to be built into it. It's not like we have said the grid 10- years from now should look like this. So let's just build one. It just the world doesn't work that way. So I'll stop there and take a couple of questions I think.

CHAIR TIERNEY: I have one.

MR. BOSE: Okay.

CHAIR TIERNEY: There's a big fat amazing statement in your third bullet. About the grid being a public good. Now, the resilience, security and efficiency of the grid is a public good. And yet, we support it as if it is a private good. I mean the only way that it is paid for is by people who use electricity and pay the providers of electricity.

So is it that you are suggesting that the R & D that's essential for all of this, is the public good, to support the private delivery of electricity. Are you arguing that there really is some socialization of costs, that needs to happen in order to make sure that this grid stays in place in the future? Or what...

MR. BOSE: I'm saying that there has to be some socialization of the cost of development. And the reason -- yes, it is ultimately somebody is making money off the grid. Because the pieces of the grid belongs to private organizations. And so, they're making their money on whatever the rate structure is for retail or wholesale

whatever.

But my point is that this R & D -- the reason DOE needs to do this R & D, is because none of these players who are making money off the grid are going to do that R & D. Because they're not interested in -- you see they don't make money because the grid is 5 percent more reliable or 20 percent more resilient. They don't make money because of that. We set the reliability standards, we set -- (inaudible) sets the standards to get to that so that's good for the whole country and good for everybody. Does that make sense?

MR. ZICHELLA: Thanks Anjan. One of the things we talked about a little yesterday, I don't see it reflected here. It's a little bit in your fourth bullet about the development methodologies for the planning design and operation of being of the national interest. We did talk a little bit about yesterday, the imperative for the United States to maintain its competitive leadership in developing some of those technologies as well and

the approaches to that. Couldn't help but noticing that there's a story in the New York Times this morning. About China baking into its 5-year plan. A real leadership role for itself and climate litigation. Which extends to the electricity sector as well. It's not just China of course, we're seeing innovations and the same exact conversations we're having occurring in the EU for example. About grid modernization and coordination too.

I'm just wondering if your fourth bullet was meant to pick that up or if you're -- you think that that has a place at least in the early draft of the report.

MR. BOSE: I don't know that I will actually explicitly thought of that. We did talk about this yesterday about the competitive nature of grid. The big issue of course is that -- unlike say China which is building out their grid. And their grid is going to be a lot bigger in the next few years, than ours are going to be. Because our load is not growing and so our grid is

physically not going to get a lot bigger.

By that I mean the total megawatt hour consumption is probably not going to be much more than where it is. So yes -- but then the question is our industry the American manufactures and so on are competitive in this area. So one of the -- but I think your point is well taken and I'll note that to include. Because I don't think anybody has this level what we're suggesting of testing and R & D.

Nobody has it yet in the whole world. So -- I mean China is probably the closest in trying to get the biggest platforms they can get, then anybody else. But it still lacks.

MR. ZICHELLA: Yeah. And it's a global market for the products.

MR. BOSE: Right.

MR. ZICHELLA: You know, so there's an opportunity for us.

CHAIR TIERNEY: Thank you Anjan. That was great. We're looking forward to seeing the draft.

MR. BOSE: Next in June.

CHAIR TIERNEY: That's right.

MR. BALL: Hey, Sue.

CHAIR TIERNEY: Yeah. I'm sorry Bill I didn't see it.

MR. BALL: Well, I was just going to say-- I actually like the thoughts of the group. I would say this from a grid operations perspective. You run into as many conversations around the future which is uncertain. Therefore, like you were mentioning Anjan, the grid needs to be able to put itself in a position where it can handle the different uncertainties. That would be -- from a grid planning, from a grid operations perspective. What I filter all that to say, you need margin, you need flexibility.

MR. BOSE: Yep.

MR. BALL: Some of the conversation yesterday in and out of those really good panels. You also heard questions around -- well by some other metrics, you have components of the grid that aren't operated on a high percentage of the

time close to their capacity. And isn't that a shame these two things are obviously in conflict.

So as an operator when I hear folks advocate let's come up with things that will help us operate the grid. Closer to the edge, closer to its full capacity. I hear more outages. Because even as good as we think we might be to ever predict tomorrow's reality. I mean, we're just not as good as the models might say we could get. So that's actually the type of tools you're talking about. Might be helpful in trying to give more information to help balance those two kind of bookends of the spectrum.

Because an operator can give me all the flexibility you can give me. That makes -- you know, any operator would want that. But that all comes with the cost and I think that's your point. And you're right, there are very -- it's very difficult to -- especially over a large area to make a really good analysis onow much margin should you be willing to pay for. So I think it's a great idea.

MR. BOSE: You know this came up in our conversations yesterday, in this way. You know, we see lots of studies which say, you can have 70 percent renewables or 90 percent renewables. And you can meet your load 98 percent of the time. Well that leaves a lot of hours that you have to face without enough power, right. And what we have lost is we use to be able to calculate the loss of load probability, very nicely.

Because we used to know the statistics of the outages of all the big central generating plants. And now we have no clue, when we're going to run out of power because we don't know what the statistics are for all our solar and wind. We don't even -- some times we don't even know if they're turned on or turned off or even connected. So it becomes impossible to calculate exactly -- and those are the types of tools we have to have to give us that confidence.

CHAIR TIERNEY: Thanks Billy, and I would just -- is yours directly following up?

MS. LIN: Janice. Okay super quick.

It's occurred to me that this work that you're doing has a lot of synergies and potentially is related to a white paper the energy storage Subcommittee is working on. And I don't want to steal Merwin's thunder from his presentation later but in this white paper, we're developing scenarios of what a very high penetration of energy storage in the future could look like, which could inform this grid modernization vision.

And I guess the thing I wanted to suggest is we'd like to work with you to find out how our thing could be most helpful for you. So maybe we can chat today. And two, that looking out into the future, it would be good not to just make the assumption that reliability will be sort of centrally planned and operate. Cause one of our scenarios for the future is it may happen. And kind of a more transactive peer to peer scenario. And so, the function of the grid itself could be really different, so thank you.

MR. BOSE: There's a lot of overlap between the different groups with the EAC. And

some things come up and we have tried to keep this one very systems oriented. And we're not worrying about whether storage is going to solve all problems or solar or whatever. Because we're going to get a combination of these things and we want to know what the impact is going to be of everything together.

CHAIR TIERNEY: Great, thank you. I think John Adams, you're up next.

MR. ADAMS: You know, I'm walking up here in a panic. Did I spell Heather's name correctly? Actually, did I even get her name correctly. I was really worried. Power delivery Subcommittee we had an in person meeting yesterday, that I thought was delightful. We haven't had one of those for a long -- in fact it's the first one I've ever been to. So I was very pleased. And we set them up for the next EAC meetings as well. So I feel like we made a lot progress there.

We only have one thing going on now, that's the transmission distribution interface

topic, that our panel was about yesterday. I'm pleased with the results of that. What we're worried about is, okay the same thing everyone's talking about. The increasing penetration of distributed resources. Hey, there's a possibility energy could come up from the distribution system.

As Woody mentioned yesterday our state estimator says, oh no, that's impossible. So we actually zero any observations of energy coming up from the distribution system. Which hey, if we get greater penetrations that might be a problem, just maybe. So we're working to understand how different regions are dealing with the increased penetrations and moving forward towards that. We have this plan for a report on the transmission distribution interface going forward.

The good news is that Heather has kindly agreed to take the leadership in that report. And to be the vice chair of this Subcommittee. So I can go back to sleep and I really appreciate that. I need to figure out how to change the page. So the plan is to conduct phone interviews, this is

basically the same thing I said yesterday.

Similar to the work of the storage Subcommittee. I want to thank Ramteen for giving us that direction. I think that worked very well. So we're planning on copying that. We had the panel yesterday. Preliminary work target is that by the June meeting, would have developed the questions that we're going to use on those interviews and target interviewees. How many people are we going to talk to, what are we going to talk to them about.

By September we hope to have completed the interviews and aggregated the data and developed a report outline. What do we think we're going to talk about, what input did we get? And by next March 2018, have something to present to the full Committee.

Other things we did at the meeting, we brainstormed about what our next product would be. It's all just brainstorming I can talk about that if you want to chew some more time up. But I don't think we have the need to chew some more time up.

So I'll just take questions.

CHAIR TIERNEY: Well, I know I have one. As you guys think about this issue, which is so massive and really important,how are you thinking about what is really the focal point? Are you thinking about the audience being the industry at large? And/or the Department of Energy's research platform and/or something else. How are you thinking about really what are the driving questions?

MR. ADAMS: I'm going to give what my thoughts are on this. Then I'm going to ask Heather to speak up. I guess our intent was to give feedback to the Department of Energy, on where are the gaps and what's going on. After having talked to the various regions of the country with different -- I don't know how say that, it's not really infrastructure. It's different social structures around the grid. And I guess my concern is being from that province of Texas, it's a little different from the rest of the universe.

CHAIR TIERNEY: That country of Texas.

MR. ADAMS: Can I say that in this forum. I worry about the solutions that are developed in the larger universe, fitting our little market design. Heather, do you have any thoughts? Anything else.

MS. HOFFMAN: This is Pat. I just have -- I guess one thing that I would like to see is, where do you also see some of the leading-edge work, you know, some of the gaps but also, the leading-edge work. Some people are talking more to moving towards D.C. line and D.C. capacity. You know, where are the trends and what work needs to be done in the United States. If those -- some of those forward leaning technology and system innovations would be, you know, our opportunities for the United States.

MR. ADAMS: I am too ignorant to have an answer for that. I can put that on our list of things to look at for this paper. And I'm just going to ask, does anyone else have an answer to that question?

CHAIR TIERNEY: Phyllis.

MS. CURRIE: I'm not going to answer that question. What I am going to point out is I think that we also have to look at the different models in the industry. Because public power and the coops have a very different approach. Now, that doesn't mean that they can't be laboratories for some of these changes. Because their ability to get the funding and the approvals is different than from the IOUs. So we just have to keep them in mind.

MR. ADAMS: Pat, let me. I wrote down what leading edge research needs to be done in this area. Does that capture your thought, thank you? Anything else?

CHAIR TIERNEY: Go ahead.

MR. GELLINGS: (Inaudible) what you just said, kind of captures it but we keep using the word storage here and there. But we forget that there is a strong potential for a lot of innovation yet, in technology in the power delivery system. We haven't mentioned the word

power electronics in a number of meetings.

And, you know, advance power electronic devices apply differently -- applied to a variety of switching and monitoring locations around the power system. There's a lot yet that can be done. They're all big buck R & D items, but I'm a little concerned that the EAC is drifting more towards investing itself in policy discussions. Than it is to be focusing on what is the fundamental mechanisms to take power from generation of any kind, and deliver it to customers. And that's technology.

MR. ADAMS: Clark, I'm going to do the same thing I just did to Pat. I captured to be sure to address the potential for power electronics in particular in technology to improve this interface.

CHAIR TIERNEY: I would add one other thought for you guys to keep in mind. And it links together Billy's point from a minute ago and Anjan's work as well. As we look forward to a world in which there's much more reliance on

distributed energy resources as oppose to traditional wires solutions one of the things that Billy's point raises is that if we don't anticipate the need to actually build in the capability for flexibility and resources

we may work towards a world in which we're just satisfying the next incremental tiny little thing and that the sum total of the parts will be really less resilient. Really less reliable, less flexible. And that is counter intuitive from the conventional wisdom.

I know that in this work that I did with SCE and ConEd, where there were replacements on the distribution system. That avoided a new investment in the grid and you'd satisfied that with DER's. Unless you add the headroom that you would normally add as you're building transmission and building new distributions systems you really are tying your hands behind your back.

So thinking about this would be really useful, to think about what standards might be really important to think as you're planning the

system to be able to operate flexibly. So maybe it's also for yours as well gridmod.

MS. SANDERS: I've said this I think the last three meetings. But I think one of the things we really need to do is, you know, the thing I call an equivalence. If we're not going to build a substation or reconductor or do circuits but we're going to DER, what do we get and what do we not get. So I really think that is what we need to think about. So if I'm not putting in a cap bank that I know how it operates, that's always there and I know how long it lasts but I'm using a collection of inverters, what do I get, how long do they last, how do they operate, how do they perform? That's something that I think we really, really need in this industry. We've hesitated to do at Edison because it appears self-serving. But this is critical, because when I add a substation, I know what it is, what it does, how long it's going to last. If I add instead a collection of DER's it's a portfolio we don't know.

And it's one of those things where we're very progressive we're very open. We're working on, you know, figuring out how to make it work. But the operators at the end of the day take this very seriously. And you know one of the implications that's happened with all the solar we have on.

I rode around with one of our trouble men and he's like, we switched in for maintenance. And it overloaded everything because we didn't know how much solar there is. So we only switch at night. I'm like what. No, it's not, you know, we're getting there with new sensors. But I think we really need this study, this report that says, if I don't do this and do this instead, what do I get and what don't I get.I think there's advantages too. But I also think that it's a whole new paradigm of thinking. It's the same thing that happened in the transmission operation when we moved from baseload resources to peakers. Now, with the whole collection of resources you have to handle the ramping. So anyway, thank you

Sue for bringing that up and so I had to say it again, third time. Broken record but I don't know --

CHAIR TIERNEY: We will put it on the agenda at the next meetings.

MS. SANDERS: Okay.

CHAIR TIERNEY: Okay.

MS. SANDES: Thank you.

CHAIR TIERNEY: Merwin, yours the last point on this before we move on. Are you good?

MR. BROWN: Following up on Heather's comments on mindset and framework. We frequently talk about distributed energy resources, deferring or not. By allowing us not to have to build central station infrastructure, transmission et cetera. I suggest that we broaden our thinking to look even further in the future where that may not be the case.

That instead we may be shipping distributed energy resources back out onto the central system to be sold somewhere else. I can easily see the central value of California, way

over producing solar energy. And wanting to get it and selling maybe in Nevada or someplace else so. I guess what I'm trying to say is, let's not get into a mindset where we see the central transmission system shriveling and the DER growing. Because I can see a point where it will flip over. And we'll be back out using the main backbone systems but they'll look different. They may have to be rebuilt. But any way I just want to get that on the record so...

CHAIR TIERNEY: Good point. John, did you want have final words.

MR. ADAMS: Just want to be sure I captured that. I think that was, be sure your thinking doesn't just consider displaying central station generation. And Sue I'm not going to retry and redo yours. But I think Heather has it down, no.

MR. BROWN: He said something that mislead you. I'm really talking about the transmission interconnection. That -- I hear people talk about in terms of the DER's going to

shrink the need for it. So we would see it diminishing in size et cetera. And I would argue that there may be a period of time where that's true. But I can see a flip over in which the reverse happens.

MR. ADAMS: Ah.

MR. BROWN: That we're using that interconnection -- wider interconnection to move distributed energy power around the interconnection.

MR. ADAMS: Thank you. Got it.

MR. BROWN: I think it's more of a mindset issue than, you know, specifics at this point so...

CHAIR TIERNEY: John, thank you so much. And you guys put together a great panel yesterday. Thank you very much. It was great. We need to change to Paul's set up. But apparently, we need to take a tiny break in order to get your slides up, is that right?

MS. PELLECHIA: Takes three minutes.

CHAIR TIERNEY: Okay. So breathe, check

your emails. Do everything else. Probably will not take a break before a panel. Because I want to keep on time for that and to keep on time for Cheryl LaFleur. But if -- obviously, if you guys need to individually go out then just take your breaks as you need to. And with that Paul thank you.

MR. CENTOLELLA: Thank you Sue. So I want to talk about where the smart grid subcommittee is and the work product that we're hoping to produce for June. But to get there I thought I would take just a few minutes to review where we have been over the last year. In part because there are some new members to the full Committee.

And then part because this is some really rather important background for the piece of work that we're hoping to produce in June on the valuation and integration of distributed energy resources. So let me do a brief recap and then talk about exactly what we're hoping to come up with here.

So as you will recall a year ago, we had a panel discussion on the valuation and integration of distributed energy resources. And I thought it was useful just to remind us of some of the things that we're discussed there. So we had a presentation by Bill Kallock who's from Integral Analytics. He is working with a number of utilities to look at how to value distributed energy resources.

And they are doing forecast, long term forecast that are very spatial granular. You'll have specific parts of the distribution system, where is load developing, where is DER going in, where are there going to be EVs. All very much looking at how do you plan on this very granular basis. And producing these, you know, these kinds of maps that you see in the upper right.

That began to look at where is there going to be congestion on the distribution grid. And how do you begin to deal with that on a very time and location specific basis. We also had a presentation by Professor Michael Caramanis of

Boston University. Who has done this work about how do you begin to take LMP pricing and push that down into a distribution system. So that you can have now DLMP pricing.

Recognizing that you can't simply start from the ISO's and have the ISO's go all the way down into the distribution system. That is not a computationally tractable system. But it's computationally tractable to be able to have distributed markets. That actually could develop real and reactive prices at a distribution level. That is not to say that there is not further work, further research, further study that's needed in this area.

And he identified some of the areas of further R & D that may be needed. In particular, the interplay between providing both real and reactive power. And the provision of reserves down at the distribution level. Thinking about where does market power begin to play in these more granular markets. And also, thinking about what's the necessary communication architecture

and how do we secure that architecture in this kind of environment. We're looking at more granular prices.

We also had in that session Professor Deepak Divan who's the head of the center for distributed energy at Georgia Tech. Who talked about an important element of this. And that is the introduction of these very fast autonomous or semi-autonomous controls at the edges of the distribution grid. And that that can in fact take, you know, for example the picture that you see at the upper right.

Which is voltage on a secondary distribution circuit. That is very ragged and in fact, it has variability that's not really captured in our existing distribution models. But if you put on these very fast voltage controls on the edges of the distribution grid. You can essentially equalize that voltage across the circuit. And it significantly changes the opportunity to control what's going on in the grid.

But there are, you know things that we need to do. We need better simulation tools and models because this is largely behavior that's not captured in our existing distribution models. We need to look at what's the interaction between these massively distributed autonomous controls and power electronics and assets. And the way the existing grid control operates.

And we need to think about a control architecture that is a kind of mixed model. With some continuation of centralize dispatch. Some transactive control at a mid or distribution level. And some autonomous controls that are acting very quickly on a sub cycle basis at the edges of the grid. And we don't know today, what's the right balance of those things. And how will they all work together.

So we had those presentations last March along with Heather Sanders presentation. Talking about the reality of what it means to be a distribution system operator. And how that all fits together in the complex world of operating

distribution systems.

We then had another panel in June that was looking at the question of transactive energy. We began to identify some of the potential benefits of thinking about this world in a more transactive way. So Dr. Srinivas Katipamula from PNNL talked about the value of beginning to integrate flexible load in buildings. And that the barriers there are really the lack of real control solutions and sensor solutions. And the lack of automated technology.

But if you could begin to bring that more into play you can potentially cut excessive building use by as much as 30 percent of the energy that used in buildings today. Which account for

percent or more of electricity use. We had a presentation from Curt Kirkeby also from the Pacific Northwest. Talking about their smart grid pilot program. And their transactive microgrid that they put in place.

Where they were using, intelligent

agents creating peer to peer transactions. Something that we're seeing emerge in peer to peer markets and other parts of the world. And how does that then relate to what we want to do here. And we had Dr. Richard Tabors talk about the development of business models that are based on platform economics. Where you might have a transactive model that both includes forward transactions and an imbalance market. That actually reflects the real and reacted power flows across the distribution system.

And accompanying that with a services platform that could animate new kinds of products and services for customers. We also had an overview presentation on transactive energy from Lynn Kiesling. Talking about the emergence of new technology, things like block chain and other kinds of adaptations for a transactive grid. Both of those panels I think were very important to our thinking about where we need to go in the integration and evaluation of distributed energy resources going forward.

Another piece of this puzzle that the Committee heard in January, was a presentation by Professor Bill Sanders from the University of Illinois. That to some degree will foreshadow the presentations that we heard yesterday. Asking the question about are we really creating an internet of risky things as he put it.

And he both talked about the value of beginning to integrate, you know, things that are part of the internet of things. But also, talked about some of the real risks that are involved. Some of which we heard yesterday. The lack of a standard security approach at a consumer standpoint. The larger attacks surface. The potential ways in which those attacks could occur. And the lack of standardization on interoperability and, you know, the potential interaction of those vulnerabilities.

And talks specifically about the October 2016, webcam attack that created widespread outages on the internet. And his overall recommendation -- not unlike some of what we heard

yesterday, was one of caution. And so, I think this becomes another ongoing area where we need to have research. We need to understand the relationship between security and what's going to happen as we begin to integrate more distributed technology on the grid.

So this plus what we heard yesterday, brings us to kind of where we've been and where we're going in the Subcommittee. Part of what we have done is we have frankly heard a lot from the grid modernization lab work that's going on. There a number of those projects that relates specifically to the valuation and integration of DER.

And so that is in part reflected in the kinds of things that, you know, that we think we want to address in this upcoming work product. What we're looking to talk about in the report that we're hoping to have by the June meeting, is to start with some foundational discussion on the importance of the grid to our economy.

And the fact that distributed energy

resources are in fact, already a part of that grid. And an important component that will continue to be part of that grid going forward. And therefore, we need to think hard about how to integrate those resources well.

And it's more than just solar PV and storage. It's the backup generators that we heard about coming on line in D.C. Yesterday. It's flexible demand, it's distributed control and power electronics. And that I had that in the slide. Clark before you mentioned it this morning. And so, it's doing that and understanding how we build on some of the work that's already going on in grid modernization.

But also, really extending into I think, at least three areas of research that we think need to be supplemented with what's going on. First of all is tools and evaluation for the variability and time location. And electrical products specific value of DER. With the potential consideration of developing more granular and efficient markets. As a way of

beginning to capture that value.

A second area which is R & D on grid control. And particularly building in this notion of autonomous control and devices. And how does that relate to the overall control architecture and this potential multilayer elements of control. And finally, the area of cyber and physical security including the internet of things. Including consideration of resilience and how do we begin to ensure that is addressed as well.

So we hope to have that product by June. We will continue to follow up and look at internet of things security concerns and potential applications and benefits. And in our discussion this morning, we also raised the topic and I think we will have some further discussion. On what is infrastructure investment in the grid mean. And are there specific thoughts or recommendations that the Committee might offer as the administration goes forward and thinks about those questions. So that's where we are and I'm open to taking questions.

CHAIR TIERNEY: Paul that was great, thank you very much.

MR. CENTOLELLA: Sure.

CHAIR TIERNEY: Heather. And then Clark is your card intended to be up?

MR. GELLINGS: It is.

CHAIR TIERNEY: Okay. Good then you're first then Heather.

MR. GELLINGS: Thank you. Thank you, Paul, and you did mention casually at least in part of your presentation the remarks made previously in last March. That did relate a bit to end use. But I want to emphasize if I may please, that I think we need to include when we think about distributed energy resources that one important distributed energy resource is -- I call it hyper efficient systems end use devices.

And specifically, I'm suggesting that as I look at a portfolio of resources -- one of the resources is making what's out there more efficient. Eleven percent of electricity if used in the production of electricity and the delivery

of electricity. We've got any of number of studies we can point to that suggest that it is both technically and economically feasible, to reduce existing electricity consumption by 25 to percent. And these are very valuable resources that should be considered along with the other distributed generation resources and along with storage.

I think we tend to forget, that as we begin to talk about the frameworks that would evolve. In order for us to see an increase proliferation of the other distributor energy resources devises.

MR. CENTOLELLA: I think that's important and, you know, some of the work that, you know, that was discussed last March in terms of voltage control. Are things that can reduce, you know, 5 to 7 percent of peak demand and nearly that much in terms of energy use, just on the grid side. Without even having to enlist the changes by customers. Heather?

MR. SANDERS: So one thing I would add

to this is a safety architecture. One of the things that's come up as we have been looking at distribution automation and automating, you know reclosers. And, you know, you don't have occur out there. And, you know, now grid checks and recloses.

But if you're going to start to do more automation and you're going to reclose in or do automated switching. To re-energize people quickly, you got to make sure that there's a safety component built in. And so, I think when we talk about this we think about, you know, security, we think about, you know, operation but I think we need to build in a layer of safety. Like how do we check.

I mean, a lot of our crews worry about inverter operations. And you know the old standard, you know, whatever it was -- 1547 that one. The inverter one, you know, is seizable to just click off. Now, as it evolves because we need reliability, we don't want them all to go off if it's seizable (inaudible) somewhere else.

Again, I think there's a layer of safety architecture we need to build into these types of evaluations.

MR. CENTOLELLA: Any other thoughts?

CHAIR TIERNEY: Really cuts across all of these papers that we just heard about. They are all really compelling, and I think they can be helpful to the department as well as the industry more broadly. The amount of overlap that could occur between these papers is enormous. Given that there's not a lot of clarity about the edges.

I can tell you how long that the National Academy Committee that Anjan and Granger and I are on. Debated whether we could use the word smart grid or grid mod or whether they were the same things. Not kidding. So I think it might be helpful for each of these groups to actually, see if they can describe the boundary conditions of what they will talk about. So that we could see whether or not we are really squarely overlap or whether or these are really focused on different things.

I mean Anjan said, "you're looking at systems issues." And it sounds like that's engineering, physics, hardware systems. Although I don't know that. There's a lot of institutional things here, but there's also hardware physics systems. And then the same is true for delivery issues. So maybe we can sharpen what the differences are between these papers.

MR. CENTOLELLA: So this was actually part of our discussion this morning. And I haven't had a chance to talk to Anjan yet. But, you know, we did think that there was particularly in the sort of premise of the importance of the grid. And the fact that they are distributing resources that will need to be integrated.

We thought there was overlap with, you know, with some of the foundations for what Anjan was going to write. Now, whether or not that means these ought to be integrated into one paper or whether or how maybe the introduction is the same. But it's, you know, we haven't figured that piece out yet. But we recognized in our

discussion this morning Anjan, that there was overlap and this was something that there needed to be some coordination on.

CHAIR TIERNEY: And before you guys respond I just want to welcome Nancy Pfund. It's great that you're here. We introduced Rolf Nordstrom as the other new member of the Committee, but we talked about you yesterday while you were not here. And it's great to have you.

MS. Pfund: Well, thanks I'm thrilled to be here and I look forward to getting to know everyone and moving forward. Thanks.

CHAIR TIERNEY: And we know you had a long trip, so thank you very much. Anjan and then Jeff.

MR. BOSE: This is the classical problem that I was referring to. One of the things that gets lost when you start talking about particular technology. I mean, if this one is going to be about DER's of course it will affect the grid, right. But the opposite is not true. The grid is going to be effected by everything.

So if you're going to do grid research you can't just focus in on DER and not look at storage and that's the issue. So everybody -- whoever is looking at a particular technology area, is going to have to say something about the grid. And how it may or may not impact it. But that's not to me that's not grid research, that's not grid modernization and the overall picture. But we should have boundaries between these reports that we write.

CHAIR TIERNEY: Oh, and it's possible that it's deliberate that there is overlap and different perspectives and angles. So that's fine too. But just clarifying who's doing what and who's not doing what might be helpful. Jeff.

MR. MORRIS: (Inaudible)

CHAIR TIERNEY: And you actually have to bring John and Heather too. That's good, yes.

MR. MORRIS: I concur with your thoughts on this. You know, sometimes the same conversations are happening in each of the conference calls we're having. It's like, didn't

we talk about that the other day. But I have a little bit different topic on this. From the state perspective, you know, a lot of legislatures are starting to legislate in this space.

And, you know, there's not a lot of -- I would say critical thought pieces out there about -- for particularly for average size utilities and smaller not big utilities. Where there's a couple of elements there's not a lot of information on. One is that you need to have good substitute for a market presence when you get down to some of the actual call for resources. And a lot of utilities don't have enough volume to justify a call for resources.

And so, the next best stocking horse, is a pilot program. But there's not a lot of definition of what a good pilot program how that might be framed. In order to get some market like results for a utility wanting to get into this space. And then from a larger perspective, there's just isn't a lot of guidance really either, about how utility might -- how they might

move into this space fully.

So if like, for a real cooperative in my state. They may have one or two substations that's worth doing this evaluation. But a lot of the documentation is about doing your entire utility service area. There's not a really good framing of how do you make the juice worth the squeeze, so to speak. On starting to get your toe in the water to look at these evaluations.

I think any type of guidance that can come out of this Subcommittee, on how to frame that. You'll get a lot better outcome at the state level, about how this is being pushed out, in a way that actually adds to the national conversation.

CHAIR TIERNEY: Really helpful point. Phyllis.

MS. CURRIE: I think when you look at the overlaps. That could come out of our various reports. There might be some value and this is maybe suggesting something that's more work. Is to have kind of a summary report from the EAC

collectively. That tries to bring out the themes, the common themes that are in all these reports.

CHAIR TIERNEY: That's a real good point.

MS. CURRIE: Because I think when you look at the audiences, they're going to be various audiences for this work. And we want to have it technical enough for the technical people. But we need to have it a little bit more general. For what I would call the lay audiences. And we also need to be able to allow people to step back and kind of see how critical electricity is to everything that we do. And to then see why all of these changes necessitate the continued investment in upgrading of the grid.

But then to appreciate what's going to happen or could happen in these other elements that are going to be part of the grid. Whether it's at the transmission level or the distribution level. Because I think what you want people to do is to first of all, appreciate the significance of electricity. And the need for the continued

investment and to understand that none of us can afford to be fixed in one point in time, in our thinking about this.

But to continue to evolve with the possibilities and the technology and the customer's expectations. So just a thought.

CHAIR TIERNEY: Really good suggestion. You get the last word on this one.

MR. ZICHELLA: Thank you Sue. It's just something that Anjan said, that really struck me as -- and something Phyllis just said also. There is always going to be some overlaps especially when you look at things from assistance perspective. Everything does affect the grid. The grid is greater than the sum of its parts. It has an oversized -- as Phyllis just pointed out, impact on the overall national economy.

There is a great deal of value from this Committee and being able to keep the perspective on how all these things affect the larger whole. We can get ourselves really, I think, tied up in looking at smaller parts of it. Without really

understanding how these things contribute to the larger national perspective. I think that the Department needs to keep.

So to the extent that we do this and we pull out common themes as Phyllis just said. That's really valuable. By identifying in each of the reports where these overlaps occur may actually focus research in particular areas that are especially valuable. To that large overall perspective. So I just wanted to throw that out there. One of the things I think that I'm personally really interested in is that larger perspective that's so easily lost. Because we always retreat to the segments of the system that we operate in.

CHAIR TIERNEY: Great. Paul go ahead.

MR. CENTOLELLA: We do have two more cards up. I don't whether you want to take them or not.

CHAIR TIERNEY: I thought they were left over.

MR. CENTOLELLA: We've got Gordon and

Merwin.

CHAIR TIERNEY: Okay go for it. I know -- want us to keep us on track for our next one.

MR. CENTOLELLA: So let's try to keep these short.

MR. BROWN: Merwin Brown, U.C. Berkley. This issue has bothered me since I've been on this Committee about five years now. And part of it is that we inherited the structure by legislation. And it never has to me made have much logic, as to why we do what we do. But we're kind of stuck with it. So I think we struggle through this.

And the one way I've attempted to do this, is I try to participate in the other Subcommittees. And don't get them all but as Chairman of Energy Storage Subcommittee, I can be there to see what they're doing. And also put input in from the energy storage perspective. To try to make these things better as far as overlaps concern.

And the other thing we did not too long ago was this joint effort which I think tackled

some of this problem. Was on the Distributed Energy Storage project which that was done jointly by the two Subcommittees. So those are kind of some work arounds that we can use for the moment. But I think the real issue persists just because of our inherit legacy structure.

CHAIR TIERNEY: Thanks.

MR. FELLER: I'm Gordon Feller with CISCO, I guess we didn't get to talk about it this morning when or group met. But I am interested in making sure in my own effort or maybe on a Committee staff level. To get this report in draft to some of the startups that are really developing innovative solutions in this area. And I'm thinking of grid OS, the solution that's developed by the Ontario based company. That some of you may have heard of who -- I believe it's called Optus.

They've developed solutions in this area that are really unique. Buffalo they deployed a transactive energy platform, they've done microgrids in Canada. They have lost of Canadian

customers that are now essentially trying to solve some of these grid modernization problems. I don't expect the report will be able to include any evaluation of the technology.

But we've talked -- I think we talked at the last meeting a little bit about emerging technology innovators who are well financed in developing effective solutions in this area. That may be scalable, replicable and transferrable. And I'm just making a call I guess in this report and in the previous report. To think out loud about how can we get some of the draft reporting work after the draft. In final report form in front of some of these startups. Who are really potentially attempting to solve some of these problems in unique ways that we may not have thought about.

MR. CENTOLELLA: Okay. So thank you for that suggestion, we'll figure out how to integrate any input we can get from them. So just in closing I want to just make a few thank yous I probably should have made earlier. First of all,

thank you to Pat for the response to the Distributed Energy Storage paper. We did look at it and we appreciate your response. Thank you to Gordon and Heather for helping to put together the panel yesterday and getting our panelist. And so, that I think concludes the report. You want to go straight into the MIT Utility of the Future study.

So our next item on the agenda is a report on the MIT utility of the future study. This is a report that I was fortunate enough to be on the advisory panel for. And it was -- what a couple of years Carlos in putting it together? Three years putting it together -- God I don't remember when it started but it's been awhile.

And it was a project with MIT and also Camillas Pontifical University in Madrid. And Carlos has appointments at both and was one of the principal folks working on the study. And is going to talk to us about its results. I think, you know, the results are certainly getting attention by a number of people in the regulatory community.

And will I think have an important affect in thinking about both business models in this sector and also regulatory models going forward. Carlos.

MR. BATLLE: Okay. So first of all, thank you very much for the invitation for me. It's a pleasure to be here. I have to apologize first for not being here yesterday. And I was really regretting not having being able to be here. I had to be in Brussels yesterday but I was listening to the comments on what you were discussing yesterday. I missed something really relevant.

Just let me say something Paul that we were fortunate to have you among us not the other way around. Enough of (inaudible) bit of this. Well let me introduce myself quickly. I am working at MIT since 2011, the beginning of 2011. As Paul said, prior to this I was a (inaudible) I'm still a professor in the University of Madrid. But at the same time part of my career I have built it around the work supporting through other

institutions (inaudible) around the world.

Designing regulations, so I firmly believe that the only way to really be helpful from the academia on the regulatory issues. She's to be there where the problems are core (inaudible) tackling practical problems. Not running on empty on general ideas. So this is what I've been doing for the last 20 years. Working in 25 different countries all over the world on this topics.

Currently now, I am the director and member of the training committee of the (inaudible) regulation. Which is the institution of (inaudible) commission to provide professional training to energy regulators. One of the two 40 members of the 8-people group of the advisory committee of (inaudible) the U.K regulator. And what I want to talk

about here -- what I want to talk a little about the work that we did in this last almost three years. With the help of lots of people as we will show later. Let me just tell you a very quick story to start with -- about what it is. Oh, by the way I've been told that I have to be talking like half an hour or so or 40 minutes. But I get bored of myself talking too much. So I really appreciate any question or comment in the middle of the thing. I mean sometimes this is good because you realize that somebody is listening, at least one. So that helps.

CHAIR TIERNEY: And how about if we do this. If there is an urgent clarifying question, ask then. But then otherwise let's take them at the end. Does that work?

MR. BATLLE: Perfect. I didn't want to

take your role at (inaudible) so, yes. She rules, perfect, perfect. So great. So what is this story about, well (inaudible) years ago I met with one utility in Brussels precisely. And the guy (inaudible) he came and said, "look you know what, you are MIT you have a visions. So we want you to help us to know how the utility official will look like."

And we are like we don't have a clue. But anyway let us take a look at it and we were wondering around that question for three months or so. And then we came back to him and then said, look we don't have any idea of how this going to look like. But we do have an idea, is that we know what is going to deeply condition what it will look like. And it's basically policies and regulations.

Policies in most cases are intended, we want to do this so Europeans decided they wanted to drive crazy or not. On renewables, the Germans -- not to talk about them well this our intended consequences to some extent. Regulation in most

cases and this is disparities that we have got after many years, are not so intended.

So it's just you realized it's flawed regulation takes you to places where it certainly, you didn't know that you were going to be. And in most cases, you didn't want to be. And this was the message that clearly, we gave to him. And said so welcome that. After talking with some people (inaudible) institutions and people in the U.S. They have the impression that there was a need to try to contribute on that part.

And this is what we try to do, we know that there are many other very good groups that are working on that topic. I wanted to just contribute into that direction and we still want to contribute in that direction. So this is why we build this thing. We started by -- well let me quickly go because I think it's important to give the massage. That we wanted first thing to have the support of very different stakeholders.

So we wanted to learn from the industry. I firmly believe that the academics are useless,

specifically in this field on our own in our tower there. Because we didn't have -- really the idea of what is going on and we wanted to really have the feedback of all the different stakeholders from other institutions. To energy companies, to new entrance all this new technological idea.

So the idea was basically, look at the options first thing -- first to take a look at what's going on around the world. And we have the good thing of counting on my former colleagues in Madrid. And bringing also the European approach and all those things. Focuses specifically in these two environments. So the U.S.A and (inaudible) and also Europe. I'm trying to look for recommendations of calling the attention of the policy makers and regulators and companies. About the importance of certain topics to really look at trying to build a framework that doesn't preclude what is going to happen. But at least doesn't avoid that certain good things might happen. And this is basically the idea.

I'm going to go quickly through that. We were very lucky to have -- sorry, very big and good advisory committee. Paul was one of them. But we have representatives from the ISO's from DOE. From regulatory authorities, the European Commission. And I think that it was also really helpful. Obviously, we had -- they are the companies that supported the study.

Again, this was important for us to have really a very diverse group of companies. I must say -- although I know that this is recorded. One sign that we did a good job, is that more or less none of these companies is happy with the things we said. So this is the reason why you realize, okay something is not at least extremely wrong because -- and we really have been able to see this after (inaudible).

MS. BROWN: Excuse me.

MR. BATLLE: Yeah.

MS. BROWN: (Inaudible)

MR. BATLLE: Yeah, all these guys. All these guys. You have in there -- all these

different companies, yes. Yeah, I think all of them are there. So I don't want it to be very clear into that. So I'm going very quickly straight to the point. Because the study has so kind of introductory assessment of the different things that are happening. New business models are taking place but then I'm going to go not to talk too much. And I will talk too much for sure. On the scope of the recommendations.

The first comment is that I said it in the beginning we don't know what is going to happen. We only know one thing that the future is not going to be as it was going to be. But we don't know how it's going to be. The only thing that we want to do is to at least suggest that we have to take care of certain things. If we don't want to condition what is going happen.

So maybe these new technologies are going to be groundbreaking. Solar panels are going to keep on reducing cost. Storage is going to make a big jump and is going to change the whole picture, we don't know. But what we do know

is that we have to make some changes in order to allow for whatever might happen to happen. And this is most important thing.

So do we really know -- are we able to answer to this question. Is the future going to be distributed we don't know. By the way this is something that is -- I don't know where did we take this picture from. But there are many neighborhoods as you know in Germany. A very sunny place by the way, that look like that, right.

But what we do know is that the future is going to be integrated. And there will be all sorts of animals there that were not present ten years ago. To what extent this is going to change the operation of the networks or the needs of this thing or the other one, we don't know. And we wanted to be explicitly agnostic at these respect.

So we are no pro or against anything. We are just saying that there will be lots of different things. Don't forget that we are trying to focus not necessarily in California or Texas or

Minnesota or Arkansas or Belgium. It's just a more general view and its particular context different things will happen, because policies are not the same.

So what we wanted to do a framework for an involving electricity sector. And we have basically four big areas in which we have tried to make some recommendations. Starting with we are advocating for an improved development of the design of electricity rates. By this and I want to be very clear with this. We are not saying that we need to quickly go all the way down to what another member of the advisory committee. Professor Michael Carmanis that Paul was mentioning before is advocating for.

So we are not saying that necessarily we have to go to the LMP on the way. And we have to enter into the largest complexity ever. What we are saying is that we have to start carefully walking into a direction, in which we have to try to look for better or larger sophistication of their rates. And the design of the rates. If

this is just moving from the plain vanilla volumetric tariffs. To one step forward or if this implies going all the way down to the LMP's. This is something that we don't know yet.

Indeed, let me have some commercials here, this is where we want to work now. We want to work in particular that topic. Is there any 80, 20 point where by moving forward a little bit we solved most of their problems. But we are not -- again, we are not saying we should change the whole thing. But taking into account the basic regulatory and economic principles that we are now about. We need to move forward.

What in which sense -- well, we need this system of prices and charges. Which you can summarize into electricity or rates. That allow a level playing field between the different technologies that can be in place. Some ideas more get into detail. Well traditionally I remember first time I was working on tariff design in Portugal 15 years ago. Everything was about designing the customer classes.

So here we have the blonde ones, the black hair ones, the tall ones. The ones connected to these thing. No, this are industrial that sell shoes -- so there are difference tool. Everything was about that and once you have that thing according to your political criteria. Then you have the hot potatoes which were the cost and you were looking at the blond -- this one for the blonde ones.

And what we're advocating for is that we have to change this mindset. Because we don't have a clue and we will not have a clue what's behind the middle anymore. And then we have to get into the houses of the people saying, I know you have a panel and there you are in panel category. And then when you have solar PV panel you're going to pay this part.

And the guy who's putting the panel in the north part of his roof because nobody sees it from the street. Because he knows that -- no, you think that I'm kidding. But this is happening now. I mean, (inaudible) from Europe or Germany

as 30 gigawatts of solar PV on the roof, 30 gigawatts installed. So these things are happening now, it's not an invention.

So what we're advocating for is like whatever we do it has to be based in the actual pattern of consumption of people. No matter what it is. I know that obviously, this may be (inaudible) for certain categories of customers. Basically because of this discussion of to what extent we need advance meters for everybody. What but as soon as this is the case and the cost of (inaudible) is not the cost that was discussed ten years ago.

We need to evolve into that direction. Disclaimer or caveat if you want. I know that many of you might be thinking well this is not so easy. We have a (inaudible) we have some social (inaudible) that we have to sustain. You cannot change electricity rates from one day to

another. We know that there lots of embedded subsidies in customers here and there, fair enough.

We are not saying that we have to change that. And there are lots of ways in order to compensate one moving one direction to another one. But clearly what we think is that we have to go into this direction in order to also send the right incentives for end users. Not consumers, not consumers whatever end users people behind the middle to make the right choices. And this is what we are planning for.

And clear obviously -- clearly, we have to work also on how to do this without breaking the current situation. We think that it can be done and this is what we want to work on now. So there is that -- if we have the user profile and we know how much the consumers are -- the users are. Which is the use of the people or the end users of the network at this particular moment in time.

Ideally, we can actually charge this use

on this basis of this pattern. And this is basically what we are claiming for. I'm trying to avoid all this nitty gritty tale of 70,000 different kinds of customer classes. Because finally this leads to all kinds of arbitrage and irrelevant or insufficient situations. More clearly has been discussed and Paul was talking about Michael Caramanis -- Professor Caramanis' work.

We have still a question to be made to what extent we need to be granular with this study. So do we need all the way down as we say to the toaster. So we have to enter into the granular of each electrical appliance has to be subject to certain tariff all the way there. To what extent the location has to be considered. Can we more relax in some cases?

What we advocate is that we need to move forward into the certain direction. But we are not to what extent we have to complicate our lives (inaudible) lives that much. But clearly there is a need to really

move from again this monthly plain vanilla full metric tariff. (Inaudible) different a levels and this levels also highly depend on where you are. Maybe I will talk about it later.

So obviously, there is a big difference on the relevance of this discussion when you live in Arizona or Nevada. Then when you live in Hong Kong. Obviously, the amount of roof that each citizen in Hong Kong has is couple of square of inches. So you don't have to be concern about those guys or talking about the big apple in New York. But certainly, it's not the case in Arizona.

So the decisions, the elasticity in the long run of consumers might be really different. So some ideas that could be there well, it might make sense in certain jurisdictions to start differentiating between network charges and energy charges. Because well as you can see, the use of the network might in some locations be very

different. And imply certain costs so we need to move into this direction.

We can also (inaudible) some the cost of these forward capacity markets that are implemented here and there. So this could be another signal that we could send to consumers also. And approve those signals just let me give you an example and I don't want to -- it's not joke. There is one university neighbor of us at MIT in Cambridge. That has signed an agreement with the New England ISO, which basically is based on participating or I guess through any kind of (inaudible) provider in the critical care pricing. For a capacity market in New England.

So what happens? What happens is that in the summer three days per year, Harvard sends an email to their employees. Saying, okay today the system is under stress in New England so we're going to reduce our consumption. So you are free to stay at home, you don't need to come here to Harvard because the air condition is going to be

off. Okay.

Great example, so you have everybody concentrated in Harvard under one or two AC's and they go home. And usually they're not going to be at home without the air conditioning, right. So they get the signal in their company but they don't get the right signal at home. So look at how weird is the regulation that we are building. What an intended arbitrage because usually Harvard is not doing anything wrong.

Please don't take this -- I mean, they're doing the right thing. But regulators are not really closing the loop in order to do something different with that. This is a simple example but it is clearly something that I will have to start dealing with. Because the ability of choosing the level of choice that we have as consumers is going to increase significantly, right.

(Inaudible) basic in order to really boost all this development of new technologies. New smart

thermostats that are minding all of these kind of things. Well the one thing I just want to mention they are not so much for the U.S. but more in the European context. Is that also the electricity rates are full of other costs. So where call policy cost especially in Europe I could show you some graphs. So in Denmark for example more than 70 percent of the price that a consumer pays are taxes and renewable subsidies, all these kind of things.

I know usually we are trying to say -- they are beware with this. Because if you start charging all those cost to consumers you might get to the moment in which they just want to disconnect. Because they don't want to pay for that. And I would give you some good examples about that. But I don't want to talk too much on that particular thing. Again, this is happening

in Europe now very often, because of this. So we need to find a solution for this.

I been listening (inaudible) interesting question about the nature of public good of networks. Which obviously is going to be very much related to this. Because it might be also the case that even if we don't have any other policy cost there. It might be difficult for the future to really allocate the whole cost of the network. And then past to consumers if we want to send efficient signals.

So this might sound kind of futuristic but it's not that much, right. But I'm not going to enter into that anymore. So well there's series of concerns. I want a just I said before, this has to always be put in context of what is efficient from the purely (inaudible) economic perspective. Together with all the social issues that surround the utility rates, not only in the U.S. everywhere in the world. So we'll have to look for the way to do it the smart way so progressively we can anticipate the change.

I think that here in the U.S. we have a very good opportunity that we seize. Is that the major changes have not yet started. So -- and again, I have a lot of expertise in the European context, as I was saying before. So we have countries that are producing close to 40 percent of their energy with renewable energies, and distributed sources. And they are mistakes that are now difficult to fix because people have some rights.

And it's difficult, (inaudible) discussion if you going to have an example with that. Here this is not an issue yet. So I think that here we have the opportunity to some extent advance and avoid certain mistakes made in other places. Well, very quickly, I'm going to go very quickly through that. Although I know that some you did it this year. The second point is that clearly, we have to look for ways to improve the remuneration of distribution companies.

So one way or another we try to look for ways to provide this companies with incentives to

innovate. To actually really reward their performance and we need to be more sophisticated into that. And I think that here in the U.S. there are good initiatives into this direction. So I'm not going go talk too much about that because I already said it. So there are ways of implementing many use of contracts. Using more advanced referenceable tools in order to really try to anticipate a potential things that might happen in the networks.

Adjust the remuneration and as things are happening and uncertainty is revealed, things like that. One polemic issue that we have been discussing also, is the really sign or rethinking the industry structure. In this particular case, I am more talking about those place where the decision has been made in order to really liberalize the retail market.

Obviously, if you are in a vertical integrated fully regulated system, the discussion is not so relevant. And to some extent it is easier to move forward this respect. But clearly

what we have been doing is reflecting -- and this is one of the points that maybe some utilities may not like much. Or clearly don't like at all.

But try to simplify a little bit discussion is that, in the '90's when we started discussing which the role of the ISO should be. And I remember very nice papers from Susan -- back then in the late '90's on that topic. And especially here in the U.S. there was a clear idea that it was very important that the system operator had to be independent, for lots of reasons.

So they were going to be actually buying the services, the research, the regulation markets. To the different market operators in order to keep the system secure. And they have to be independent in dealing with the trading and the markets and blah, blah, blah. Now, we are talking about future world where not so future that where distributed resources might be buying and selling services to the distribution companies.

So that we can ideally avoid network

(inaudible) and all these kind of things. On that discussion that we had in the '90's in which nobody discussed -- Sarcozy and Angela Merkel in Europe did and they won the battle, because they run the thing. But that discussion in which we said we need a system operator independent. We need to transpose it to the current situation or the situation that common situation that we have now.

And I would dare to say that it's even worse. In which sense well, we will not have one single highly monitored with transpiring market as, I don't know, the PJM or Miso. We will have lots of small -- ideally, we might have lots of small locational markets with lower number of stakeholders. Lower number of competitors with much more nitty gritty details in the services that you might need or not need. Needs of coordination between distribution and

transmission.

And all these things require even a more strict supervision. We know that ideally, to some extent will be bundling the distribution company from everything else. But well in some cases this is again, political unacceptable or even inefficient might be the case. So we're saying that we should try to be very careful, in keeping the distribution system operation away enough from everything that is market and traded.

This implies for example that -- talking about -- I know this might sound a little bit aggressive but we don't see reasons why distribution companies should own storage. They might resort to it (inaudible) can be very helpful. But well they should acquire the service or the benefits from storage from market agents, or retailers or whatever it is, this kind of discussions.

So I'm sure that we can discuss about that (inaudible) later. So I'm going to go quickly through that. And finally, and I will try

to be even quicker with this. We need to update electricity markets. So I'm hearing the message is very clear on our side. We need to realize that renewable technologies are no longer unable to be part of the market. So they are sufficiently mature, they have them on straight (inaudible) particularly in Europe that they can behave, exactly the same that the traditional conventional technologies.

They are very well able to forecast their future consumption. They are very well able to play in the regulation markets. They respond to signals and when you send the right market signals to them in the short term, they improve their performance. So we are basically advocating for more integrated to a better regulation, to fully integrate renewables into the markets.

And this effects also to the subsidies that they might receive which are perfect, great. But at least, what we advocate for is try to design those subsidies so that you avoid

interfering in the market mechanisms. So let's try to avoid the subsidies that lead to inefficient negative prices. Unnecessarily, these kind of discussions. We are also advocating for auctions.

In the case of -- to the assign the actual volume of these subsidies. Everything revolves around trying to better integrate renewables. And trying to treat them as any other source. The generational of demand. And this is basically the idea just to finish with this to illustrate a little bit that we have not only discussed on air about regulation.

But we have made lots of efforts on the analytic side. We count on very detail models at MIT that are able to simulate with the highest level of detail distribution networks. Dealing with 20 million customers to the level of the last feeder and last socket in its house. And we want to also really illustrate how important the locational value might be in the future.

And just to give you a illustration

about that. This is as you know the state of New York, and we were just looking into the actual value of distributed generation into different locations in New York State. One of them is Rhode Island, as you know Rhode Island is kind of congested and there we were able to really on local -- or evaluate the average locational value per (inaudible) produce of this distributed resources.

Due to the energy value but also the value for transmission, distribution, voltage control, distribution deferral. A lot of these things. As you can see in that particular location the value -- I mean again, be aware of the numbers because it's more a way of corporation of this. But it can be significant.

Well if you make the same analysis with the same regulatory retailer Mohawk. In a different location in the state of New York. Well this value is almost in existent. This has also implications. This is not a question of fairness. Regulation has to get rid of this is a personal

view of the concept of fairness. Because fairness leads you to inefficiencies.

You have to implement efficient measures and then leave taxes, governors, ministries to implement fairness later on. But what we are trying to illustrate here is that, it is not the same thing to install a solar PV panel on the roof in Rhode Island than in Mohawk. And if we don't make this distinction and if we don't send the signal, we will be losing a huge amount of value that we could take advantage of. And this is not a simple thing. I fully acknowledge -- because as I said I been working, and I keep on working for lots of other institution.

To some extent this sounds too challenging for regulators. Not because they are not able to do it. Because in many cases at least the ones I have been meeting. And I've been in all kinds of countries. They are well prepared for this but sometimes it's because simply they are risk (inaudible). And I fully acknowledge that this is the case. We are not saying that we

have to go all the way through. We don't say they have to understand Michael Caramanis ideas. Because for me it took me some discussions with him until I got to understand what he wanted to do. But we need to start moving forward. And we need to do it quickly. Because there is one main thing that changes the whole thing -- the whole picture.

Last month I was discussing Bogota Columbia -- one of the most -- by the way advanced countries in regulation in the world. They invented the foreign capacity market back 1988, with the energy minister, right. And the guy was saying, "well, we are very much concerned on how we're going to plan our system." They have a very developed market for electricity there. Because we want to see which would be the technologies and stuff. So we have to think about it first. And I was telling him, look you don't have time to think, because you cannot control any more -- this is not discussing with seven utilities, talking with them, negotiating. You going to build this

coal plan (inaudible) do me this. No, no, people don't wait.

In many places, they love solar PV panels because they feel great, right. Having one on the roof. In the same way that some of you feel great with a iPhone. Even if it's more inefficient cell phone or more expensive or less compatible or whatever. And they just implement or just install the solar PV panel.

So it is not that control situation that we had now. And we need to go quickly. On top of this there's lots of other subsidies signals that are being there that are really relevant. So we need to change. To what extent this step has to be -- how quick it has to be we don't know. But there are ways to start with and this is what we want to do going forward.

So again, commercial we finish with this in December. And now we are building -- we think there are interesting things here to explore. I am currently now the head of the regulatory and policy (inaudible) analysis for power systems lab

there. We want to keep on working into that. More into the practical implementations. So saying okay, it would be great to go all the way to the LMP but let's be realistic. So which is the next step forward. How much we gain with this? Which is the right step to stop? Up to here where fair enough. We don't create a political issue.

We want to find this balance just because we think that it is very important to do it. I thank God here in the U.S. we're still on time. Because things are not so fast as they are for example in the European case. And I want to stop here so that -- just in case in you have any question. Or you can catch an early flight in any case. Thank you very much and happy for any questions.

CHAIR TIERNEY: That's fantastic. Thank you, that was great. I am sure there are lots of questions, comments, reactions that have been provoked. So I'll start here, then there, then there and then feel free to put up your -- and

then Nancy. So those four first and go for it.

MR. ADAMS: I'm going to have to ask you to go back a slide. You had a wonderful graph that was showing transmission capacity, charges on time of day.

SPEAKER: (Inaudible).

MR. ADAMS: Yeah, it was towards the beginning. There this one, network capacity charges and energy charges. It's both of those are relevant. I think what you're saying is your capacity charges or markets or whatever. That an annual capacity market doesn't make sense you need to do it on time of day. And in fact, you need to split amongst the different components of the charges. Is that what this slide means?

MR. BATLLE: Yeah, so what it's saying is that tariffs have to reflect, rates have to reflect cost, right. And the example I was giving you about Harvard is that okay. If you have the amount of response participating in the -- for example full capacity market. The value of this the product that you are providing

(inaudible) provider is that. In particular days of the year in the polar vortex in the winter in 2014 or in the summer in Boston. What you have to do is send the signal to consumers that reflect that's particular thing. Because if not you have part of the system that can respond and it is starting to respond. That is being just taking advantage of arbitrage opportunity. Or you just simply using the opportunity to unlock certain value from that.

So if this case, if the foreign capacity market is rewarding the ability to help the system when there is lack of supply for example. Send the signal to every stakeholder in the system. The new paradigm is that ideally, maybe domestic customers not yet in some cases. But there are lots of low voltage consumers or end users that can actually react to that. And they are doing it so why not send it --

MR. ADAMS: Do you have a vision of the algorithm to calculate these charges? Cause it...

MR. BATLLE: We don't have any algorithm

-- we don't have a vision in calculating this algorithm. So again, the complexity -- I can tell you for example what is done in other places. You can start by for example, starting by not the low voltage small domestic customers. But supermarket, malls and all this kind of things.

So you can start gradually and you can implement simply time of use tariffs. Or as they do in the U.K. for the large or not so large industrials they say okay, we're going to allocate the cost. Depending on your highest consumption in this particular 50 moments in which demand has been the highest in the system. I mean, as soon as you count on an advance meter that is able to give you the hourly consumption of the different consumers.

It is not so complicated to send signals. I agree, we of course that for my model it is still very soon to do it. But not for Macy's or for Kmart. And many of these guys don't have those signals yet. Or they do because they have

(inaudible) going to them and saying okay or Harvard saying, no can you do it. And they do it but then the leakage happens all over the place.

So we don't think that we're talking about an algorithm. We're talking about something simpler. But again, we're working into that. So now, this is the next challenge how to practically implement this. I can tell you from our own experience. You take the regulator in OSHA and regulator in Portugal, Italian one. They are already implementing measures into this direction.

So it's not something that you can faint just because you think about it. We're not talking about algorithms yet. Although if you talk with my colleague Professor Caramanis, they will tell you that no, no, no, this has to be a super software with a super computer. No, we don't get to that point yet.

CHAIR TIERNEY: How many people in the cue are addressing this point? Jim next, Janice

are you? Not on this point. Then Paul. Go ahead Jim cause he's on this point and then you can.

MR. LAZAR: First of all I'm very pleased that you expressed some of this on a dollars per kilowatt hour basis. Rather than in some other unit. But the thing that troubles me about this and throughout the report, is at no point in the report did you seem to compare your recommendations with the traditional foundational principles of rate design.

To Bonbright's principles of simplicity, understandability, feasibility of application. Freedom from controversy as to interpretation or Garfield and Lovejoy's principles. As to insuring that all loads are contributing something to system costs. And this graphic really illustrates that Garfield and Lovejoy principle in a very troubling way. It looks to me from this, if I can confine my business operations to start at 8 p.m. and wind up by 2 p.m.

I would have to contribute absolutely nothing whatsoever, to either generation capacity

costs or network capacity cost. Even though I would be using both generation capacity and network capacity to serve my business. If I can confine myself to the blue only hours --

MR. BATLLE: No, because.

MR. LAZAR: That's what's mostly troubling about this presentation.

MR. BATLLE: I agree. That's a very good question. As you surely know there are two kinds of costs. There are marginal cost and average costs, right. What we having here --

MR. LAZAR: No, they're three types of cost. They're four types, there's average cost, short run marginal cost, there's long run incremental costs and there's total system long run incremental cost.

MR. BATLLE: -- long run incremental costs are the long run marginal costs (inaudible).

CHAIR TIERNEY: Carlos, would you just speak into this.

MR. BATLLE: Oh, sorry. So yes, to some

extent as you see there is a blue part at the bottom where you actually are going -- you should pay the lower rate for that.

MR. LAZAR: But I get to hitch hike.

MR. BATLLE: No, no -- yeah, you know what you can do. If you -- in the current situation when you get this completely flat. What happens is that those guys that are able to make -- to have this (inaudible) consumption that you're talking about. They are disconnecting. So it's great, I mean obviously, I mean the first thing I start studying 20 years ago was the book of Bonbright.

But the world is completely different from that. Has changed amazingly and it's going to change even more. So fair enough. I mean, all these things were great. And have been implemented for years. But we are facing a different animal, it's completely different. And to some extent what we're saying is that okay in those places, where there is actually a marginal signal that has impact.

As you properly said, not only in the short run but in the long run. And what we need to send this signal properly, if consumers can be elastic. Again, if you are in Hong Kong you don't get care about good (inaudible) they don't have a chance to have a solar PV panel on their roofs. You can keep on doing things according to your world. And you can keep on using electricity rates as a taxation tool to have the rich paying more than the poor. You can keep on doing this, no worries.

But you're in Mexico for example, and you have this subsidies studies that they have in Mexico. And in some states in the United States to some extent. You have to be careful, because what's going on in Mexico one of my most brilliant students at MIT, three years ago -- and it was not my fault by the way. He came to me a couple of years ago say, I'm making money.

And I said, "what are you doing?" I have open a company and what I'm doing is I'm going to the rich people in my country. Saying,

"you rich, you have a roof just install this solar P panel," you making money. And you have plenty of solar panels that the only reason for the installation is just avoiding paying for subsidies. The same thing if you go to consumers and say, hey you know, this networks we build them in 1935. Has costed a lot of money, we still have to pay for that, okay.

You have to understand that your grandfather was here, your father was here, they used this but it will need to pay for them in still

more years. And the rest say, okay great, bye.

(Inaudible) marginal signal. So if we have marginal signals let's send the signals. And this is the basics of economics because now consumers have thousands of choices. The ones they have now and the ones that are coming with this guys, CISCO guys and all the

super companies that are bringing new ideas and new things. And we don't want also to avoid this to happen. We want to promote those ideas, to have a more sustainable system. So we need to move forward into that. So yes.

MR. LAZAR: You haven't begun to address my question. Which is this framework allows customers who use consumption is in the blue area. To hitch hike without any charge for the use of capacity that's supplied by customers who are consuming in the orange and red periods. There's no assignment of any of those network costs. To the consumption that uses the network.

MR. BATLLE: Yeah.

MR. LAZAR: We don't do that in airlines it's cheaper sometimes. But it always contribute something --

MR. BATLLE: No, no, yeah.

MR. LAZAR: -- in rental cars and hotels. There's always some contribution to the

system.

MR. BATLLE: No, no, I don't have any sort --

MR. LAZAR: Overhead.

MR. BATLLE: Sorry. I don't have any contribution when take a room here in D.C. when I come here on anything. I just pay what the market is. So I'm comparing the cost of being in the hotel where more or less I feel comfortable with a shower. To the idea of being in the street sleeping, right. So there is no allocation of contribution of anything. There is market price, so I don't buy your example.

But again, going to your question, we are not saying that these guys have to pay nothing. What we say, is that they will have to pay up to the point where we cannot surpass -- because if we charge the with more, they will do something that we don't want them to do which would be inefficient. Whatever it takes. So again, I was trying to -- sorry I didn't do it right.

What I was trying to say with Hong Kong example or in New York. Is that if they don't have any other way or anything to do, right. Well, we can charge everybody the whole cost of the network from 1925, no problem with that. But we have to be careful first not to charge more than what they are going to bare. And second, on the same time on the right side on the left if you want.

Also in those places where certain behaviors might simply larger course. We have to send them the signal, say please do something different, please. Hitch hike the system and go to the hours. Because you are the one to force us to change these (inaudible). That is a lot of money when can have (inaudible) other doing things that can avoid us those costs.

And we need to do that this is, I mean, is so basic economics that. Now how we do this, how we solve this social issues? Fair enough we have to explore this carefully, but don't say no. Bonbright things where Bonbright -- I mean,

Bonbright died some years ago. And he couldn't even imagine he was not Fred Schweppe again MIT. So he could have envisioned LMP's before they happen and stuff. He was a rather simple context, I think.

CHAIR TIERNEY: Okay. Thank you. Let's go to clarifying question and then we go Janice, Nancy, Paul.

MS. LIN: Thank you. Great presentation. I think at a high level a lot of folks would agree with the conclusions. I think the really hard part is that everywhere you look in our sector, it's kind of messy. And it's hard and we have gobs and gobs of existing processes and rulemakings. And so. I had two questions, I was curious at a high level if you have any preliminary recommendations.

Even of where to start with this implementation. Like is it easier to start with one or four or three? And I was also wondering if you could elaborate a little bit more on item 3, which was revisiting the industry structure. And

you said something very interesting. I wrote it down. It said, "the future will have lots of small locational markets and that we should keep distribution companies as far away from markets as possible. For example, they should not own storage." And I'm wondering if you could elaborate on that? It's a very interesting topic. It's a very relevant where I'm from in California.

MR. BATLLE: I know. And I know this was going to be -- it was just to warranty that there will be a list of questions. So on the first thing, what do we think -- a number of things. Starting by the cynic approach, right. And I said it before. The first recommendation is take a look at to what extent you are in a hurry in your particular jurisdiction, right? Okay.

If you're in a place where unless you drive nuts like the Germans. But it is not very sunny and people kind of concentrated. You of course (inaudible) take your time. I mean, but take a look at the need to do it quickly. This is the first thing. Then assuming that you find

places like California for example where it might make a lot of sense. Then try to explore and this where what we're trying to do now. And this is why we are looking for companies to help us fund these things is.

Let's start from the very beginning. So if you're in volumetric tariff, let's try to explore things that are peak coincidence tariffs. So to what extent this is feasible for which kind of customer this make sense. So enter into this evaluation, right. This is one of the alternatives. Another alternative that is worth exploring some jurisdictions is this even more simplify, that I don't fully buy, I must confess. But which would be of any kind of capacity charge.

So looking at for example, something like which is your contracted capacity. But this again, needs some kind of electronic meter to limit your stuff. Or critical pre-price in time of use. Something very, very simple compared to the LMP's, right. And again, try to evaluate this to see which the actual impact on the current

start of QOA's.

Also take into account that and think about which should be the ways to compensate that to. You know, you can have lump sums going back and forth so the marginal signal is here or there. But again, this is part of the work that we want to do going forward.

On your second question, in 2009, I -- we had a requirement from the European Commission to work particular in this topic. So on the question of the role of the DSO. And as you know, the decision of the -- why 2009, because as you know the third package in the European Union was the one that fully said we go all the way down to full retail evaluation. No regulated tariffs, no base rate tariff nothing. Just fully market based.

As is the case for the gasolines here in the U.S. And clearly, the idea was well to what extent the system operator (inaudible) they work on actually impact, this competition of

(inaudible). And for example,

which was the concern because there was lots of customers. That when they changed from one retailer to another one. So from the incumbent retailer from the (inaudible) utility to another one. And they had a problem in the transformer. Quality of service distribution problem.

They were complaining because before it was fixed in two hours and then it was fixed in ten hours, right. Just to give you an example of things that happen. So at that time our recommendation and the recommendation from the European Commission. Now and the recent winter package is going more or less into these direction, is well, we should be very careful in the way that -- because distribution companies if the DSO's have lots of opportunities to really influence this market.

Take for instance, if you are a institution company and you need some

interruptible loads a particular region. You can go and say, okay I want to pay you for some response. But only if you are in my retail company. That's it. So you can actually affect very much this. So this why we're advocating for not fully ownership on bundling. But just lots of ways of monitoring.

The second issue on storage, is that we have read lots of things and this goes back to our discussion with European Commission in 2010, 2011. Saying well, it is very important because distribution companies know that the value of storage in particular (inaudible) of the institution. There might be very important great. If you think that this is the case long (inaudible) auction or something. Say I would be very pleased to have somebody starting a storage facility here. And I will use it under this circumstances. Why, because also this allows this owner of the storage to play for the rest

into the market.

We avoid having this idea of the (inaudible) company managing a market facility, right. Which we in the wholesale market doing other things. And also, because it's California, right? I'm sorry for the criticism but all these roll out of storage, right. Say okay 1.30 watts of storage in California is going to be (inaudible) by the utilities.

But if I am the owner, of market based (inaudible) turbine. I would be really annoyed by this decision. Because somebody has made (inaudible) decision for a related company. And the value of my fully merchant plant has decreased and this is a huge intervention, right. Why not limit it to the market and if you consider that distribution

networks might benefit from storage. Let the market do it in one way or another. And have them paying what it's worth. And that's it and it's part of deal.

So that's why we think that it is for the mental health of the whole thing. To keep distribution companies doing the work of distribution system operation. And for the rest leaving the market and keeping the separation. And we don't see any single reason why this shouldn't be the case. And I have this discussion last Thursday with the Italian regulator. But it's not under certain circumstances, only for those -- why, why not saying I need it please somebody build it. And I will pay it on a PPA whatever on a longtime contract whatever. This is our point.

CHAIR TIERNEY: Terrific. Nancy then Paula and Carl.

MS. PFUND: Really interesting presentation. And I have -- I think the notion of

locational strategies and the comparison that you're making are hugely useful. And yet you also recognize that they're people that just want to do what they want to do. And you suggest kind of using incentives and taxes and such to kind of work that out. I'm a little bit surprised and maybe this is more of a suggestion than a question. When you have the slide of who supported this work, your consortium. I didn't see any of the new entrants on that; and so, by definition, you're already setting up a division as a result. Yeah, no new entrants on that.

MR. BATLLE: You have Draper?

MS. PFUND: Draper -- I mean companies like Sun Power or Tesla -- the people that are in the mix and taking market share. And, so, I guess one question is why? Because now, you're -- they don't care that you're from MIT, they want to be involved in this and so they're going to question your assumptions. And the fact that you're, you know, you're at MIT is irrelevant to them.

MR. BATLLE: Full transparency in to

that, okay? And since you're recalling it, you can contest to what I'm saying, we have lots of conversations with EnerNoc and we had also conversations -- and it is in the advisory committee here, right -- so, finally we realize that to have a minimum level of participation into that, okay -- there companies are unable to fund a single penny, right. So what if we included them in the advisory committee, so we had people from Opower, people from EnerNoc, people from other companies, and --

MS. PFUND: I understand that, but that's not my point. The point is that in order for all of us to make progress, we need to be inclusive, and an advisory committee is not the same as the people that fund the work; and you're just setting yourself up for your assumptions being challenged.

MR. BATLLE: No, no. Let me clarify, and I appreciate a lot of your question because this is very important. The advisory committee have --

MS. PFUND: Especially because MIT has done work that the industry really doesn't value and doesn't like.

MR. BATLLE: No, no. Let me finish; and again, Paul can correct me if I'm wrong. You said that the advisory committee is the key part of the whole thing. The companies got the results two days before the rest of the other people. Do you have a word -- these guys --

MS. PFUND: Again, this is not the list that they would want. You need to do a better job in the future of bringing in the folks that are really on the frontline; and again, that's the world I live in and, again, it has nothing to do with the quality of your work, it's just -- be smart.

MR. BATLLE: No, no.

MS. PFUND: -- be smart, and bring these people in next time. That's all I have to say.

MR. BATLLE: One is as smart as (inaudible). I mean, I was born the way

(inaudible); but, I mean, no listen --

MR. PFUND: You're just setting yourself up -- okay --

MR. BATLLE: Let me answer you this.

MS. PFUND: No. Just do better the next time.

MR. BATLLE: Opower is a new company -- I know it's not a new company -- but Opower is one of them. I tell you --

CHAIR TIERNEY: Okay, let's give him a chance to finish. Everybody's going to agree to disagree.

MS. PFUND: It's just to be smart in getting policy done, you need to be inclusive from day one because they're just going to say, yeah, of course you come -- and maybe they agree with your findings. I have no idea.

MR. BATLLE: I am telling you that we were inclusive from day one and not only from day one --

MS. PFUND: You're not, because you

don't have the new entrants on there.

CHAIR. TIERNEY: Okay; let's move on to the next topic. There's a disagreement on this point. Thank you. So, Paul?

MS. PFUND: Sure. But I think what we need to do is be respectful that these are the players that are creating billions of dollars of market value.

CHAIR TIERNEY: Nancy, you have said that now 20 times, and we absolutely hear it. Absolutely hear it.

MS. PFUND: But he's not accepting it.

CHAIR TIERNEY: We hear it; the Committee hears it.

MR. ROBERTI: Let me try to -- I actually want to follow up on what you're talking about -- more of a comment along with what Nancy said. Going back 25 years ago, I remember when the most powerful utility was the telephone company, and they had a copper network with twisted pairs into everybody's home. Now we're

years later, we're in this age of

technology. All sorts of tremendous things are happening, and one thing I recognize as a consumer advocate that went to public hearings -- hundreds and hundreds of public hearings. Sue you were a witness in many of those cases, and then set on the bench for seven years -- I underestimated technology. I totally underestimated it; in fact, I was wrong and it bothers me. So, now here we are in 2017. We've got all of these tremendous things going on; and I look at this page, and I force, I come up with a term that I call the hardwire centric view of the world.

Everyone on this page is connected to a business case that relies on a network, but what we fail to do, and you've heard that analogy -- that new, I think it came from, I just heard somebody speak from the military at the NARUC meetings -- he said, oh it's the cheese. Everybody's going to the cheese; the cheese is over here.

I wonder if the network centric view of the world is actually the right view -- and a

couple of points on this. The telephone network went away even when the companies, the RBOCs, that we're still trying clinging to that network, doubled-down, and replaced the twisted pair, the copper twisted pair, with fiber. Had they known what the world would be today, with wireless technology, they would never have spent the hundreds of millions of dollars, at least in my state.

When we look at this situation -- I want to take it to a comment that you made about deployment of utility-scale storage, because I think storage -- as I sit here today, and looking at the cost curve of solar, I think storage is going to follow a cost curve that's even more exponentially down, because I would be ignoring history, ignoring the way technology is developing. And you said that the utility today should be doing the work of distribution system operation and maintenance, as is if that's all they should care about; and what I say, right now, is the utility may be in the same struggle for its

life that New England Telephone & Telegraph was in 20 years ago. And this whole notion that we want to take Bonbright's principles and the archaic principles of utility regulation in this day and age and force customers to react to these time-of-use pricings. We want to force customers to do things -- engaging behaviors that they're not interested in. And I know, because we wanted customers to call between 3 and 5, we wanted to give a discount -- we wanted to do all of these things; and thank God, technology got me to a time and a place where I don't have to worry about that; I don't have to care about the network capacity on some cell tower; I don't have to worry about when I call, where I call, anywhere in the world, I've got a flat price. And to think that the psychology -- and in all these years, the psychology of consumers, the psychology of the people are the one thing we always miss. The inputs economics, engineering, environmental impact, but we miss the zeitgeist. We were talking about this yesterday. What consumers are

thinking; what consumers want. Consumers -- while in this room, we all would want to engage in some pilot that probably will never go to commercial scale; and there're tons of pilots out there; there's one going on in Worchester, Massachusetts -- but when you try to force consumers to do things like behavioral changes in the home that they want to check right now what's going on with the thermostat, the average consumer doesn't want to do that. I know this because I appeared in probably, I don't know, 500 public hearings; and the people in this room don't actually reflect the average consumer.

So, why shouldn't the utility be looking for utility-scaled deployment of storage because they can do it so much cheaper than a particular customer at a granular level no different than roof-top solar that they are economies of scale that the distribution system, the distribution operator can deploy and actually maybe stay in the game and not lose its business altogether?

MR. BATLLE: May I, because --

MR. ROBERTI: Anyways, I've said enough.

MR. BATLLE: No, no, you've said tons of things. Let me tell you something. I fully sign under your statement. I fully agree with everything you said; so, I don't see -- maybe I didn't miss something -- but I didn't really transfer the message well because what you said I buy it 100 percent. Things that I remember are the many things I should have. I said one thing about distributor storage. What I said is right, exactly this. If the utility wants to do it -- it's up to them -- let's change the way that they are remunerated; and if this is good and they save money out of that, perfect; but we're not saying that it has to be mandated; and I was criticizing the mandate in California. So, I fully agree. On the flat tariffs, you are using an analogy that is not good as possible with telecomms and electricity. When telecomms were, the networks were saturated -- I mean, were congested in the beginning -- we had different rates. Because now the thing is that now the value that you get from

this telephone is not the network, or it is very irrelevant; it's all the services that you are getting. So, going back to the comment that was made before, if the marginal value of the network is zero, you don't have to charge anything for it. So, it will be ideally the same situation that you are talking about with the cellphones. If there are certain locations where this is the case that everybody wants to use the network and its forcing, or is stressing, that you need more costs, and consumers, for some reason don't have PV panels so they can -- other alternatives to do something -- well, you have to tell them, this is the way.

What we're advocating for is to give consumers the choice. And don't forget one thing -- I fully agree with what you said, but look from where we come from. So, all your criticism -- which I fully by -- is in situation where now we're being charged irrespective of what we do. We're being charged of costs in Mohawk from Rhode Island that we don't have anything to do with that

because somebody had said we would have to do with. Like, we don't say, no, no; we have to move towards the world that you are envisioning that is fully that one. So, I think that what we are advocating for is going into that direction; and, obviously, one of the messages that some utilities don't like is that eventually this might mean that nobody is going to pay for networks -- probably good. This is a political decision; we're not entering into that, but good luck.

MR. ROBERTI: One comment, follow-up, on the Mexico example. I work in Mexico, and the $6 billion annual subsidy that the Treasury pays to subsidize the residential bills -- in Rhode Island, you could say the same thing happens. 40 cents a kilowatt hour for a solar panel, when Mexico just did auctions and the average price for renewables without any ITC/PTC, maybe a little bonus depreciation --

MR. BATLLE: $24.00

MR. ROBERTI: -- came in at -- yes.

MR. BATLLE: $24.00

MR. ROBERTI: So, just about that, the subsidy -- perhaps that's why we have this problem in the first place. That's another --

MR. BATLLE: That's why we're advocating for auctions for the subsidies. We are saying, no, no, don't just -- if you want some solar, say who gives it to me cheaper. But this is not the U.S. This is happening not only in Mexico. It's happening in Mexico, and Morocco, and Germany, in France, in Chili, all over the place. So, yes, we agree with.

CHAIR. TIERNEY: Great, Paula?

MS. CARMODY: Thank you. I'm not going to try to repeat. I represent a residential consumer advocate office in the State of Maryland, just to give some context to my own comments; and they probably tie into what Jim Lazar and, certainly, Paul Roberti over there has talked about. But I don't want to repeat or reiterate it, but they do raise very real concerns; you know, certainly that an office like mine represents 2 million households in the State of

Maryland and that's kind of where my focus is.

And I think the kind of the discussion that's been going on and very much appreciate your presentation, but one of the things that we always end up scratching our heads in the consumer advocate world is with all that, you know -- there is, and I understand it -- a total focus on economics, and sort of I get it; but we do live in a very real world, and it is a world where Bonbright principles -- even though you may think of them as outdated -- actually have some very real meaning to our consumers; and I'm not going to repeat what, you know, Paul has just said. I think they have to somehow be accounted for when we're doing all of these kinds of studies.

And, I think, Nancy was talking about kind of lack of presence of other types of companies, but one thing -- and it's really what I am going to focus on -- is a question, perhaps or a comment/question, as you're going forward with your further implementation kind of discussions and more kind of looking at practice, is there

ever any discussion, when everybody's focusing on the economics, of trying to mesh all of the work that you're doing with kind of, I don't know -- are there other parts of MIT, or other kind of academic studies, or bringing people in from the other world talking in the sense about, partly about behavior of, you know, kind of the consumers, or impacts of the consumers? I mean what Paul has said is just a very real issue. We have seen it, you know, seen it in all sorts of worlds. I've seen it most recently. We have energy suppliers, and when you're talking about that polar vortex, people, you know, not responding to variable rates and getting hit with $2,000, $3,000 bills because they didn't know they were supposed to respond to a variable rate, you know, as a household.

So, I question -- there are health, when you talk about the polar vortex and kind of the extreme heat, extreme cold -- folks cannot, you know, that elasticity is not there. There's a real health issue, a real, like, social issue.

So, what I'm trying to say in a long-winded fashion is when we're always kind of focused on economics in terms of rate setting, it doesn't exist in a vacuum. Households, in particular, don't kind of respond the way you think that they should respond, thoroughly don't respond as quickly.

So, how do you as academics -- and doing these kinds of studies -- kind of bring in maybe some real world discussions into the world; and also, I think, part of that real world discussion is when you're talking about people setting policy at the federal level, state level, local level. This is in terms of laws that are passed, taxes, and so forth. Is what you're really talking about is potentially kind of changing the way you change rates and the rate, you know, this kind of energy regulated world; but they will have impacts over here, and you're doing it in a silo over here and you not tying it into, or you're going to have to change tax policy or regulatory policy, or, you know, social policy.

So, the question is, is there any thought given to that kind of intersection or cross academics, you know, studies; and if you're not, I would actually kind of recommend it because --

MR. BATLLE: No, let me, I understood. First thing, let me dispute the word academic, I don't embrace it much. Myself and my team --

MS. CARMODY: I wasn't --

MR. BATLLE: No, no, no, no, but it's important; it's important because we are trying to run away from that. We clearly have done a work that reflects the trajectory that we have that is very much practical. And let me give you what I was thinking listening to you is, I spent too much time -- I mean, very happy here in the U.S., but I still take some time in Europe -- and it is fascinating to listen to the message as an advocate for consumer that you are bringing here compared to the one that comes from your peers in Europe currently now, which is right the opposite; and I will try to explain you why.

In those places where you have huge amounts of, for example, solar PVs (inaudible), most consumers are really complaining about (inaudible) the country, which is a problem. It's like we are, the ones who have not the choice of having a solar rooftop in our roofs, since we have a flat tariff and everybody pays the same, we are paying for the use of the networks that these other guys are making. We want a solution.

There is something else on top of that of this situation that I do discuss with them very often -- I spend a lot of time in Brussels -- and they say, it should be socialized to some extent. So it should be the government who pays for this as if the government is a third party, but they argue this. And they argue something else. This is something that can happen in Europe because governments -- according to Lisbon Treaty -- are not allowed to pay for this yet.

So, which this what I want to try to tell you is that we are talking about Bonbright, and something that we need to move from, because we don't envision that this will be a problem for consumers going forward. You can see it in Europe. Take a look at what's going on in Europe and take a look at what's happening there, and the social problem that is starting, and the example of Mexico was alluding to that direction; because until now, we're all consumers, we are all the same. We have the same choices, had the same opportunities; we couldn't go anywhere else, but now we are very different.

We're different depending on where we are, how the network has been available next to our places, and there will be lots of unfair -- from the perspective of consumers -- solutions if we don't try to sophisticate a little bit our policy, our regulations. And this is what we firmly believe on, and it's not a question of thinking, it's happening already in many places where they -- the rural development (inaudible),

development is in another galaxy compared to the U.S. This is actually an issue.

So, this is why we are saying that we need to move into. Now, to what extent, how to do it to keep these balance, I started by that saying, clearly we have to make an effort in keeping the balance between all the social things that are behind it; but we can't keep on thinking our utility rates as a tax; and this is what is under the fairness concepts of Bonbright and many others.

MS. CARMODY: Well, one thing, I wasn't suggesting in my comments that, you know, that we just stay doing what we're doing and no changes; but what I am suggesting, you know, is that these other things do need to be taken into account. I understand what you're saying about these things are moving, and so we do need to take a look at these things, but I always do get the sense that you're saying it is consumer driven, it is consumer driven in this country from certain quarters but not, you know, not from all quarters.

So, I would just simply suggest -- I mean, I do get the sense that there are other factors that are not being necessarily taken into account that need to be taken into account to achieve that when you're talking about kind of balance, you know. Some states may go, you know, this far, others are going to go this far; but that is really important to acknowledge that -- and also the intersection.

The reality is, is that in this country, we have used kind of rates, you know, as a substitute for taxes. I, in fact, have stood in front of our state commission and said, this X -- you know, whatever policy -- should be under a tax policy; but it's not going to happen. So, we're going to have to use the rate structure. I mean, this has been built up, it's decades old. So, part of the discussions that do have to take place is if you're going to be making these changes over here, what's going on over here in the other arena; because if you just do it over here, and you're not making changes over here -- whether it's tax, you know, some kind of external

subsidies, or whatever it is -- there will be some fallout. So, those were only my kind of suggestions to you and, at least, it always need to be thought.

MR. BATLLE: And I fully agree with you. I mean, this is a crucial issue; and again, it's not the same thing discussing this in the California context with the Californians behind that having this discussion in Texas or doing it in our council, clearly. This is where I started from. Try to guess where your consumers can go, up to where they can go; how diverse they are, and then think about the need of hurrying up or not. Maybe you can give the whole thing and nothing happens; but, in many cases here in the U.S., you will have to do things, and quickly, I think; but maybe I'm, surely we're wrong.

CHAIR TIERNEY: Carlos, you have a great job of doing what you said you did when you did this report. You said none of your sponsors were happy.

MR. BATLLE: Susan, let me say one

thing. Just to answer -- I know we don't get the agreement; but honestly, the ones that have reacted in a better way and you can understand it, are precisely this what I think is the new entrants. So, we had conversations with Google, they're in campus next to us; with EnerNOC, with Opower. These companies are the ones saying, yes; but, obviously, some others, like, because they say, we want complexity; so, okay, perfect for you; fair enough, but these are essentially the ones that are happy with this, and it's certainly not the utilities.

CHAIR TIERNEY: All joking aside, thank you. This was extremely informative, provocative, thought-provoking -- I mean, it was wonderful; so, thank you --

MR. BATLLE: Oh, thank you.

CHAIR TIERNEY: -- Thank you so much for joining us. We appreciate the push -- the intellectual push; and with that it's a great segue to introduce the Chair, the second-time Chair, of the FERC, Cheryl LaFleur. We are so

appreciative that you have found time to join us today, and you have always contributed great remarks to the Advisory Committee; so, thank you, for being here.

MS. LAFLEUR: Well, thank you very much, Sue. Thanks for having me, and it's great to see such a great group and so many familiar faces around the table; and I'm sorry I missed most of the MIT presentation.

I have with me Jessica Cockrell, who is sitting next to Larry Mansueti, that's with the smart people's table, there. She is an advisor in my office; has joined me since I've been acting chairman; she was in the policy office of FERC for years before that. So, standard disclaimer -- I don't speak for FERC, only for half of it; and I will try very hard not to talk about pending adjudicated cases, but I'm mostly going to talk about our rulemakings which are not covered by the ex parte rules.

As Sue alluded to, I'm in a new

position, two months ago, even in my rather non-standard FERC stint, this has been the strangest plot twist; and I used to have a boss that said, this will add a line to my obituary and hasten its appearance. But, here I am. So, I'm sure everybody in this room of FERC followers knows that we lack a quorum, and we have since February 3rd. All kidding aside, I was surprised and disappointed that Norman left so rapidly. I wasn't surprised he would leave at some point; but we are where we are.

We normally put out about 100 orders a month. We delegated some additional authority to FERC staff primarily to protect customers so that somebody couldn't kind of come in and increase rates and have it go into effect without Commission review. Most of the extra delegation we gave staff was around customer protection. Staff has issued 33 orders under their newly-delegated authority of which about half of them require us to come back and do something. So, even with those numbers, we're building up

quite a backlog; and we are working, I'm working -- I feel like my job here is to keep things moving with Collette -- Commissioner Honorable and I are trying to keep things moving; and organize the triage of pending cases as clearly as we can so when FERC 2.0 arrives, they will know what's most time sensitive, what's been pending, and so forth. Obviously, we want a quorum as soon as possible. We've been hearing for some time names are imminent. I hope that's true.

A lot has been made -- I think my predecessor used to talk a lot about the low number of dissents at the Commission. I mean that's numerically true; but when you look at the more policy-driven, or the more controversial things we work on, I think the low number of dissents doesn't reflect unanimity of thought, but rather the excellent job that our staff does in finding the middle ground and bringing us to something we can agree on. I generally say I'd rather get it 20 percent my way than write something stirring. And so, with that in mind, I

am at least personally quite optimistic. I can work with the new people as long as they're energy people, and continue to find where the sense of the Commission is and look forward to having the opportunity to do that. I do plan to serve out my term. When you go in -- I'm sure that you don't hang around the FERC picture library on the second floor -- but if you go by the Sunrise Cafe, there's like a little gallery where there's pictures of the guys with the mutton-chops on the Federal Power Commission in the 20s -- and underneath my picture it already says like, Commissioner, Acting Chairman, Chairman, Commissioner. So, they've used up the little plaque; so they're going to have to put another one for all my new series of titles.

One of the things -- over the last year -- under Chairman Bay's leadership, the Commission has undertaken a number of rulemakings and open-policy inquires; and I'm going to only comment on some of them -- the ones that really relate to electric markets and transmission; but

there's also, you know, the length of hydro terms, how we handle master-limited partner taxation, and lots of other things that are pending. And a big piece of what we're trying to do -- Collette and I, and the staff -- is to build the records for these rulemakings so we can shape the policy options in as transparent a way as possible when the new Commissioners get there so they can see what they have before them. Obviously, a new Chairman will make a decision what he or she wants to prioritize. I think some of these, I expect, would not be particularly controversial. Others might be subject to a significant re- look. But, I'm going to run through some of them.

The first is price formation. It's been about a two year effort to really sharpen up the rules of how prices are set in the competitive, wholesale, electric energy markets -- the energy markets -- to try to make sure that, to the best of our ability -- they reflect the real cost of keeping the lights on and so money's not going out in uplift or other things that's not shown into

the energy price. That benefits the resources that are there keeping the lights on. So, we've already finished shortage pricing and the offer caps. Those went to final rule; obviously, subject to rehearing. Without checking I would bet anything they're both subject to a hearing; they both have received rehearing requests; but we have in the proposed rulemaking stage a notice of proposed rulemaking on fast start resources that just went out in December for making sure that when a market has to call on the sorts of things that has to ramp up quickly that the whole cost is somehow reflected in the energy cost; and a lengthy rulemaking on uplift cost allocation -- who pays for the uplift that went out in January. Those are now teed-up; we're getting the comments in to get them ready to take the next step.

Second thing I want to mention is storage and distributed resources. I believe it was just in January, we issued a notice of proposed rulemaking on storage and distributed resource aggregations; and it was really -- I

believe, we called it the storage rulemaking, but it really had two, somewhat differentiated, parts. The first was on pricing energy storage in the wholesale markets, and it really built on a record that we had built over some time with having storage providers into open meetings, sending out a request for comments, reaching out -- I think staff had reached out to each of the RTOs for how they price things; and what it basically does is proposes a participation model for energy storage seeking to make sure that the different market tariffs and rules don't erect barriers to any type of market product or service that storage can provide. So, in some markets they are limited to regulation, or if they do this, they can't be in the other market. We're trying to -- if storage can help as energy, help feed-in, help as load, help as demand response -- to try to unlock the different uses of storage. It's easy to say but can be complicated to work to make sure there's not double payment and make sure the tariffs work; and that's the first part of the rulemaking that

attracted some controversy; but, I think, it largely seems rational to people, let's use storage as best we can.

The second part of the rulemaking is on distributed energy resources, including distributed storage, but not limited to storage. Obviously, I'm sure it probably has already been discussed -- a lot of distributed solar and other distributed resources. And what that part of the rulemaking did was called upon the RTOs and ISOs to work out the various tariff provisions to allow those distributed resources, which are primarily on the customer side of the meter, on the distribution side, to aggregate and bid in as wholesale resources.

This is pretty closely patterned on something the California ISO had filed at FERC and gotten approval for last summer. The California ISO as part of the CPUC storage mandate; is trying to aggregate storage; and figure out how to price it and dispatch in the market, and they're well on the way to figuring that out; although I don't

believe the aggregators are actually bidding in yet, they're still working a lot of the rules.

This part of the rule, I think, has attracted a lot more controversy than the first part. I had put out a statement when we issued the rule that I was, and remain, concerned about making sure we get the operational rules right. If you're actually feeding through the distribution feeders, back to the grid, as opposed to just reducing load to shave peaks, I think we have to make sure we have figured out the rules of how the distribution control center -- because distribution systems are more dynamic than transmission grids -- how that control center talks to the transmission control center, talks to the ISO. And some of the comments that we got were around those sorts of issues.

We also got a lot of comments about are we stepping into state jurisdiction; can states opt out of this under Order 7.19 as they could opt out of demand response; how is this going to work; will things be double paid, we got a hundred sets

of comments. We're just really digesting the comments, but it would not surprise me if the two parts of the storage rule went on different trajectories. I think we might need to build a little bit of a record on the distributed resource aggregation. I do think -- I don't have a crystal ball -- but I think we'll be seeing more distributed resources in the future than we have now, not less. So, we do need to figure this out. We need to leverage what they're learning in California and figure out how to do this. So, I think it's well worth the Commission working on, but we got quite a lot of comments about the speed with which we were going, so we'll have to take those on board.

The next big hot potato is transmission competition. We had a two-day technical conference last summer on what has become of Order 1000. Is it doing what it was supposed to do; do we need to do more? Really focused on five areas: What projects face competition; where the right of first refusal applies and doesn't reply. If you

recall back, my goodness, six years ago when Order 1000 went out, it did two different things. One was beef-up the rules for transmission planning and cost allocation; and the second was to introduce more competition into the transmission world. There's been a lot of the energy, over the last seven years, has been put into refining what are rules of what faces competition and what doesn't.

Second is how cost containment is considered in bidding. What we've seen where there have been competitive windows is all kinds of innovative proposals to have cost caps, even have cost caps including return; having just construction cost caps; what are the reopeners; how are the ISOs supposed to compare these. It's very good for customers to see things come in cost capped, and we've seen much more cost competition than some might have thought in the things that have been competitive bid; but we have to make sure we're doing it fairly.

Third is transmission incentives; the

fourth is competitive bidding. There are different models the different ISO have; and the fifth is should we be doing more on interregional. The Order 1000 was very, very soft on interregional. This required coordination between regions. It kind of was to interregional what 890 was to regional planning. Are we ready to take the next step or not?

As reflected in a lot of the separate statements I've put out, my interest here is in the nexus between competitive bidding and what gets bid out and what's subject to a right-of-first refusal and transmission competition. I'm concerned that because people want to avoid having things competitively bid, that Order 1000 not have the unfortunate effect of chilling transmission, big transmission, because people want to make sure they do the kind of projects that they don't have to bid out, and I think that requires close watching; and, I think, before we add to Order 1000, we need to make sure that the first one is, to the best of our ability,

doing what it was supposed to do and, I think, it has not done, in my view, as much as we thought it would. We have seen some competitive windows; we have seen some transmission planned; but, I think, it's a good time to take a look at, is it doing what it was supposed to do and, if not, what do we do about it.

Third big area is generator interconnection. It's been a long time since the Commission sent out its interconnection rules. We'd heard from the wind industry and others that there were barriers to new technologies in the interconnection rules; that there were a lot of arguments about late-stage interconnections, and withdrawals, and how you cluster things, and who paid what to whom for what; and so, we reopened that extremely complicated set of rules again to see whether we could reflect what we've learned in all these years of running the old interconnection tariff and do it better; and we took a lot of comments on those. The comment period was extended until April 13th; and we're still hearing

a lot to figure out how do we tighten or tweak the interconnection rules to make them work better.

The next area I want to mention -- a little bit different -- is the Commission's use of data. We do have a rulemaking pending on the relational database, which started as the connected entities rulemaking and then we reissued another notice of proposed rulemaking. Two different things were going in parallel. One was changing the market-based rate rules -- what we require people to file and in what form; and the second was a proposal to require considerably more filing of information with the Commission on corporate families and connected entities that would help the enforcement effort in making sure that cross-market manipulation, and other things could be identified.

That attracted a substantial amount of comments and was pulled back to a new proposal, which was a combined database that would do the market-based rates and, part of what the connection entities was supposed to do that went

out, and that's pending now; and that's before us. And I had issued a separate statement in the beginning on the connected entities one.

But that's an example of a larger phenomenon that I think under Chairman Bay's leadership, the Commission really improved its ability to analyze data and taking in more information in the quarterly electric reports, E-tagging information; more information from market-based rates; more of the reliability information. I mean it's more of a data world. I mean every conference you see across your screen talks about data analytics. So, it makes sense that the Commission would also be using more analytics and making decisions, rather than just fights between lawyers, pieces of paper. Although, God, who could not love lawyer's pieces of paper?

But to me it raises a lot of rules, a lot of questions that we need to mull; you know, if we're using more data, how do we assure due process and ensure things are shown in the record;

what about if these things are confidential; what do we keep confidential; what do we not keep confidential; how can we use confidential things in making decisions? And I just wanted to put this on the radar screen of the brainiacs in this room because I think this is a growing issue not just for the FERC, but for other Commissions of how data and numbers are used in making regulatory decisions.

The second to the last one I'll mention is PURPA -- good old PURPA. We did have a tech conference on this as well; and after the tech conference, out of the mass of testimony in all we heard, we pulled out two things to take more comments. One is the one-mile rule. You know, that you could have a PURPA machine a mile apart and it would count as a different machine; and the second is the contract term. I was just reading a summary of comments on that, of course, heard a lot from folks.

There's also talk going on, on the Hill about this -- trying to see if there is anything

sensible we can do to tighten our PURPA regulations. I think some of the commentary we heard at the tech conference went to the whole concept of whether PURPA, itself, is needed in a world where we have production tax credits and renewable portfolio standards, and sharply decreasing costs for certain of these technologies; and I believe, those are valid questions; however, they're questions that really should be addressed to Congress, which reaffirm PURPA as recently as 2005, so FERC can't make its own decision about its current necessity or relevance.

One message we heard loud and clear and repeatedly in the tech conference was that the combined heat and power people still very much are reliant on PURPA because they can't site a mile apart. They're in an industrial facility and that payment stream is very important to them. That message came through loud and clear; but as far as the wind turbines a mile apart, there was no consensus developed at the tech conference. But,

that is here for FERC 2.0. If they feel like opening Pandora's Box, it will be all lined up for them.

Final thing I want to mention is on kind of the FERC issues teed-up for the new Commission is the very complicated and, in my mind, extremely interesting question of market rules and state initiatives to choose resources. And I have to be careful because we have a lot of pending complaints; although our pending complaints here are in New York where the Independent Power Producers of New York has filed a complaint at FERC against the zero emission credits for the upstate nukes in New York; and also in PJM where the Electric Power Supply Association is challenging the Illinois nuclear credits. To the best of my knowledge, as of 11 o'clock this morning, there's nothing pending in ISO New England, so we can talk about ISO New England.

But the issues are roughly parallel in the different places; which is in the large eastern markets reflecting decisions made by the

states about 20 years ago -- exactly 20 years ago in the case of Massachusetts, and I think 21 years ago in Rhode Island; PJM just had its 20th anniversary last week, or maybe earlier this week -- so about 20 years ago, some of the states decided to introduce competition into the generation part of the value chain believing that competition in the generation resources would provide savings for customers, transfer investment rates to the generators, rather than the investment risks to the generators, induce innovation, share resources over a broader footprint -- at least in my mind, all of that has happened. We've seen ISO New England, New York ISO, and PJM move to a more merchant- generation model which has produced greater efficiencies in the plants, induced innovation in things like demand, response and new resources; and, I think, worked well for customers in finding the resources to keep the lights on at least cost, which was precisely what they were designed to do.

And they also, in the cases of those

three markets, looked to rely on a forward capacity auction to send an investment signal when generation was needed or resources were needed for reliability because you no longer had the obligation to build on the part of the incumbent utility as you had before, and that was part of the model; although in the beginning, they had a lot of the resources built under the old world to deplore. Increasingly, for various reasons, those are being replaced by new resources that the capacity market is seeking to incent.

What we have seen in a variety of places for a variety of reasons is states that are not happy with the choices that the markets they've created are making for them. Maybe the markets are causing competitive issues in units that they like because the gas is so cheap and it's making hard for some of the other baseload to compete; as we saw in Ohio, seeking to -- a couple of years ago -- subsidize the coal and nuclear units. Maybe they have climate change goals that the market is not optimizing because for the most part

it wasn't set up to optimize them with the exception of the Regional Greenhouse Gas Initiative, which I'll come on to in a minute.

The market doesn't price carbon, it only prices externalities that are required to be cleaned up in a command and control faction and priced into the cost stream that the generator bids in; and so, states like Illinois, New York, Connecticut -- I'm talking about pricing carbon outside the market or requiring distribution companies to buy certain resources. Maybe the state wants different resources. For example, Massachusetts passed a law last year wanting -- I always get this wrong -- but its 1.6 gigawatts of one thing, and 1.3 gigawatts of another thing, and one of them is offshore wind and the other one is imported hydropower; but it's about 3 gigawatts of designated renewable electricity that's not selected by a market; and this is causing a real issue for the competitive market structures. Because if you have some units that are bidding into a market and the only money they get is what

the market gives them; and on the other units that are being paid by the state, then you can't set a fair market price. Obviously, we had a couple of cases -- the Maryland and New Jersey cases -- where, you know, FERC held the line, said, you're going to take the market price, okay, always nice to win; but the markets only exists with the by-in of the states. The states created the markets, and if the markets aren't producing the resources that the states want, we have to figure out why and where we're going to go from here.

So, in my mind, there's only three ways this can work out. One is that we somehow have a negotiated or planned solution, or maybe more likely, solutions in the different markets, not something national, that adopts the market rules in some way either to allow the states to optimize their preferences, or to set up differential payment streams for the subsidized and non-subsidized, or somehow adopts the rules in a way that addresses this issue. I just have to say that, I think, for the states that want to do

carbon, this is what the Regional Greenhouse Gas Initiative was set up to do -- as one of the many original signators; however, the way that program has been administered and the amount of carbon that they've allowed has left the carbon price very low and it's not the price that the states were seeking to set on carbon, and I have, thus far, not been able to talk any of the states in -- to use RGGI -- they all say the other state doesn't want to it, or is politically infeasible; but that is a vehicle that's there, that already exist, or other ways to design markets.

Second way we can resolve this is through litigation. There was an argument in court yesterday about New York -- not in FERC court, we're not meeting, we don't have a quorum -- court, court had an argument on New York. People have complaints filing at FERC. There's always a way -- I mean, that's the baseline of society -- if you can't resolve it any other way, you have cases.

And the third way to resolve it is

through some sort of re-regulation where the states take back resource adequacy, which does not offend me if that's what they want to do; we have parts of the country where that's how it works. The problem is that if a state only wants to take a third of it back and give us the rest, or they take the clean part and we take the less-appealing part -- I won't call it dirty -- but the part that the state doesn't want to take back, that is a little bit of a challenge; and my worry is that if we don't get ahead of this, you'll have unplanned re-regulation where the states will take some and then the next most threatened resource will come and say, I need a subsidy, so the states will subsidize that; and then the next most threatened resource will say, I, too, now need a subsidy; and before you know it, you'll have re-regulated but not in a planned way, in an expensive way, that could be very messy.

So I'm all in for door number 1. Let's figure this out, and that's why we're having a tech conference on May 1st and 2nd. I don't

believe that we will have white smoke come out on May 2nd at 5 o'clock and everything will be solved; but having two days where we can get people in a room without ex parte rules and hear what their issues are with the markets; what they're going for, might do something to promote a solution and build a record for the new FERC, which is what we're trying to do is line these things up.

Just a last thing I'll mention really quickly because it's so du jour is the executive order, the Energy Independence Executive Order yesterday. We have not fully digested what it means for FERC, but our focus is on the change to the CEQ rule on pricing greenhouse gases in NEPA because we had been working on the old one that came out in August, now we have a new one; and we'll be, obviously, looking very closely at that. I think the general trajectory toward gas and renewables will continue, because it's being driven a lot by economics and technology; but we'll be looking at the Executive Order like all

the other parts of government.

And with that, I will take your questions.

CHAIR. TIERNEY: Thank you, Madam Chairman, for the second time. I think you are the only one who has ever been it twice.

MS. LAFLEUR: Apparently, I am.

CHAIR. TIERNEY: And your shoulders are really showing that.

MS. LAFLEUR: I know. I'm like the movie that is like it sometimes gets to be best picture because it's everyone's second choice. You know, there's a pay -- people who want one movie really a lot, but then there's that one that everyone kind of likes -- I'm that movie.

CHAIR. TIERNEY: That's great. All right. I'm sure that there will be cards. Let's start with Jeff, then Heather, then Nancy, then Jim. I'm going to put myself in the cue. Okay.

MR. MORRIS: Commissioner, thanks for joining us today; Representative Jeff Morris from Washington State. I'm not going to ask about

particular, I think, things that you probably can't comment on; but I asked this question yesterday. I'm concerned about a construct that's just starting to get off the ground with some of the aggregation rules that are really, you know, aggregating distributive resources up to the HV-side of the system, and my concern is that the way the construct's going for states that don't have a distribution balancing DER process, like New York and California are pursuing, that you are going to see all the DERs with value have those values stripped from the distribution side and taken up to the high-voltage side of the system for interstate commerce purposes; meanwhile the states are left with only the DERs that costs ratepayers, holding the bag. So, do you have any general thoughts about that because if we don't resolve this upfront, there'll be lots of litigation on jurisdiction probably on the backend?

MS. LAFLEUR: Well, my general thought is that the last sentence is right; that we should

resolve it upfront. I think, you know, we have this very complicated ecosystem of federal and state authority to regulate electricity in this country.

From a point of view of economic optimization, the -- whether it's a solar roof or whatever other battery should be contributing wherever it contributes the most to value for the customer in the system, which may be -- I mean, I could make an argument, certain things if you deploy them over a broader -- for example in California where they have so much solar that they're, you know, have abundance in the daytime, than having a broader region to trade over might help as we've seen with the energy and balance market -- and so, sometimes going bigger might be better for customers.

On the other hand, there might be, even in New York, where you mention New York where there are things that NYSERDA is developing or subsidizing that are helping on specific distribution lines like the thing in Brooklyn or

the Bronx, or wherever it is where they're deferring a substation with a specific development. So, in a perfect world, we could somehow make sure that there is enough communication to figure out things are paid at the right level.

At a minimum, we can try not to double pay or, you know -- so perfect rationality where everything is optimized might be the ideal, but not making it worst should be a doable thing -- and, I think, that's why we need to think through how we do it. Just as we shouldn't say, everything goes wholesale, you know, nothing has value at a distribution level, that's wrong; but to say, hey, these are on the distribution side of the system; therefore, hey, that's a first name, they must have more value there. That might not be true. It might be that, for example -- I mean, if you believe that everybody's going to plug in their car batteries and it's going to collectively be some big giant battery like pumped storage -- that might have more value over broader areas.

So, I think, we need to figure that out.

CHAIR TIERNEY: Thanks, and who did I say next? Did I say Nancy?

MS. LAFLEUR: I thought you said Heather, but I didn't --

CHIEF TIERNEY: Heather, you're next.

MS. LAFLEUR: Here's the lady figuring it out.

MS. SANDERS: Yeah; good to see you again. I appreciate all that you're doing and the opportunity you provide for a lot of stakeholders to weigh in; so, keep it up; and you're not my second favorite, you're my first favorite.

Anyway, mine is really simple. For interconnection, does it also apply to the Wholesale Distribution Access Tariffs, as well?

MS. LAFLEUR: Could you repeat that?

MS. SANDERS: So, for interconnection; there's transmission interconnection rules; but there's also interconnection governed by FERC for Wholesale Distribution Access Tariffs. So, connected to distribution voltages --

MS. LAFLEUR: Yes.

MS. SANDERS: -- participating in the wholesale markets. It's really, really, really, needed and really, really important. Just ask Janice. So, just something to look into because --

MS. LAFLEUR: Absolutely.

MS. SANDERS: -- transmission interconnected voltages really, you know, that's not what we're seeing the challenges in; it's the Wholesale Distribution Access Tariffs, and then the treatment in between, you know, the jurisdiction of the states. So, our Rule 21 versus the wholesale distribution access tariff if you want to participate in the wholesale market. So, that's going to be a really tricky one in the future as we connect more things behind the meter, and then stack the values of storage. So, we, right now, don't allow any state jurisdictional interconnections to participate in the wholesale market. That's why we need movement on the Wholesale Distribution Access Tariffs, in general.

MS. LAFLEUR: Yeah. Well, I will take that as more of a comment or question. I think it's different in different places. So, California, where you're obviously from, and the midcontinent, so already have cluster interconnection. I don't want to say they've entirely cracked the code, but they have a lot of what we're requiring the others to do. New England, for example, has had substantial problems interconnecting wind in Maine, and the tension lines there are kind of -- where does the transmission system end, and interconnection start; how do you reconcile that; so, it's not solved at a transmission level everywhere.

But your second generation problem of what about the wholesale distribution assets, I think, just as was just commented, is more of the future, and it's not easy to solve because you just can't sit in 888 First Street; it's so related to the multiple states. I guess, I think it would be -- if I had to say what I think, would be optimal -- would be if a couple states step

forward and we figured it out; and so, I think, California has seemed to have raised its hand and, maybe New York, to sort of crack this code rather than trying to do it everywhere at once.

CHAIR TIERNEY: Next, Nancy, I think.

MS. PFUND: Thanks for a terrific summary. This is another kind of California-based question on the data activity that you described. In California, we participated in a paper on data transparency and access that the tech industry, and the solar, and Tesla -- kind of all were involved in -- and it kind of catalyzed the legislature to start writing some bills that really open up the data for the reasons that you described; and, also, kind of set aside frequently made points about national security risks, and all of that; so, really, trying to promote more innovation by making the data more freely available. That's really the tech industry's approach is that we'll get better products and services. And so there are two bills that are kind of making their way through the legislature,

and Nancy Skinner -- one of the folks that's written one -- has a pretty good track record in terms of getting these through. So, how do you see -- so you may have, you know, the nation's largest state with the most amount of DER, you know, kind of already doing this -- how do you see that unfolding?

MS. LAFLEUR: Well, it's a complicated question and, obviously, I was just -- I read half an article in the Washington Post this morning on this new rule that Internet providers can release your data of where you looked on the web and all; so, it's a bigger rule than just electricity. I think at the state level, when I used to be in a distribution company, a lot of the data rules were around customer privacy and customer identifying information, and so forth, and making sure that's protected; making sure that if we are going to figure out, you know, where the duck is fattest or something, we do it in a way that's anonymized to customers so that we don't violate customer protection.

What we deal with at FERC is more two other kinds of confidentiality issues. One is the national security, people trying to do harm to the grid; and that one, at a very straightforward level, it's very easy. You say, well, of course, nobody should be allowed to see something they could use to plan a terror attack. Isn't that obvious? But if you have scientist who are trying to get information on how the grid is operating in order to, themselves, figure out how to do something better for the grid, how do we package the data in a way that they can get it, is a substantial issue that I hear about as I go around; and, I think, that we need to figure out a way to protect what we need to protect while still being able to use the data to make things better; and I don't think we've figured it out yet.

And the third is commercially-sensitive data, which we get a lot of, and it's hard for us, I think -- I'm not going to lie, there's been times I read things and I thought this really isn't commercially-sensitive, but you can't just

use a gut test. It's hard to counterman a company that's saying that it is; and, I think, the general trajectory is toward more sharing of data and more figuring out how to anonymize things so we can learn from it and make more databased decisions; but because of the different types of things we're trying to protect, I don't think we've cracked the code.

My worry is, I mean, you seem like a troglodyte if you say don't take the data if you don't know what you're going to do with it; but sometimes I do feel like a troglodyte because if I'm going to have data, I want to understand how we can use it; is it in the record. You're sitting next to Mr. Ball who had a case that raised an issue of data analysis that we had done and sort of pushed the envelope on how do we share it with the company, and so forth.

MS. PFUND: Thank you.

CHAIR TIERNEY: Jim?

MR. LAZAR: (Inaudible) I'm going to follow up on exactly the same topic, so that's

good. I'm Jim Lazar. I'm an economist. I work with Regulatory Assistance Project. My first rate cases were in the 1970s. At that time, all power contracts were available for discovery without any limitation. At that time, the FERC Form 1 required the utility to list every wholesale transaction that they had; what was the point of delivery; how much power was delivered; and what was the price?

As an economist, markets need that kind of information to be efficient. I'm curious what ability FERC has to help return us to the transparency that we used to have. The New York Stock Exchange is a pretty transparent market. I don't know who bought 100 shares of Microsoft for $25.00 at 2 in the afternoon; but I know that some transaction occurred between a willing seller and a willing buyer at that time, at that price; and that makes for a very transparent market.

The ISOs do a nice job publishing transparency of market clearing prices down to notable prices on (inaudible) intervals, but that

doesn't help us with people who are trying to negotiate bilateral contracts as, particularly, a problem for smaller utilities that don't have the kind of market power that the larger utilities have. So, what's the ability to restore the transparency of the bilateral contracts?

MS. LAFLEUR: Well, that's a great question, so let's look at, in my mind at least, what are the, you know, break points at which transparency was lost. One was the introduction of competition. So, I mean, it used to be you'd go to EEI and they were so much more worried about, you know, don't share information because of antitrust -- because it was one big happy family and everybody had their protected monopoly. Now you have people competing with each other to do things all around the country and, I think, they're worrying more of what will people share. Although, I mean, I don't speak for --

MR. LAZAR: But in order to compete, people need information. Markets to thrive on perfect information.

MS. LEFLEUR: -- and so the question is -- and then the second big driver was 911 when, that's when the confidential energy information, whatever the CEII, the Confidential Energy Infrastructure Information -- ACSAR came out of that -- the thought of more sabotage of the grid; how do we protect that. I think one thing that we need to do is -- starting with the latter -- do the best job we can making our best decisions on what should be confidential and what shouldn't. So, I'll just give two examples that I don't believe either of them are currently pending. One is these people who are the companies that are now want to have a national kind of repository of transformers to share among themselves. We had people on the docket saying the location of that inventory should be a matter of public record so we can go audit it; and, I mean, that one to me was -- I was persuaded that there was a security issue if you were having this sharing of transformers for security reasons and not knowing where the field was where they were stored.

On the other hand, in our geo-magnetic disturbance final rule, we had people saying the ground conductivity underneath different parts of the country, and the monitoring of the geo-magnetic current and different things, could be confidential; and when we asked why, they said, well, if you got enough of it together you could figure out where the big substations were. I was like, well, couldn't you just drive and figure out where the big substations were? So, I mean, we ultimately, said we'll entertain requests, but we start with the supposition that just knowing where the ground is, how the ground works, and where the currents flow, is not per se confidential; although we'll entertain requests if somebody can explain it to us. So, those are kind of two ends of the spectrum, and we're really just trying to navigate our way through on the security front.

On the other front, I think the answer is in more analytics; finding ways to anonymize things; during more like the ISOs do; we're adding work at the Commission to kind of look at some of

our data and understand kind of what's the pool we have; how do we store it; and how can we help. It's not going to be the baby boomers who figure it out because its somehow in the IT that the answer is, I think. I'm sorry that doesn't mean no baby boomers. If any of you are computer experts, God love you; but, in my experience, it's not us.

MR. CENTOLELLA: Thank you, Cheryl, for being here and it's a pleasure to see you; and I appreciate the fact that you're holding the fort. I guess my question is about how FERC thinks about the development of distributed resources and its implications for markets. So, you've quite, justifiably, paid lots of attention to pricing on the generation side of the energy and ancillary service markets. These were markets that we developed after Order 2000 to deal with congestion on a transmission gridline. What we had to deal with it was the dispatch of large generators. We now see a range of distributed resources both, you know, responsive demand and distributed generators

and storage coming up on the distribution grid who are largely seeing and responding either directly or through their retail supplier to the implications of prices on the load side of those markets.

Those load prices, however, are not nodal or interval prices by and large, their, at best, zonal and hourly averages, and in some places they're not even that because the load is priced or allocated based on some historical customer- class load curve that may not even reflect current class usage. I'm wondering where is FERC in terms of looking at this issue; what kinds of information are you, you know, having in front of you; and how do you think about that going forward?

CHAIR TIERNEY: Good luck with that one.

MS. LAFLEUR: We probably haven't thought about it in the way that you presented it, enough. So, I would say, serving on FERC 7 years, the first 4-1/2 or so, we were battling more foundational things about demand response --

should it even be allowed to be wholesale -- major battles between the people whose livings depended on the greater deployment of traditional resources and people who wanted to pay the demand response resources; whether FERC should even be doing anything; and what are the gross rules, not the very refined rules of how you price it. I'm sure there are people who think -- I know, I'm not just sure -- there are people who think we should even re-look at that and go back before Order 745 and how we priced DR, I would not be among them. You know, if I could go into a time tunnel, there might be things we could do better, but having won at the Supreme Court, I would say, at least I would lead it. Now, what is FERC 2.0 going to do, I don't know. We had one recently departed FERC Commissioner who put out a lot of separate statements about overpaying DR, and there could be -- actually two somewhat recently departed -- so, we'll see.

On storage -- and if you want to say other non, so that's like demand -- not feeding

the grid, but lowering demand, but on resources that can actually feed in, like batteries or rooftop solar were even earlier in that, and I would say in the December rule -- whatever it was, December or January -- back where we were in demand response in 2010, sort of kicking off the first issue of is it even FERC; what is FERC doing here; and, if so, all the other questions that follow from that.

I hope we can learn from the four year DR battle and not repeat that battle every time a new thing comes along, and maybe figure out a way to do it with buy-in from the states, or whatever, so that we can go more quickly; because, otherwise, I think we're leaving a lot of value on the table. But, I mean, I hope this doesn't become political with the new FERC; but I don't see into other people's brains. I'm lucky if I can see into my own.

MS. SILBERSTEIN: (Inaudible).

CHAIR TIERNEY: Nicely put, Pam.

MS. SILBERSTEIN: Your list of the

things that are on your two-person plate left me breathless; so, with some trepidation --

MS. LAFLEUR: You know, we're not allowed to eat though, we just can kind of like put them on the plate, and make the buffet; so, it reduces the temptation a little bit.

MS. SILBERSTEIN: Right; but I think that's temporary. I guess we all assume it's temporary. So, with some trepidation, I'm just going to add one more thing. I just wanted to share with you something that my colleagues and I have been hearing from our members in the markets, which I call gas electric coordination 2.0; and what a lot of our members, but certainly other market participants are experiencing is just new demands on gas-fired generators as a result of the much greater level of intermittent resources in the markets; and that just leads to new requirements from pipelines -- well, I guess, the whole pipeline or the gas supply chain -- and that was a difficult, also, couple of years; but, I think, there are a lot of gas-fired generation

owners, plants, participants that would be interested in seeing that revisited because the needs for our flexibility and coordination between these industries are as, you know, potent as they have ever been.

MS. LAFLEUR: Well, thank you for that comment. I mean the, I'm not eager to step back into trying to change the gas day, but I know who I'm going to get to run the NASB Committee if I do. But in terms of pipelines offering more services, more strategic use of storage, I think there's a lot there. I mean, we're using gas differently and its too hard to build out the pipeline network to just build it out so prolixly that there's enough for everyone all the time, you don't have to plan anything. So, I do think there's more. I agree with you that there's more work to be done.

We are seeing some of the -- because we had recently some staff work on what different tariffs see; how the different pipeline schedule, what kind of computerized scheduling they use --

it's not like a single platform; and what sorts of services the different pipelines -- and it's quite different between pipelines, and then the ones that offer a lot of different services. Spectre comes to mind as one that's really been out there offering different, rather than just like take it, I forget what it's all called, take it a 1/24th every hour weigh more shaping services. How much are they? What's the trajectory of how much they're being utilized, who's taking them; but there's more to happen in this area, and it ties a little bit to Paula's question because gas isn't our only tool. So, if you need to ramp up, we'll say the document, though that's a simplification -- but from lows ups and downs, gas isn't the only thing we have and how do you somehow coordinate those. That's a big issue.

CHAIR TIERNEY: So, Pam took one of my questions as you might guess; so, that's great, but the other question I have is to ask you to actually, you know, imagine you're the brainiac that you are with very big wide vision, and long

vision of what's happening in the industry, and one of the things that I think arises as a result of these state actions to enter into markets and require a long-term contracts for various pieces, that fact combined with the fact that more and more of the resources coming into the market are actually quite capital intensive, very low energy costs. So, you can imagine that many of them need contracts to enter the market, and often utility balance sheets are being used for that purpose, either willingly or on a mandatory basis.

I can just imagine a possibility in which we just march inexorably toward more and more contracts, even in a centralized market. So, does that fact mean that in the states where there're -- and I'm thinking of MISO, New England PJM especially, where their resource adequacy has not been kept at the states, where it has been in the capacity markets. Whether they're just more likely to migrate to a MISO model or a California model where it's either through bilateral contracting or through the state saying we're out

of this market totally, just officially. I mean, is that where we're heading, or not; and I realize this probably occurs maybe after you get to take off your FERC shoulder pads; but, anyway, I'd be interested in hearing your thoughts.

MS. LAFLEUR: I think that we're at a really critical point right now; because, I think, the jury is still out on whether we have the political will to set up a competitive market design that will produce the new resources that we want. I just recently asked for a piece of work to be done on -- like the resources that are in the market -- how many of them were there before, and how many came into the market; and when the ones that came into the market, did they respond to a price signal or, you know, where did the resources come from; because we haven't yet, as everyone knows, transition, we don't have a set of resources; that's all post restructuring. We have legacy resources too.

CHAIR TIERNEY: That's a great analysis; that's good.

MS. LAFLEUR: I think something will be lost if we just default to not using the market for resource adequacy at all because I think a kind of hodgepodge of political decisions is going to be driven by much more short-term political objectives when we're building long-lived assets; and I hope there are regions that have enough sticking power like, maybe New England, that they can figure this out and pull together as a region.

But, I think -- if you think of all the things that people are trying to do outside the market. There're at least two different categories. One is people want new resources that the market isn't providing; and the second is people are worried about existing resources that exists and they don't like what the market is doing to them.

Just turning to the second for a minute, this is big picture, post my time at FERC, you know, the problems that the nukes are having with the gas being too cheap is just the tip of the iceberg. Eventually, we already see in California

the gas plants are having problems because there's so much solar you can't make money on gas, and pretty soon if you get enough renewables, they cannibalize themselves because there's so much of that; and so, big picture, I think, if we truly are marching toward a clean future where we're changing over a lot of the resources -- and I know I'm not smart enough to plan it, but I hope I can say it -- we might need to move to some kind of non-volume metric way we pay things.

We used to think -- like telephony you paid by the minute, like before 6 and 7 o'clock, long distance cost this much; after 7 o'clock it cost this much, it was just taken for granted, and now we don't pay telephony by the minute; and maybe, if you have gas plant and you still need it for when the sun goes down in California and you need that gas plant, it's not going to make it up on volume because the duck is going to get fatter. Someone came in my office the other day -- had an argument with someone -- they said the duck was pregnant. And, so, well ducks don't get pregnant;

ducks have eggs. So, please don't let the pregnant duck be the new thing that everyone in electricity talks about because I just can't handle it.

But anyway, but if the duck gets fatter -- not because of pregnancy -- but just because of fatness, then, you know, there won't be enough volume. So, the concept -- we made this up that you pay everything by volume, that's not the only way you can pay things. And I just think that might not be the long-term future. So, before we start subsidizing maybe we just need to step back and say what is it that we need that thing to do, and let's pay for that.

I mean, I say this to people, maybe it's the new ancillary service type thing, and everybody says, oh, yes, yes, yes, that's very brilliant Commissioner. Let's now talk about the capacity market and my fight next month. But, I mean, someone has to be thinking of not the fight next month but kind of long term. I'm not sure the whole way we think of electricity pricing when

you have fewer and fewer of the megawatts being generated by a fossil that you pay by volume, that it should be done by volume; and somehow it's because of that -- it ties to why you need the contract, I think.

CHAIR TIERNEY: Yes.

MS. LAFLEUR: Yes. So, that's my brainiac answer. Don't ask me to figure it out. Rate design was never my thing; I don't know how to do it.

CHAIR TIERNEY: Well, my guess is you will hear a lot on this topic at your upcoming technical conference. Thank you so much for joining us. This was extremely, (Applause) extremely insightful; and we hope that the two FERC Commissioners just keep being fine, and healthy, and staying, and moving the ball forward. Thank you so much, Cheryl.

MS. LAFLEUR: Thank you.

CHAIR TIERNEY: I know that we have one more presentation to give, which is the one from Merwin, about storage. We are going to break at

12:30. We have been going for a very long time. If people do need to take breaks on their own, please do; but I feel like we should keep going so that we don't end up pushing things at the end of the time frame.

Thank you, Madam Chair.

MS. LAFLEUR: Thank you.

CHAIR TIERNEY: Merwin, you're up.

MR. BROWN: Okay; I'm Merwin Brown, Chairperson of the Energy Storage Subcommittee, and what I'm going to report on are mostly the future activities and plans -- of course, that's what a plan is, it's the future -- that I want to talk about here, and if there's any reaction, or feedback, or guidance from this Committee, I think I'll appreciate it.

So, the plans for roughly the next two years of this historic Subcommittee is, one, we have an activity underway now to develop a work product related to a high penetration of energy storage work -- again, maybe for the new people here, it's what I call what happens if the dog

catches the bus; in other words, what would a very high penetration of energy storage mean for the electric grid both in terms of opportunities and in terms of challenges. In some ways, this idea came about in sort of copying what has been done in the renewable energy area of trying to forecast what the impact might be with high penetration of renewable generation.

An update on this -- well, first of all, let me just tell you what I'm going to cover -- I guess not, I'm going to cover it now. We've been working on this now for, I don't know how long, a couple of years I guess, or maybe approaching that -- it's been a very challenging effort to work on. We've taken a scenario-planning approach to this. We have developed the scenarios and have done some analysis of those scenarios, such as what have we learned out of those, but we're not happy with the results yet. So, we're continuing to work on that, and following this meeting, immediately, and going over into tomorrow morning, we hope to put this to rest, that we finally come up with

something that we feel that we can report back to you that has some value. So, that's where we are. If that happens, we might have a report ready for the June EAC. However, when you think about it, that's actually not a lot of time. There's really only about two months of work time between now and then because the next EAC meeting is kind of early in June and, so, it doesn't give us a lot of time. But, that's our plans going forward so far, and so we, at least, I put in there, we'll finish in 2017, probably that's pretty assured; I hope.

Now, I'm going to talk about some proposed and scheduled new work products and I've labeled them in this way, proposed and scheduled, because they're kind of a mix. They're still being formulated so they're somewhat proposed; but we're far enough along on some of these that, for all practical purposes, I think they're going to happen, unless you change my mind at this moment here.

One of them I want to talk about is the thermal storage, as it's labeled here. What this

effort is really a follow-on to a change that we made at the Energy Storage Subcommittee -- I think it was, it was when we did the two- year review and the five-year plan -- which was, in the past, we focused on electricity in and electricity out energy storage from a grid perspective; and a number of players along the way, a number of Committee members, have pointed out that's not the only form of energy storage that can impact the grid one way or the other; and they're right. So, in that period of putting together that five-year plan, etc., we expanded the scope to include energy storage. I'll use the rough definition, whatever impacts the electric grid in one way or another, that is what we'll look at.

But the first kind of an obvious one we want to look at is the thermal storage and get a handle on defining what that means. What are the opportunities and challenges? And Ake Almgren has agreed to handle that effort for us; so, I think, this one is going to go ahead, and we're going to get this done. So, that's one of them.

Another one has come about. In a number of past EAC reports of various kinds we keep coming up with this issue -- and it's been mentioned in this meeting, this particular convening of this EAC -- is that energy storage represent some challenges in the traditional way of doing rates, tariffs, market designs, regulatory designs, etc., and how it ends up getting deplored. So, there are great arguments that go back and forth about it. Should you be allowed to put energy storage in as a rate base; or, no, that gives certain market power; so, no, it should be in a pure competitive market, but, no, that doesn't really allow energy storage to realize it's full value at least under current market designs. But the industry has gone ahead. It's already putting in devices and etc., and it's being done in different ways. And, so, the purpose of this project is to look to see what we can find out that is being done in different areas.

We know California has taken one

approach to this, for example, through a mandate. It says it'll just do it. What has that done; what does it mean, etc.? So, Ramteen Sioshansi has agreed to take on that lead, and Tom Sloan, who is a past member of this Committee, I believe has agreed and volunteered to help out, because this was something he had a passion for when he was on this EAC and has done a lot of thinking on this. So, I'm fairly sure this one will probably go ahead as a work product.

And, then, a third one is the energy storage in the modernized electric grid security. I'm going to cover this a little later because it is fairly complex. I have slides for all of these, and I've been covering them with just this summary slide, but this one I want to wait until I get to the slide because it's a bit more complex. But it is a work product that we're planning on going through with here focused around the role of energy storage in security and resiliency in the electric grid.

And then one that we really don't have a

choice on, but it's looming large again, is in 2018, we need to have produced another biennial storage assessment. In other words, a two-year review of DOE's energy storage work; and so, the date that we must shoot for is the EAC meeting that probably will be held in September of 2018, and that really isn't that far off in terms of what it takes to put these together. So, that's what's on our plate coming up.

Let me just go into a little more detail. I probably already covered this and so I may go on -- that's the energy thermal storage look. So, I'll be repeating what I just said. But the status right now is the scope is pretty well defined. There's something in writing that defines what it is this product is going to be looking at; and in the area of the second one, the rate tariff and regulatory design for energy storage lessons learned, this is really going to be looking at, as I said, a survey of current practices and proposals in this area and, then, if any recommendations of further work come out of

this that we can pass along to DOE, that would be a product of this effort.

The one I held off until -- and I wish Janice was here; where did she go to. This is -- Janice Lin's agreed to take on this particular one. In past work product and others elsewhere around the world, energy storage is identified as an element of interest, as a special asset class for modernizing the electric grid, and in peeling the onion layer more deeply here, the energy storage assessment proposes to examine the potential role for energy storage provide backup resiliency and reliability services when the grid is down.

While I've also been able to participate in ordinary grid operation services -- which is what it's been looked for -- the point is here we keep seeing references, energy storage must have a role in resiliency and things like that. What we don't feel it's been well thought out as to what that means. Just what are we talking about when we say that has a role for energy storage? The

other thing that's happening here is that it's beginning to happen. In some cases, energy storage is being deployed for these kinds of purposes. So, what we want to do is learn from that and confuse ourselves at a higher level on what it means to use energy storage as a resiliency security backup device in the grid.

So, Janice has put together a very lengthy and well- documented proposal to describe what we want to do here, and what our end result is; and I hope I summarized it in this third bullet, which is the core of the activity of what we want to do is to conduct a facilitated discussion-oriented session with invited expert speakers along with industry, academic, public sector participants -- for example from the Department of Energy; from the Department of Homeland Security, and other federal agencies, and that's not an exhaustive list, probably -- the idea is this session would be conducted as part of a regular DOE/EAC meeting; and we'd take the majority of one the days; and right now, we

propose the second day for the June 2017 meeting, because we do have a sense of a bit of urgency here to get this meeting going and get it done because of things going on with changes in DOE energy strategies, R&D funding, and this kind of thing.

In some ways this is nothing special. We'll have panels and we'll have discussions. Maybe what is special, a couple of things; one, we're proposing, based on an agenda that's been put together by Janice, it is going to take the one whole day -- whatever you want to call that. We're proposing going in to around 3 o'clock in the afternoon on that second day, which, by the way, in case of those who are here are new -- meaning in the last couple of years -- where we always quit around noon -- we used to go until

a.m. in these meetings, so this is actually just going back --

CHAIR TIERNEY: P.m. You said a.m.

MR. BROWN: Did I? Okay. Thank you for telling me what I meant; 3 p.m.; yes, good point.

The other thing that will be somewhat different from our conventional meetings is that usually the panel members come up, give their presentation, then the EAC members ask questions or tell them things that they thought the panel might want to know. But what we're going to do in this case, is allow for a more free-flowing of discussing in which panel members, themselves, and other invited guests, if you will or experts into this thing, will be able to discuss with one another; ask one another questions; and, therefore, it opens up the number of communication channels that would take place. So, that's really what's really different here. The intent is to really get down and let people think about this, and in real time advise us on what this all means. From one perspective -- from the people who worry about resiliency and security, etc., what do they think is needed, etc., out of the grid; and then from the other experts who are beginning to look at, well, what can energy storage do in this function. And so, that's really what this is all about.

So, those are the three work products that are -- what's the word I want to use; I can't think of the word right now -- but we have the flexibility to do them or not do them. So, that's what I wanted to let you know.

Just to finish out the presentation, but there's not much to say about it. The 2018 energy storage assessment is looming again, and for those of you who are new to this, the Energy Independence and Security Act of 2007 formed the Energy Storage Subcommittee as part of that law; and in that law, there are two requirements of the Energy Storage Subcommittee, and one of them is five-year sort of forward looking plan or a strategic plan that the Committee comes up with for DOE's use if they so choose to do so, and the other one is a two year assessment of what DOE has done with their resources, etc., and any recommendations that come out of this. We did the five-year plan and the two-year plan in conjunction last year, and it was approved at the September meeting of the EAC last year; and now we

need to start thinking about doing the next one already. So -- oh I just said that -- the 2016 energy storage plan, both of those requirements were met then. And so, we're shooting for the approval of the 2018 for September 2018.

So, that's it. So, if there's any feedback, any reactions, to what's been proposed here, fire away.

MS. SANDERS: Heather. Can you go back to the rates one?

MR. BROWN: Yeah.

MS. SANDERS: One of the things that I think may be interesting here is to, once you look at the current practices and proposals, look into the needed capabilities and maybe technology, enabling technologies, okay? Now, let me explain better. One of the things that I think limits us -- and when I did the energy storage roadmap in California -- when you use the stack-to-value storage it's hard to separate the measurement of that, right; so, do I want to use it for one use this time, a different use this time. And so I

think a lot of times our rates and our tariffs in a regulatory design are driven by the technology capabilities we have; and since we're DOE, I think, we need to bring that technology component into this analysis. Agree? Just a suggestion, but I think that would really help here.

MR. BROWN: I hope you're taking notes, Ramteen.

MR. SIOSHANSI: Yeah, I totally agree.

MS. SANDERS: And I will volunteer to help you. I'll come back to the Energy Storage Subcommittee. I think this is really interesting.

MR. BROWN: Thank you.

CHAIR TIERNEY: And just to clarify. Are you specifically saying that as part of figuring out what you pay for, you articulate what attributes you're looking for?

MS. SANDERS: Well, kind of what capabilities of, you know, that you would need in order to change the rates or -- you know, so, you need smart meters in order to get --

CHAIR TIERNEY: I get it, okay.

MS. SANDERS: -- you see what I mean, or you need to be able to separately measure when you're using storage for regulation or local demand mitigation, etc., or you don't. But I think that's one of our big barriers in fully utilizing energy storage is really our ability to separate how you validate its response.

CHAIR TIERNEY: Thank you. Yes, Janice?

MS. LIN: Thank you, Merwin. So, on the workshop that you mentioned on the next slide, I've three comments. One, that part of the inspiration for this was the Trump priority infrastructure plan -- I don't know if you mentioned that -- where storage --

MR. BROWN: I didn't mention it explicitly. I was trying to stumble around that without being too blatant; but, yes.

MS. LIN: -- okay; well, so the idea is that the EAC could help flesh that out and inform and come up with priorities and opportunities so the work product -- I don't see it listed there-- is after the meeting, our Subcommittee will work

on a white paper that we'll share with all of you, so that'll take care of the second point.

My third point is a request to all of you that this kind of meeting is most successful when you have the right people in the room; and because it's intentionally designed to include not only DOE leadership, but also some other agencies in the administration. We, definitely, would like help if anyone here can help identify who those people are and facilitate with the invitations. We're definitely outreaching broadly to get help with that. So, thank you in advance, and if anyone's interested to help or volunteer, please let me or Merwin know.

Thanks.

MR. BROWN: Yes; thank you.

CHAIR TIERNEY: Are there questions or comments? Merwin, thank you. You have navigated a Subcommittee leadership position that really does require you guys to do a lot of work. So, thank you for your leadership, and for all of the members of that Subcommittee, in particular.

Thank you.

MR. BROWN: Yes. I definitely want to thank -- I mean, I thought it was remarkable that three people came forward and said they would lead these efforts. It's usually you got to take someone in a back alley and work them over.

CHAIR TIERNEY: Break their knees.

MR. BROWN: That's right. It either says they're extremely capable people, or extremely ignorant. I know it's not the latter.

CHAIR TIERNEY: But, seriously, in advance for all the work that you guys are doing, thank you very much. That's great.

Any other questions? If not, then we have the scheduled time in today's meeting to see whether or not anyone has signed up for public comment. Has anyone?

(No. Response)

CHAIR TIERNEY: Okay. Is there any further comment that any member of the Committee would like to make?

(No Response)

CHAIR TIERNEY: Well, if not, then let me just close by saying that you guys really put a lot of effort and thought into your participation in this. You do a tremendous amount of planning and execution to make sure that our meetings are productive and constructive.

Most importantly, Pat, thank you very much for spending time with us, all of his time with us. We know with four, at least, jobs that you're holding right now at the Department of Energy, the fact that we got these hours of your attention and care is just really wonderful. So, I'm going to let you have the last word, if you'd like.

MS. HOFFMAN: I just want to thank everybody for attending. I thought it was a great set of discussions on the topics, we want to continue to be forward-leaning as we think about what are issues coming up facing the nation, facing the electric grid; and I've enjoyed the conversations; so, thank you, for your participation.

CHAIR TIERNEY: Thank you and we look forward to seeing you in June.

MS. HOFFMAN: Thanks.

CHAIR TIERNEY: All right, everybody. I can't believe we actually got out 10 minutes early. I didn't expect that, so thank you. Thanks everybody, safe travels.

(Whereupon, at 12:11 p.m., the PROCEEDINGS were adjourned.)

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CERTIFICATE OF NOTARY PUBLIC

COMMONWEALTH OF VIRGINIA

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

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My Commission Expires: November 30, 2020

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