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Session 4: "Electric Power Infrastructure: Status and Challenges for the Future"

Mr. Sitzer: Sorry for the delay. Welcome to this afternoon's session on challenges for the electricity infrastructure. My name is Scott Sitzer and I'm with EIA and we have three very excellent speakers here today to talk about this issue of the electricity infrastructure which is a very broad topic. It can encompass everything from capacity in the ground to transmission to distribution and I was looking yesterday at the North American Electric Reliability Corporation's recent long term reliability assessment and a couple of sentences stood out.

One of them said, "Though total miles of transmission additions have increased when compared to last year's assessment, much more transmission will be required to reliably integrate projected location restrained resources such as wind, nuclear, clean coal and others into the bulk power system, and a conclusion which us regulators need to continue their support for additional transmission resources.

Further, they should revise their existing processes to expedite the licensing of transmission projected needed to maintain reliability." So reliability is very much an important issue here.

A couple of things I'd like to mention about Q's and A's, we'll go ahead and have our speakers give their presentations and we'll try to leave plenty of room at the end for questions and answers. Some of you may want to come up to the microphone at the end, some of you may prefer the anonymity of the cards so I believe we have the cards out here, and we will collect those during the course of the session.

So with that I'd like to introduce our first speaker who is Kumar Agarwal of the Federal Energy Regulatory Commission. He's been with FERC since 1994. He's presently serving as an acting Director for the Division of Reliability and Engineering Services within the Office of Electric Reliability. He previously was with Florida Power and Light Company from 1987 to 1994, he's a registered professional engineer and has degrees in electrical engineering from India and a Masters in electrical engineering from Florida International University. So please join me in welcoming Kumar Agarwal.

Mr. Agarwal: Thank you, Scott. Since this is a panel on transmission infra – I'm sorry, since this is a panel on electric infrastructure I would add my disclaimer that FERC does not have any authority to order anyone to build either generation or transmission facilities, but we do have some authority in two important areas and those are [back stop siting] authority and authority to grant incentives, and with those authorities come the responsibilities.

Speaker: Want to do a slide show?

Mr. Agarwal: I'm sorry?

Speaker: Slide show.

Mr. Agarwal: I would. I'll bring them up –

Speaker: Okay.

Mr. Agarwal: Yeah. I'll be focusing on the second area of responsibility that is transmission incentives. In the past two years, we have processed over 30 applications seeking incentives to build new transmission totaling approximately $20 billion and that, if built, would add 8,000 miles of new transmission lines.

A little bit about the history of transmission incentives. Energy Policy Act of 2005 created a new section in the Federal Power Act called Section 219 and FERC, after a year, after the passage of the Energy Policy Act, issued Order Number 679 that was the final rule that adopted regulations to promote transmission investments

through pricing reform. Essentially, we adopted regulations about the process, how we would process an application. The goals of Section 219 and Order 679 are the same which is to spur growth of new transmission and by providing a high return equity we want new transmission built and by higher return on equity what I mean is suppose the base return on equity would be 11%. By granting an additional basis points or 200 basis points, it would become 13%, so 100 basis points would be an additional percentage point. So in other words, that would be an additional profit for the investor.

What kind of incentives do we grant? We grant essentially four different kinds of incentives. The first one is higher return on equity, that's on the base rate that ranges from 50 to 200 basis points, the second one is recovery of CWIP, Construction Work in Progress. That helps the investor or the project developer with the cash flow situation. We also guarantee recovery of abandonment costs which is if a developer has to, for some reason, abandon the project – for example, he can't get a siting permit, then he is guaranteed that he can recover his abandonment costs. We also grant advanced technology adders and that is for new and innovative deployment of advanced technology. An example would be using a six conductor line whereby you could increase the through put 40%.

How do we process? The next two slides, this slide and the next slide, would show you how do we process the transmission incentive applications. If a project developer meets one of the following three criteria, it is assumed that that project qualifies for transmission incentives, and they are the project has been approved through the original transmission planning process, for example, PJM's regional planning process, the second criteria is if the project is in the NIETC [National Interest Electric Transmission Corridor] corridor, DOE has designated two corridors in the nation, one in the northeast and one in the southwest as NIETC corridor, so if a developer proposes a project in a NIETC corridor, that is assumed that it qualifies

for additional transmission incentives. Or if a project has been approved by a state siting authority it is assumed that the project should get transmission incentive.

The second test we perform at the Commission before granting a transmission incentive is whether there's a nexus, nexus between the incentive sought and the investment made, and the total package of incentives which I told you about-- four of them--is weighed against the risks, challenges and the benefits of project as a whole.

What have we done so far? We have processed 33 applications for transmission incentives. We have accepted 27 of them, we have rejected 3 of them, and there are 3 pending. The 3 that have been rejected, they did not meet the nexus test meaning they were routine projects. So if a utility wants to replace an auto transformer that has been operating for 40 years, now is coming towards the end of its useful life and the utility simply wants to replace that auto transformer, it would cost them $10 million, can I get incentives for that? We have seen some applications of that nature also, and we have denied those types of applications. We call them routine application or routine maintenance and the utility should recover it from the rate base without trying to take an incentive.

Out of the 27 accepted projects, I just totaled up the cost, it represents $27 billion worth of investment and if built, it would be 8,000 miles of new transmission lines and they range from 230 kV, 345 kV, 500 kV, 765 kV and there is one project for 640 volts, 640 kilovolt [hbdc] line, and the range of basis points awarded have been from 100 to 200. I will talk a little bit about 4 major transmission projects that have received transmission incentives.

Pacific Corp. has proposed an energy gateway project in a six state region in the northwest and they, for the first time, will be building a 500 kV backbone in that area, it's a 2,000 miles long transmission line. It will be delivering 3,000 megawatts of capacity from location constrained areas and it will be bringing renewable

resources to Wyoming. It is the largest project so far we have approved, $6 billion, completion date is 2014 and this project has received 200 basis points of transmission incentives.

Another one is Tallgrass Transmission and Prairie Wind transmission. These two came in as two separate projects but they were both for a 765 kV line in Oklahoma and Kansas area. It would interconnect approximately 10,000 megawatts of renewable resources. These two projects cost together $1.1 billion and they will be completed in 2013. These two projects received 150 basis points of transmission incentives.

This is the third big project, Pioneer Transmission, a 765 kV line, there's a 765 kV line that goes like this so this would complete the loop and would make it a ring. It would cost $1 billion, would be completed by 2015. This project also received 200 basis points of transmission incentives.

This is the last project I'll talk about. This is TrAil project, Trans-Allegheny interstate line, it starts in West Virginia, it's 300 miles of a 500 kV line that would increase west to east transfer capability by 3800 megawatts. It cost $870 million. It will be completed in 2 years. And as I understand, the project is on schedule. It received 100 basis points. I'll show you the transmission line, how it traverses. This is the TrAil route in West Virginia to Pennsylvania and here is the remainder, Pennsylvania to Virginia.

This is a chart I wanted to share with you all. This chart shows the actual transmission lines from 1990, 2000, 2007 and projected transmission lines for 2012 and 2017. These numbers are taken from a NERC database called ES&D, Electric Supply and Demand database. You can see that in the 10 year period between 1990 and 2000 the growth is approximately 6%, 6.2%, and Order Number 679 giving transmission incentives was issued in July 2006. We started processing applications, so I captured the 2007 and in the next 10 years out, the projected

transmission line growth is almost 9%, so it's a 50% increase compared to the past 10 years. The exact number, if you're interested is 45%.

In summary, what I want to say is transmission incentives are designed to foster a more robust grid through greater investment. Petitioners can receive general return on equity adders, CWIP [Construction Work in Progress], recovery of abandonment costs and advanced technology adders so there are four kinds of incentives we are granting and we have acted on 27 projects so far representing 8,000 miles of new transmission and $26 or $27 billion worth of investment. Thank you very much.

Mr. Sitzer: Thank you, Kumar, for that update on what's going on with FERC and its transmission incentives. Our next speaker is Mark Lauby of the North American Electric Reliability Corporation. He has been with NERC since January 2007 as the Manager of Reliability Assessments. He leads the Electric Reliability Organization's efforts to independently assess and report on the overall reliability, adequacy and associated risks of the interconnected North American bulk power system.

Prior to joining NERC Mark worked for the Electric Power Research Institute for about 20 years where he held a number of senior positions including the Director of Power Delivery and Markets. Mark is also an electrical engineer receiving both his BA and his MS in electrical engineering from the University of Minnesota, so please join me in welcoming Mark Lauby.

Mr. Lauby: Got it. We can do this. High technology man, this is the smart grid in action. The only thing is I've got to take my glasses off to do it. Alright, let me just get that slide show there. Bang. Well, good afternoon and thank you very much. I wanted to thank EIA and of course the Chair, Mr. Sitzer for inviting us here to discuss some of the activities at NERC. I plan to chat a little bit about what NERC is and then perhaps just kind of looking into the future, identifying some

emerging issues and how NERC tries to address those as well.

So, real quick on the background. The 2005 Energy Policy Act suggested that all users, owners and operators of the bulk power system shall comply with reliability standards. All entities – FERC's rule is all entities subject to the Commission's reliability jurisdiction shall comply with those standards, and of course the industry had kind of worked together before that but in much more of a voluntary fashion.

So the idea of the Policy Act of 2005 was that there should be one electric reliability organization in the United States and that, you know, that provided, you know, with FERC oversight, but this would be a self-regulatory organization, you know, the standards are set by the users, owners and operators and then they say they're going to follow them and then presumably they follow them.

So what's NERC's mission? It's to ensure the reliability of the North American bulk power system. We have kind of a long history, began in the 1960s after the blackouts. How many of you are old enough to remember the blackout in the 1960s? It's waning, man, I'll tell you, but that was really kind of the – people had this "ah-ha" about, you know what, maybe we should plan together our systems and operate together our systems, because there were so many different entities as this has evolved in the United States, the number of different, you know, public utilities and municipalities, and investor-owned and, so how do we work together, and so NERC was formed in the 1960s and over time through this peer pressure, set guidelines that were to be followed but it became kind of clear that after, with the advent of markets that perhaps we needed to kind of start setting those standards a little bit more in concrete and that kind of supported the 2005 Policy Act as well. We are also seeking similar recognition in Canada and in fact, Ontario was actually the first organization in North America which, you know, decided to follow mandatory standards, before the U.S. As usual, Canada was first.

So – I have to say that. This is what the regions look like in that area in the middle there between SERC and SPP is not the result of climate change, like a giant lake, but rather just a matter that the transmission owner-operators are in one area but yet the generators are in another area so we have a bit of an overlap geographically there. But you all should be familiar with that and of course it is North America, just a wee bit of Mexico, south of California there for the western interconnection.

So how does this work? The whole idea here of course is to have government oversight over a self-regulatory organization and the regional entities, the ones I just showed you, are part of the game as well. They set local standards, regional standards, excuse me, as well as they follow the NERC standards that are, again, set by the industry, organized by the industry, voted on by the industry and then finally sent to FERC for their agreement or remand and then improvement.

We have this kind of virtuous cycle of improvement here because we not only then set the standards, but then there's a compliance piece, so in making sure that those people who said they were going to follow the standards do in fact follow them, and there's an audit trail, etcetera, and then reliability assessment which is the area that I'm in, and I pick up information from the compliance folks for what's working and what's not working and also provide advice to the standards folks and say, you know, something's happening in the future here and we might want to start thinking about putting standards in place. And I've got an example of that later on in the slide deck.

So we do have an independent Board of Trustees. This kind of adds to our independence. These folks that are on the Board have no association with any particular utility. They represent a wide span of individuals anywhere from electrical engineers to policy, then we have a committee structure but then NERC itself also reports to the Board of Trustees, and this provides us an ability to be independent.

We can disagree with our industry, we can take it to the Board of Trustees if we'd like, we try to organize and fight it out ahead of time and there are some rather, you know, vigorous discussions, but then by the time we get to the Board we get them sorted out generally.

We're organized very much like a normal organization. The ones in the blue are the actual departments while the ones in the yellow are those folks that help make sure that things run smoothly. But you'll see we have our standards group, our training and education, compliance and organization certification, situation awareness, and then reliability assessments.

We're funded through the load serving entities based on net energy to load and of course we do delegate some of the funding to the regions that perform some of the standards and compliance activities and if there are any penalties those are just kind of reducing the funding on an annual basis.

And as I mentioned before, it's the whole idea of kind of ensuring that we have a platform of standards, but standards generally set the floor and then over time you start increasing them as the industry moves forward and so this whole idea of a virtuous cycle. So we do have, as I mentioned before, delegated to certain regions or to the 8 regions certain functions like local compliance, like organizing regional standards and, of course, then there's a registration activity because we had to decide well, who has to follow the standards and who doesn't, and this whole idea what's a bulk power system or a bulk electric system and what isn't, and what is a critical facility and not, so all those things were sorted out and then of course, then getting some regional consistency, it's interesting, this industry has evolved over time in different parts of the United States, and you'd be surprised, maybe you wouldn't be surprised, how many different ways there are to do some of the things that folks have to work on and so what we're trying to do over time, again, is to try to get some consistency so we get a consistent set of measures.

So ensuring reliability includes standards development, then follow through and compliance, situation awareness which is kind of looking over the horizon, you know, is there anything that's in our face here that's coming up that we need to be ready for and then we also kind of look, you know, back to see well, what lessons learned from recent events and then look forward, look at emerging issues in the long range, for 5 years, 10 years down the road.

Now, I just wanted to kind of real quickly cover this chart because I think it gives you an idea of the forward looking that we do, and I'm not suggesting we've caught it all, but we do look at, you know, supply transmission and demand and the kind of areas in which we need to keep in balance and then we see some overall industry issues such as greenhouse gas regulation, aging workforce, you know, folks like me, the people who raised their hands that remember the blackouts in the '60s were the aging workforce, unfortunately. Add another 10 years on.

Equipment availability, and of course, that was really an interesting issue about 6 months ago, now perhaps not so much of a worry about demand for equipment, but that's going to come back again when economies pick up. As we all know, the global economy will create more demand for equipment. And then when we look at supply, renewables and storage, how do we integrate those into the system, what kind of standards are going to be required, that's just - the whole underlying theme here is what are the reliability issues, influencers, and do we need to change standards we have now so we're not looking in a rearview mirror and saying, gee, I wish we would have done that.

So looking at nuclear power because of course, if you add a lot more nuclear power, what are the transmission requirements, etcetera. Fossil fuel security, hot weather and plant capacity, some people suggest the hotter the weather the less available some plants can be. Extreme weather impacts on demand, and actually on equipment too, and we've been working with EPRI on some of that. Demand

response, of course, how do we integrate large amounts of demand response, what are the reliability issues there, static and dynamic reactive sources. I am continually concerned about the reactive supply, especially in large cities where all the plants are out - as they are further and more remote from the large cities there is a reactive issue there that we need to be able to plan for and manage from the operations perspective. And then planning tools and then of course the overall modernization.

So this triangle, and actually into 2007, the long term reliability assessment, we had about a hundred page summary of some of these different issues, and what were some of the reliability considerations, and then from that then we kind of launched off into what we thought were some of the more important ones based on the planning committee and operating committee input so we've been kind of digging at those since then.

So let's look at an example that seems to be kind of near and dear to everybody's heart which is integrating large amounts of what we call variable generation and it's not farms but plants, you know, when you get, you know, people talk about farms and farms are nice, and you've always got cows by this big windmill, so it's a farm, harvesting the wind, but this is – from an engineering perspective, it's a plant and it has to have certain kinds of characteristics including contributing to reliability and so how will it impact or influence reliability? What do we need to do differently? What do planners have to do differently? What do operators have to do differently? And I'm always reminded when I say that, I'm reminded of the operators and planners who never really get along. Are there any operators and planners here, operational people and planners, and do you ever kind of get the feeling that, you know, those operators, they don't know what they're doing because, see I'm a planner, and then the operators say, if they would just plan the right system, you know, and so that argument occurs many times in utilities and so – in fact there was one case where they took an operator and a planner and they

put them out in the woods and they said you know, you guys learn how to get along, and it worked out for a day or two, but then pretty soon they were arguing again and so the planner left in a huff and walked out and came upon a – well, I'm from Minnesota so we'll say a bear, you know, and the bear – roar - and he starts chasing him and runs up to the cottage and he opens the door and the bear runs in and he yells at the operator, you take care of that one, I'll go get the next one, so – so operators and planners have got to understand how they're going to have to change, along with working together a little bit more.

So let's look at variable or wind generation. This is the projection for this winter, actually and this data that came into NERC around September-October and we have different, varied gradients of certainty here, anything from existing plant to planned and proposed, and one thing planners do is they say well, let's look at the peak hour and let's see how much reserve we have on top of that and that gives us the flexibility, if we hand that to the operator and it's like 10 or 15% or whatever the number is, that they'll have a reliable system. So this is installed capacity, so-called name plate capacity that was sent into NERC for the coming winter. But when we look at the peak what we see is a far less number. Now, we're used to being able to deal with de-rated units, summer and winter ratings, etcetera, but this is a substantial reduction and so we need to understand what that means for overall planning. For example, we're going to have a lot more energy available perhaps off-peak than we have on-peak and what does that mean, and what does it mean for the direction of the flows and the system, and how do we integrate something that has this kind of different intermittent, some people call it, or variable nature.

Of course energy's always located, and I don't know why, I mean, I lived in Minnesota, it's a pretty area, there's good pheasant hunting in South Dakota, but there's not a lot of people out there but yet that's where they're very rich in resource – by the way, a lot of lignite there, and you can overlay on that solar which is over in

the southeast a lot, geothermal and you see that all of it needs to be unlocked and you can't put it in a railcar and ship it across country in a railroad. The best way to get this thing moving is through electricity, of course, but to unlock that we're going to have to change again to what planners do and operators do.

So there was a – we convened a group of 50 engineers. Well, most of them were engineers. There was a lawyer or two in there, too, which is okay because they have something to say about this, and tried to determine well, what are the reliability implications? What are the standards that need to be changed so we'll be ready? What characteristics will the system need to have. And we came up with basically what I like to call the fat fingered technician, FFT, or if you are a, perhaps not an engineer or if you are an engineer you think of fast four year transform, flexibility, forecasting and transmission.

We're going to have to have a system that's far more flexible. We have to design a system that will enable it to handle not only the ripples but as somebody says, Mark, it's in the ramps, not the ripples. We're used to demand going up and down, turning lights on and off. Maybe it's additive some days, but the idea is being able to forecast when the ramps are going to occur so we'll be ready.

So we need to have some consistent ways of measuring energy and capacity. We find that some people use historical ways and some people use kind of a real hard probabilistic approach and some people say you know what, it's 20%, okay? I mean, we need to have some sort of consistent way. That way we can do a better job of planning for it. Also looking at probabilistic expansion analysis. Many planning engineers, this is kind of an enigma, they just have these deterministic tests, N-1, you know, but actually having probabilistic tests and understanding what the energy implications are is going to be important for planners, so they're going to have to change there.

They have to design flexibility when they're doing the planning, so what kind

of ramp rates am I going to be looking at and what kind of ramp rates can I generate? You know, what kind of system do I need to have here to support the integration of large amounts of variable generation?

Transmission, plug-in hybrids, storage and demand response, they are all sources of flexibility including, by the way, balance and area consolidation, maybe they're too virtual through the – as long as you have an adequate transmission or just consolidating straight away, so we have to look at different ways to add flexibility to this power system.

And also we found that, you know, there might be a need for reference manuals so that planners know what they need to consider differently than in the past. And by the way, I used to be called a dinosaur because nobody ever plans transmission anymore, so it kind of feels good they have to worry about this stuff again. Nobody's denying that I'm a dinosaur, though. I heard that.

Okay, so operators, what do they got to do different? Well, they sure got to make sure that they have the forecasting in the operator room so they know what's coming up. One of the major challenges we had recently was they were just testing a wind forecast tool and it wasn't in the operator room, so we've got to make that kind of part of the standards, perhaps, larger balancing areas or structural changes perhaps, enhancing the standards and procedures for interconnection. The rules right now say you have to have rules, but it doesn't say what the rules need to be, so we need to get some consistency around that. That was the view of the task force.

Operators need to know how to manage the added variability of uncertainty. Variability is this ripples and ramps and the uncertainty is not knowing when it's going to happen, so those are the two major characteristics that are somewhat more challenging for variable generation. And balancing authorities need to be able to communicate. There's always these stories about some poor operator that calls

somebody and says you know, could you feather your wind plant, and he says hey, I'm at Denny's, the plant's a hundred miles away. That ain't going to play anymore. This is serious business, it's a lot of megawatts and we need to have the operations and communications that are required to run this plant. And then finally a reference manual as well.

R&D recommendations. There's your flexibility again I like to talk about which is, you know, what new tools need to be developed? We worked with EPRI on this effort, as one potential as well as the Department of Energy. They're aware of what some of the additional tools that are required so that they can start studying those. This report, by the way, was by the Board of Trustees and should be out next week.

But these are the kind of things that we do to kind of get ready for some of the future challenges that the industry's going to be facing in the next 5 to 10 years, the what-ifs.

And then finally, of course, there's a work plan. We're not done yet. There's a lot of things to study. What are the impact of plug-in hybrid electric vehicles? What are the impacts of storage? These are the things that will add a lot more flexibility. What about the smart grid? How are those – those flexibility improvements, but then what do we need to do about the standards to ensure that we maintain bulk power system reliability?

Finally, I just wanted to just real quickly go through some of the emerging issues that the planning and operating committee identified last year and they went through these 7 issues and then performed a risk assessment on them, so we have the rising global demand of energy and equipment, transmission for the 21st century, limited water availability, mercury regulation, fuel storage and transportation, greenhouse gas restrictions, and increased demand side and distribution generation resources. These were the 7 major issues that the planning committee and

operating committee identified at NERC and they said, well, for the next 5 years and then from 5 to 10 years we asked them, you know, from low consequence to high consequence and low likelihood to high likelihood what were some of the impacts from your perspective on reliability.

Now remember that the frame of reference is that these are the 7 that they viewed as being the most challenging, so you know, your frame of reference here, but I would keep your eye on the greenhouse gas reductions, rising global demand and transmission for the 6 to 10 year period. This is again, a perspective of industry looking at the risk of impacts on reliability. So we see that especially in the greenhouse gas reductions and rising global demand, and I think part of this was, you know, just the uncertainty of what they're going to be facing. NERC is now beginning a study to look at the reliability impacts of climate change initiatives so that we'll be ready to advise, to provide what are some of the reliability considerations for any kind of plan.

So with that, I think I'm on to thank you's and I appreciate all your time and look forward to answering any questions you might have.

Mr. Sitzer: Okay, Mark. Thanks very much for that NERC perspective and let me again remind you that if you want to submit a question on the cards please write it down and we will collect it between speakers and we'll have one more speaker and then do Q's and A's.

So our next speaker is Timothy Brennan and Tim is a veteran of some of these sessions. He's a Professor of Public Policy and Economics at the University of Maryland, Baltimore County, and a Senior Fellow with Resources for the Future. He's also worked on the Council of Economic Advisors and as a consultant to the Bureau of Economics of the Federal Trade Commission. Tim has written a couple of books on competition and deregulation in the electricity sector with RFF and he's our first non-engineer today, he's a mathematician and an economist so please

welcome Tim Brennan.

Mr. Brennan: Let's see here. Okay, thanks. I want to thank Scott and Howard and EIA for having me here. I guess the first question I have is whether Homer Simpson is a planner or an operator. I want to say first I noticed in the opening slide for the thing, and in the sheet it says I'm at the University of Maryland, so – I actually really am at UMBC, so if you looking for me at the University of Maryland you won't find me. On the other hand, depending upon how this talk goes I might wish that you were looking for me in College Park rather than Catonsville, so we'll see.

I was thinking about exactly how I fit in here because I'm not an engineer and don't know – certainly don't know much in detail about many of the things that we've been talking about so far, but in trying to place it I was thinking back to a story, and I too, am one of those people who have been around forever, and I've been around here so long that I was at the Justice Department at the Antitrust Division when we broke up the phone company back when – well, we knew what the phone company was – when we broke up AT&T in the 1980s and shortly after that was implemented, one of the lead attorneys who had worked on the trial was leaving and we were sitting around talking to him before he left and asking him whether he would be willing to kind of, you know, stay on and provide advice to us and that sort of thing, and his response, which I've never forgotten, was, well, you know, I know how to break up the phone company, I still don't know why we broke up the phone company.

So in a sense, I'm – we've heard a lot about how to foster more transmission, how to improve reliability in the system and the question I want to think about, not that other people here don't know way more about this than I do, is why we do these things, and in particular, whether the reasons we do these things might have changed in some ways from opening electricity markets just as kind of a way to help

frame things, so maybe we have a better idea about how big should these incentives be for these new transmission lines, how strict should the reliability standards be, that sort of thing, not that anything I'm going to say tonight is going to be able to plug into any kind of equation to talk about that, but that's sort of a way of kind of framing this and so basically the way I think about this is to ask what here is different about electricity, you know, why isn't it working like an ordinary market where in ordinary markets we don't have to worry about a lot of this kind of stuff, at least by and large. Obviously we're in a currently stressed situation now economically but by and large we don't worry about these things in most other sectors.

And so I want to talk about very briefly just sort of five things and most of what I have to say will just be in the first couple of slides and then I will just sort of elaborate on those things a little bit.

The first that I said a little bit about was, was the commitment to opening markets realistic, particularly in a political sense, a second was, do consumers fit the economics textbook about being glad about being given the opportunity to choose things and a little bit about their energy efficiency adoptions. I'll say a little bit more about that in a couple of contexts. Restructuring versus investment. This is, I think, one that really speaks specifically to us. Dr. Kumar was talking about, you know, did the divestiture, did the restructuring help or hurt? You know, there's some arguments in favor of doing it on competition grounds and given my background in antitrust that's what I tend to be instinctively most sensitive to, but there are engineering and management sorts of things that might have gone the other way and maybe those have deserved more attention.

Reliability issues, we talked about that a bit. That's sort of where Mark's stuff comes in. I'll say just a little bit about that and kind of where I think we stand on that today which is in some sense basically lucky, and finally if there's some time, and

there may not be, some words about what's going on in Maryland which, where there are some kind of interesting paradoxes at a number of levels in where electricity policy is going. So that's sort of what I – those are the basic things I want to talk about.

First, just a little bit about the political issue associated with opening markets. As other people here know better than I do, at extreme peak demand, costs can exceed the average by 50 or 100 times, especially if you're worried about recovering capacity costs in a very, very tiny amount of time. Now, with regulation those costs were sort of buried in the average price. People didn't really notice it very much. When you open markets at the wholesale level, everybody gets to charge the super high price while that's going on. Now, economists like me, you know, safely ensconced in the ivory tower, see this as a virtue and that so people say hey, if you do this the price is going to go way up and you know, so everybody will know how much it costs and that's a good thing but what that brings about, especially in the short run is a massive redistribution of wealth from the consumers who see their electric bills double or triple or whatever, to the producers and that was, I think, the problem at least I didn't see coming in California a long time ago and so we basically had that sort of chain of events where you had some high retail rates, you had retail re-regulation, when the wholesale rates went up the distribution utilities went bankrupt, the market disappeared and there we were, and it's possible again in theory, the economists like me can sit back and say well, you know, eventually people are going to enter, they're going to drive prices down, they're going to drive profits down, and get back to zero, what economists call zero profits, so it's covering your investment costs and that kind of stuff. But will the public, you know, wait for that if that's going to take years and years and will the public officials wait for that? So we've got a political problem with all of this and obviously as we've seen from the last two talks, that politics are hardly independent of these other things.

Now on to some – a favorite issue of mine which is, at least at the residential level, has this been something that consumers really wanted, you know, what is their tolerance for all this stuff that we like to spend a lot of our time talking about? And, first I've got a few pet phrases here. One is, this is again, not only am I one of those old workforce people, I'm an old '60s kid and for those few old '60s kids out there, the word market there replaces the word war from a poet by Allen Ginsburg, so what if they gave a market and nobody came?

The next one is something that some of my friends have heard me talk about before. My Dad is still around, I'm glad to say. When I was working at the phone – at AT&T – I was very, very peripherally involved in the breakup, but my Dad to this day still blames me for it, and you know, my Dad's a very kind of polite guy so he does really say those people as opposed to idiots or something worse which is what he really has in mind, and so still to this day if he sees any sort of telephone ad on TV or anything like that he'll go, like, how could this happen, how come some people can get stuff cheaper than me and who's going to fix things if they break and just all this kind of stuff, and it's easy at one point to laugh about it, but on the other hand, there's something here which is, you know, economists are supposed to take revealed preference seriously and if people reveal that they don't want to be bothered with something, then maybe the thing to do is to not bother them with it, and so perhaps, going back to the '60s again, and by the way, this may be the only slide where my Dad and Allen Ginsburg are in close proximity or whatever be, would be the famous line about the Vietnam War which was declare victory and leave, and at the residential level that may be what we should do.

I'm going to put up now, some people have seen these before, a few of my favorite slides on this. Alberta was one of the pioneers in this and the only line on this you can probably read will be the one at the top, but that's good enough. This is your helpful, comparative electricity and natural gas shopping worksheet. They

have now divided this up into about 3 or 4 different websites. Those of you who like filling out taxes would love this. I think maybe the next year's version of Turbo Tax for an extra $19.95 will include a DVD to tell you how to buy electricity, but has names of energy suppliers, contact, fixed rates, variable rates, energy charges, built in price increases, retail service fees and goes on and on down the line, yes, no, and some of my favorites there are some that say if yes, explain and all this, and Alberta's one of the pioneers in this in Canada. Shopping in Pennsylvania – and I don't mean to be picking on Pennsylvania or anyone who's opened these markets has probably done this, and there may be some people here who have designed these websites. How to shop for an electric generation supplier and using the chart on the opposite page I reproduced and we go on and we have this eight step little process here including things like multiply line 3 by line 4 and put the number on line 5, divide the subtotal and so on.

And then here's someone with a smiling face, probably intoxicated, with questions to ask your electric generation supplier and there's all these things here too, and you've got to, you know, one can't be surprised after this to realize that penetration rates for this are just miniscule, even leaving aside things about standard offer service being low and that kind of stuff.

So we talk about smart grids, but how inclined are the users to think about this? And we've seen other examples of this as well, including some of the charts that have been used today about sort of negative costs, carbon controls, how efficient compact fluorescent lights are and that sort of stuff and so, you know – John [Roe] had this chart, we've seen some others, some earlier ones, things today and probably they'll come up in other ones again, and so the question is, you know, we have all these out here and there's also lots of advantages, people talk about smart grids, avoiding people cost by controlling capacity, and that sort of thing, but the question about this to me is like, has always been as an economist is why

wouldn't the market take care of this? And I'll just relay a quick story about that.

I was at an EIA electricity meeting some years ago where some people from PJM were speaking and these people, I think their chief economist or something, I guess people on the planning side, and somebody there asked him a question on [*unintelligible*] mind which was how could you open these markets without having some sort of mandatory real time pricing program, don't you need to mandate it? And the response they got back was well, if you're a distribution utility and you're buying something at 400 and selling it at 50, I think you've already got a pretty good incentive to be trying to control peak load demand and that's always left something with me which was, you know, why don't these things just happen? It's something that to some degree I still don't entirely understand, which is, you know, to use an economist's joke [*unintelligible*]– is why are all of these twenty dollar bills lying all over the sidewalk? Is it, you know, is it that the consumers don't have the information, whatever that is, are utilities keeping it from them, is it up to the utilities to be deciding how much power we use, that sort of stuff, and if I have time, I may not or may return to that theme at the end.

So what should we do about this? Well, residential consumers may not be interested in the hassle, you know, do you want to go to the trouble to say, well, we need to have competitions, let's have competition be a default provider. I haven't heard people talking about that very much, so maybe that's kind of died out which may not be such a bad thing. You know, one thing that gets lost in all of this, it's getting lost in the debate in Maryland right now, is how successful this has been, at least in Maryland and I'm sure in other jurisdictions, for users for whom it's worth the trouble to scope this stuff out. So maybe the thing to do is to declare victory for the two-thirds of the market that's ready to choose and just leave, and just kind of keep regulation for residents as a backstop, and again, I'll say more about the re-regulation movement if I have time.

Now, I'm going to fly by this transmission stuff here because it's been talked about very much already. This is data from Eric Hirst I think, and this stuff is pretty familiar which is that in terms of transmission relative to generation, that it peaked in the early '80s and has been going down ever since is somewhat old information, obviously, and so the question is, well, are we starting to run out of it, or do we need more investment in it? One possibility, of course, is maybe had too much investment early on, because of rate of return regulation, at least in theory that may be true, whether the empirical work would bear that out I don't know, but there's other evidence of declining investment rates and also increased transmission global relief requests and things like that so there has been some evidence that the transmission is getting scarce which is, and speaks to some of the things that Kumar was talking about, and the question I just want to bring into this is restructuring the problem here, is that what brought this about? Now, some people of course advocate deregulating everything. I think it's a general consensus still that you really can't deregulate the wire side for a variety of reasons, but if you're not going to do that, and this is a lesson of breaking up the phone company, that what you want to do is have some kind of separation, how much you need is a question for debate. Separating the regulated sectors from the competitive sectors, and that justifies if not divestiture, the I's in the ISOs and it's especially important nowadays for the regulators because of some certain antitrust decisions in the last five years, antitrust is not going to come to one's rescue if there is discrimination going on.

But there's a question about whether this has really all worked out. Can you have this separation when there's so much coordinated planning and pricing that has to happen between these two sectors, and so the question is, you know, to me is, is can you do this without the kind of coordination that Mark and Kumar have been talking about, basically, where you may have to get the generators and the transmitters together and if the monopoly is involved in planning the competitive

side of the sector, how much competition is one really getting, and that's a good question, which brings us to reliability, and I'm close to wrapping up here. Electricity is special. I think everybody in this room knows that. That's something that came to me rather late because my experience at the antitrust division was that you had these laws of general application and then everybody would come in almost from some industry to say well, I know that under the law you should block this merger or stop this practice, or not let us do this or whatever, but our industry is different, and after you've heard stories like that, like for 8 or 10 years or so, you can't stand them anymore.

And so for me to say well, gee, electricity might really be different as the concession but I think it really uniquely combines that we – it's really important, supply has to equal demand all the time or else things fall apart, and where our prior speakers have been talking, and that it's interconnected, so basically the problem is if I can't supply your power, somebody else gets blacked out as well. So August 2003 being a great example for this and a policy rationale for the kinds of stuff we've been talking about – getting to the why question for the how.

A lot of questions about this I'm sort of interested in. You know, how much do we spend on this? You know, 10 billion, 20 billion, 60 billion, 100 billion, how much are these things worth, I think that's a great, at least to me, open question and another is how much central control is necessary? Do you just have an air traffic controller or do you have to have complete management of dispatch and investment?

So I think the news so far has been pretty good, but we have to stay vigilant. So far I don't think reliability's been threatened very much, despite some of these trends, but - there's things obviously now that Kumar is talking about going in the reverse direction and Mark is sitting on there making sure things don't go bad as well and it's a really good sign that we're arguing about price instead of blackouts.

You know, I'm sure they'd be happy to have a Lehman Brothers stockholder's meeting right now where they lamented a 25%, you know, decrease in their profit rate as opposed to hey, we're no longer here anymore.

So compared to other things, things have actually been going pretty well, but you know, will it stay that way, what happens if there is another blackout like August 2003, there's claims that we're going to run out in Maryland in 2011, 2012, and reliability as a collective good justifies a lot of what we've been talking about but as we've all been hearing all day today, policy is not out of the woods on this and in fact, if I have a minute I'll just – which brings me back home. The two pillars of Maryland electricity policy are the price is too high and people buy too much of it. Now, if there any economists in the room, that's a very difficult thing to keep in mind because, you know, the problem with prices being too high is that people aren't buying enough of it because the price is too high. So how you get around it is you have to have some sort of consumer cognition failure or something that people don't have enough information or they're irrational or something along those lines to get around that or it could just be wishful thinking.

I was talking about this at an academic conference over the weekend and somebody pointed out that university professors feel the same way about campus parking. They charge too much for it, but people use it too much because you can never find a parking space, and the economists would say why don't you just raise the price, the faculty wouldn't be too happy about that, so everybody says well, you know, I'm not using too much, you're using too much, so you guys should stop so I don't have to pay very much for it, which – hey, we'd all like that.

But there's other paradoxes going on also, this isn't the only one. One of the things that Maryland has been very much out in front for is a policy that I think has been codified by the state legislature to reduce electricity use 15% by 2015. I believe that target was chosen only because of the rhyming aspect. I don't that

anyone actually sort of did a cost benefit analysis to come up with that, and they've also, you know, they want to, as there are people in this audience who know 50 times more about this than I do, they've joined the regional greenhouse gas initiative, they want to use the money to try to cut electricity demand, all that kind of stuff, and at the same time what's been going on in Maryland recently has been this proposal to re-regulate. Why do they want to re-regulate? Because people aren't building enough power plants. Okay. You told me that you don't – that we're going to reduce electricity demand in the state by 15% and somehow it's your fault that you're not building more power plants. I can't quite figure that out which is why I'm going to leave you with a request which is get me the aspirin. So thanks very much and I appreciate coming. Thank you.

Mr. Sitzer: I don't know whether that's a symbol of reliability issues or not. Tim, I hope there are no Maryland regulators here but thanks very much. Are there any other questions on the comment cards that we can take, because I have a few here that we can start out with, and on the theory that there's no question too provocative to start with, I have an interesting one here.

As more electrical generation occurs distant from load centers and transmission becomes more important, how will transmission lines be protected from terrorists? Any takers on that one?

Mr. Lauby: Well, I guess I'll kick the can down the road a little bit on that one.

Mr. Sitzer: Can everybody hear? Is the mic working?

Mr. Lauby: Can you hear me? NERC does have a critical infrastructure protection effort. We have, of course, standards, which look at cyber security and security overall, and you know, we are working with out stakeholders to identify what are some of the plans, etcetera, that people have to protect the hard assets and the soft assets as well.

Mr. Sitzer: Kumar?

Mr. Agarwal: I'll try, can you hear me? The power system is run at N – 1 [*unintelligible*] so if – it is not the key element that would bring the system down. I do not see much danger to the power systems, but if the terrorists have also figured out, have access to CEII information and they know that getting these two sets of lines at the same time can bring the whole power system down, then there's a problem, but other than that, just hitting randomly some transmission line is not going to bring the power systems down.

Mr. Sitzer: Anything? Okay. Would anyone like to come up to one of the mics and ask a question? Sure, sir?

Speaker: I have a question for Mark. It was interesting to see in your presentation a graph that showed the in stored wind capacity was the actual contribution during the peak time and even part of this issue was discussed in earlier panel where someone commented that the generation variability because of wind could be almost 60 to 90% of the wind capacity, but then one of the panelists commented that the solution is we need to have more wind because then it will cancel each other out.

But as one of the panelists commented, that we need more demand response and demand response is going to take care of everything, but if you see the current demand response participation even in markets like New York or [*unintelligible*] where there is demand response program available it's not even 5%, it's typically around less than 2% and most of it is reserved for sort of emergency demand response and it's not available on day-to-day basis, so my question is there seems to be a disconnect between reality and what people assume that situation will be at. Do you have any solution or comments on this?

Mr. Lauby: You know, planners are used to dealing with, you know, the disconnect between the reality and their disillusionment of the future. I would say

that the – there are those that talk about having a broader base or more diversity so that you can then, of course, in a reduced way, you know, of total installed capacity have kind of a more persistent amount of capacity, you might say, available.

I have also heard arguments, for example, in Alberta, where the bulk of their wind is in the southwestern part of the province and it just goes up and down together so unless you start building long lines much further away where they could perhaps take advantage of some of the diversity, spacial diversity, then – so you know, there are people that are on both sides of that discussion. I would say that what it really comes down to is you know, making sure that one has the flexibility to judge how much, you know, what kind of ramps you're going to be dealing with, and ensure that you have planned a system which will provide the kind of flexibility you want.

Now, demand response, I would only suggest that, especially in ISO New England, I think we're seeing it also in New York ISO, more day-to-day bidding into the market for demand response. There are actually curtailment service providers we call them, or CSPs, like EnerNOC or [Konverg] that are in their bidding capacity and are bidding ancillary services. We see in Florida up to 6%, we are seeing major increases, well into the 4 to 5%, I believe about 2000 megawatts were added in the last LRTA for places like – substantial numbers, up to 5-6% sometimes in ISO New England, New York ISO, PJM MISO, so I think we're seeing more of the ancillary services and capacity, you know, from demand response. So I think we're going to see that grow.

Speaker: I agree that there is more focus being given to demand response but if you see the actual participation number, I'm not familiar with ISO New England, exact [*unintelligible*] number, but now PJM has opened the demand response program for ancillary services and most of the participation is only in synchronicity [*unintelligible*] but there is – I don't believe there is even a single

customer - demand response customer participating in [providing regulation in PJM market.] Similarly New York ISO had just actually opened a demand side ancillary service program this year and we are far away from situation where we want to, for example, in New York, ISO is currently worried about having 5 to 7,000 megawatts of wind being added over the next two years, so the amount of demand response to scale to the level is almost – I would be very surprised if that happens, although I would love that personally, but –

Speaker: Well, it depends on how much is going to be needed to ensure that they have a flexible system, but you know, are you – you're specifically interested in regulation, right, the ripples not the wraps?

Speaker: No, I'm saying that if you're talking about variability with wind –

Speaker: Yeah.

Speaker: - and you are wind will require maybe possibly more ancillary services and that's something –

Speaker: Yeah, we're seeing ancillary services go way up. Look at the 2008 long term reliability assessment. We saw substantial increases in ancillary services from demand response.

Mr. Sitzer: Okay, thank you for that. Any other comments on that? Okay. A question I think mainly for Kumar. If FERC has already approved 8,000 miles of new transmission lines and new financial incentives, is it necessary for Congress to consider additional authority or is the authority still there? Maybe you could explain that.

Mr. Agarwal: Well, yes. It is still necessary for the Congress to consider additional authority because our grant of transmission incentives only speaks about the capital being made available, it doesn't go as far as the siting. Siting is still a big issue and the 8,000 miles of transmission that we have approved, my estimate is roughly 70 or 80% would be - only come to fruition and that's because they would

run into siting challenges. There's the state of Indiana where they don't have any formal siting process and the pioneer project is facing some difficulties because they must go from county to county, circuit court to circuit court, to get that siting permit, so homeowners and businesses can come in the way of getting a project built and there are two bills pending in the Congress at this time, Bingaman Bill and Reid Bill. They do talk about giving FERC additional authority. We are in touch with several committees in Congress and we are supporting some bills. That's all I will say.

Mr. Sitzer: Okay. Any other comments on that? Question from the floor? Sir?

Mr. Schwartz: Hey, I'm Evan Schwartz from DC Energy. So if you look at, for instance, ISO New England's summer projections, they project the deficit in generation including sort of all sorts of reserves. If you look out west at California, some of the areas have very low water levels, are there sort of parts of the system that all of you are really concerned about in the short to medium term?

Mr. Lauby: I would – if you look at the long term reliability assessment and that looks out 10 years, that was published in November, based on data submitted in March of that year, and we identified a few areas that we had some concern about at that time, I think that Western Canada was a concern, I believe the desert southwest was a concern in the United States. That would be like in Arizona, New Mexico, Southern California – Southern Nevada, excuse me. We were concerned about that as well. What we did find was that it came down to how we were asking the questions to get the actual resource plans, and what you'll see in that report and you'll see in the upcoming report is that we're asking for a different type of categorization, that accommodates things like [four] capacity markets or conceptual units, things that are twinkles in people's eyes that we have kind of a general idea what's the overall plan for resources going forward and in some cases folks only know that they're going to get resources, but they don't know if it's going to be

demand response or a gas fired unit or a wind turbine or whatever, because they just don't have the visibility looking out beyond four or five years, especially in some of the markets that we have nowadays. It takes 8 years to build a coal plant. You can – but you've only got a 4 year capacity market so you're not going to be able to see some of that and that also provides – kind of incentives for more of a gas turbine, combustion turbine type view of the world, especially if you've got gas on your hands.

So – but those were the two areas that we kind of poked at and said, you know, we're concerned about that, we think that there's more resources needed there. Now, when it came to transmission and adjunctive, my colleagues' discussion, I think we are very much concerned with 145 gigawatts of proposed wind – now, that's proposed so there's some uncertainty there. Unlocking that wind is going to take a lot of transmission, obviously much more than the 8,000 miles that Kumar spoke about earlier, and so we'd like to see those get – if we're going to in fact do that, if that's what's planned and proposed, then we need to get cracking on building those lines, and we can do that. I mean, it's just a matter of getting the kind of rules of the road right, but a system with 145 gigawatts of wind we can build if we have enough money and enough time to build it, you know, so it's just a matter of making sure that the rules of the road are set and defined. Did that answer your question?

Mr. Schwartz: I think so, thank you.

Mr. Sitzer: Okay, others? Okay. Tim, this questioner wants to put you on the spot. In your opinion, what were the reasons for California's market crisis? Can crisis be connected with transmission line congestion or inadequacy, or was it the regulation of the retail market? Or all of those?

Mr. Brennan: I thought about California quite a bit after it happened as I'm sure many people in this room did, and one of the things that sort of struck me about

it was nobody knew it was going to happen before it did, or at least not very many people did, and after it happened it was over-determined. You know, the – oh, there was this, and there was this and there was, and there was that. My sense of it is partly sort of the perfect storm thing, though, the decline in hydro power, the growth in Las Vegas that maybe there was less extra power available, that kind of thing.

I – for me the thing that sort of I think turned it into a crisis [*unintelligible*] turned – what we're in the middle of now in the economy in a crisis is on the financial side, I think once the – once people selling electricity in California lost confidence they were going to get their money back from the sales because with bankruptcy, potential bankruptcy of utilities. Until that got fixed, all bets were off and I think that that has sort of always struck me as being the precipitating thing was there congestion, you know, congestion on transmission lines, I'm sure there was, I don't – it's been awhile, I don't have that information in front of me here to read it, I had it once upon a time.

Mr. Agarwal: I would add that from my perspective it was the exercise of market power by some generators, certain generators engaged in some schemes of sending power out only to bring it back in and I think FERC did that investigation and put out a report known as [*unintelligible*] Report. I didn't work on it, I didn't read it, but my gut feel is California crisis was caused by excessive greed on the part of some generators.

Mr. Sitzer: Mark, any comments on that? No? Okay. Question from the floor? Sure.

Speaker: I was part of that thing in California and following, it's a lot more complicated than what people think. You can't boil it down to a couple things, but this is a question for Kumar. I noticed you mentioned four projects that had provided incentive returns on and there's different degrees in terms of what those incentives are and the highest bonus performance, or however you want to

characterize incentive returns was associated with the project with Pacific Corp. It was like 200 basis points. I don't know if a lot of people here know that Pacific Corp.'s owned by Warren Buffett and what I was wondering was why does he get such – here's a guy that has the most access to capital than probably anybody in the United States and yet he gets the highest incentive return of anybody. To me, I would think that he'd probably need the least of anybody because he has the most access to capital, so if you could sort of differentiate how you guys come up with at the FERC, someone get 200 basis points with an unlimited amount of access to capital and others have to sort of claw for it?

Mr. Agarwal: It is very well documented in the priority order. There are several factors we look at. We look at what is the incentive the petitioner is seeking, that's number one. What are the risks and challenges? What is the borrowing difficulty that the petitioner faces? This is the largest project, $6 billion. The second one is about a $1.1 billion project. We get involved in each one of those from the point of view of whether the project would ensure reliability or reduce congestion, but we do not get involved in terms of what number – should it be 200 basis points, should it be 250 basis points, because that's a determination that is made by financial people and I'm not sure what else goes into it by the nexus test. The risks, challenges, and the benefits. That's what I would say is looked into it. You brought up a good point that Pacific Corp. is owned by Warren Buffett [richest guy], I don't know if that was one of the considerations or not, but I would say no.

Mr. Sitzer: Okay. Question for Mark. The Energy Independence and Security Act of 2007 had many electrification requirements that are either just being funded or in rulemaking at DOE. How is that legislation impacting NERC because you mentioned mainly the Energy Policy Act of 2005?

Mr. Lauby: Yes, yeah, the – I believe that the component they're asking about there is the certain amount of funding that's been put aside for DOE to work

with NERC on bulk power system reliability and we are, right now, that's in DOE's hands and we're not engaged in any conversations with them. They've got a process they're putting in place and they're going ahead and going through that process.

Mr. Sitzer: Question from the floor?

Mr. Miller: Yes, Leroy Miller, American University. My question is about storage technologies and how they can be used to address peak loads and also the variability of production from distributed energy sources, and if you could maybe discuss some of the different technologies, the fly wheel or even the advanced battery technologies, lithium ion batteries would be one that I would be particularly interested in for distributed energy.

Mr. Lauby: Sure. Well, I mean, it's an interesting area and it's one that we're going to be studying, I would say that starting in this quarter, as one of the follow-on activities from the variable generation study and of course there's a variety of different technologies, and if I start listing them I'm sure I'm going to miss one, but compressed air, you know, seems to have – there's a lot of interest there and of course the different types of rock formations that it works well in, and there's even a lot of technology development yet to be done there, there's always of course the pumped hydro if you can take advantage of that, and distributed resources, as you suggest, different types of battery storage, perhaps, which can – you know, I mean, one could paint a picture here where the plug-in hybrid actually also is the battery for the home too that generates there, and every home would have its own battery and then would charge on off peak and then you could use it during peak. It would be really cool, because then you wouldn't have to – you know, you'd just have to manage that particular on-site facility, and then you could use a number of other different technologies like internet or whatever cyber security, secure element to purchase off-site power. You might say off-site your home power when you need it

during emergencies. So – you could also then use trickle down with sun, solar on your rooftops, so there's a lot of different things that can happen when storage becomes more economic, or you know, if we start pricing in different types of things like the overall like or impact, cost of carbon, etcetera, so – now, we're very interested in storage and – as a technology for the future as it does provide some of the flexibility we're talking about for variable generation. That's just an additional component, even without variable generation storage has some very interesting components from a technical point of view and a reliability point of view.

Mr. Sitzer: Any other comments on that?

Speaker: I just want to throw in something I – an observation I've heard about plug-in hybrids which is one's got to be a little careful about that because everyone comes home at the same time and plugs their car in. Unless you've got some other kind of management system –

Mr. Sitzer: Sure.

Speaker: - start to allocate when your car gets charged, somehow.

Speaker: When I leave on vacation, which is very rarely, my wife has a little timer she puts in and it turns the lights on at a certain time and turns it off. A simple technology like that would take it off peak, though they're even talking about more complicated cell phone technology and sending a signal or whatever else, but it can be done –

Speaker: Right.

Speaker: - you know, but I add a little bit of the cost, so you're right, it's something very much – most engineers are concerned about. There's a great study by NRDC and EPRI where they looked at the impacts on peak that plug-in hybrids could have out by 2030. The number sticks in my mind of around 24,000 megawatts on peak which may be absolutely wrong. You all probably do a better job of reading the report, but of course, the energy, the off-peak energy, that

impacts – that flattens that load in effect, and so now we're getting a flatter curve and what about maintenance and – boy, you are getting more than you expected on that one. I'm sorry, but thank you.

Mr. Sitzer: Any comment – okay. This question's a little bit similar. As distributed generation becomes economical for more places, is its adoption going to be thwarted by the incumbent grid big power plant establishment? What about shifting public money – it's a policy question, I know – what about shifting public money from some uneconomic transmission territories to distributed generation adoption? Anybody want to tackle distributed generation?

Mr. Lauby: I can touch in it from a reliability perspective but that's not really a policy, and that is that we – you know, from a reliability perspective, we are very much concerned about what is going on in the distribution system as you have, you know, two-way flows of energy on a system that was built for one-way flow. Clearly you need to start looking at different type of design of that system. Some of the existing standards like IEEE 1547 just to throw something out there for you lawyers, doesn't help you when you have a low voltage event. They all trip off and then that load becomes available for the bulk system, so you know, we are concerned that it be done wisely, you can build that system and it can be kind of an optimal system that, you know, which – where you have a large generation and small generation and you manage that. It just has to be done wisely and we have to look beyond the existing standards and – both on the bulk system and the distribution system, to build that new system and it's not cheap but you know, I mean, none of this new stuff – adding new technology, is never cheap, but one thing you need to understand about technology is engineers, they are conservative in the approach but once they understand it, they optimize it. We've done that with combined cycle generation, we've done that with nuclear power, we can do that with variable generation as well. Once we have history, we understand how it's going to perform,

we'll take advantage of it. Tim?

Mr. Brennan: The only thing that I want to add to that is just a clarification a little bit. I think reliability is a policy issue. It's a big reason why electricity is a public good. Reliability is a public good. It's something that's shared and when things are shared it becomes a matter of the general interest, how it gets managed. If the industry [weren't] taking care of it in these various ways, you know, it would be coming from up top and it already is, there's sort of an interaction from – you saw it from the chart he had before about everything sort of fitting together in this so it is a strong policy issue and so the question here would be how do the policy benefits or the reliability benefits of distributed generation compare to those from transmission and – at least on that ground, if you thought one was bigger than the other and over-simplify it you put it where you get the biggest bang for the buck.

Mr. Sitzer: Kumar?

Mr. Agarwal: When the distributed generation becomes cost effective, you would see the dollars flowing in that direction automatically from the big power plants and the big transmission lines.

Mr. Sitzer: Okay. That's how an economist would speak, not an engineer. Any further questions from the floor? Okay, well I think – yeah, one more? Okay.

Speaker: I submitted a question, but I don't know what happened to it. My name is Christy [Rish] from Marshall University in Huntington, West Virginia, and I had a question about transmission line cost allocation and my question regards the PJM area, because we are part of PJM West and the reason I'm interested is because there's two lines proposed right now to come – to head this direction and there's a proposal, I think it was postage stamp, that's the term for it, and I just wanted to know a little bit about the decision that led up to deciding that that was the way to go with this cost recovery. Our state is a little different in this area because we don't have congestion, but we are part of this region and the postage stamp

allocates that cost uniformly but we don't really need a new high voltage transmission line because our population growth has been so stagnant. So if you could just elaborate on that.

Mr. Agarwal: No, I didn't get the question. Can you repeat your question? What is your question?

Speaker: The postage stamp transmission line cost recovery allocation process that's determined, I guess, right now it's been determined that that would be the process for recovering the costs that are part of the transmission to alleviate the national interest transmission, or national interest corridor transmission situation that we have now between Washington and New York, and we are part of PJM West in West Virginia, and the postage stamp rate divides that cost recovery uniformly amongst the entire PJM region so I was hoping to hear a – some explanation, rationale about how that decision was reached.

Mr. Agarwal: PJM has a method whereby anything at 500 kV and above gets allocated on the postage stamp basis and it doesn't matter who benefits, who doesn't benefit, that's the method they chose and we approved it.

Speaker: Can you say that another way?

Mr. Agarwal: Okay. Anything that is a high voltage line, it is assumed that everyone benefits, so that's why socialization of costs and that –

Speaker: Anything that's high volt.

Mr. Agarwal: - 500 kV.

Mr. Sitzer: Okay.

Speaker: Thank you.

Mr. Sitzer: Okay. I think that's going to do it for us. We have some more questions but we didn't get to them. We had some great presentations and some great questions, so thank you all very much.

[*Break*.]

[*Miscellaneous chatter.*]
END OF SESSION.