UNITED STATES DEPARTMENT OF ENERGY

ELECTRICITY ADVISORY COMMITTEE MEETING

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P R O C E E D I N G S

(8:05 a.m.)

CHAIRMAN COWART: Good morning, everybody. I think we should begin. Please take your seats.

Thank you. Once again, let me begin by reminding people that a transcript is being prepared and that when you speak, you should speak into a microphone. And it's also very good to eliminate feedback if you're not speaking, to turn your microphone off.

If there are any members of the public who wish to address the committee, please be sure to sign up so we can plan for that at the end of today's session.

I'd like to begin with just a couple of announcements. It's hard to decide which is more important, but -- I say that jokingly. First, we're happy to give you some news about further changes in the leadership of the committee due to the pending retirements of Wanda and Gordon van Welie, who are also terming out as chair and vice chair of the Smart Grid Subcommittee. We are pleased to announce that Paul Centotella will become chair of that subcommittee and Marilyn Brown will serve as co-chair with him. And you can see they're already organizing their agenda together.

And the second announcement is just simply to thank our support staff for bringing the coffee this morning.

(Applause) See what I mean about which is more important of these two? (Laughter) In order to have coffee on the first day next time, it would be good if we took up a small collection, when you have a chance this morning, to hand $5 or something like that. Please do that and that way we don't have to wait until day 2 to actually have coffee in this room.

This morning we're going to be discussing in some depth the proposed Clean Power Plan that has been unfolding in the United States in order to moderate carbon emissions from the power sector, obviously raising quite a number of economic, environmental, and potentially power system operations, challenges. And we're going to have two panels. The first one is being led by Sue Tierney, who is jumping right into her role on this committee. And I'll just turn it over to you, Sue.

MS. TIERNEY: That's great, and maybe I will ask the panelists to come up to the table. Since this is my first time actually working with you in a presentation mode, I don't really know the style, so come on up, you guys. Let's go. I have to say that Rich knew I would be a sucker for saying yes if he asked me to get involved on this particular topic. I probably am spending about 80 percent of my time on this topic at the moment and feel like it's very important for the nation and the world's future outcome that the United States

is moving toward reducing its greenhouse gas emissions.

I had the pleasure of doing some writing on this topic, on reliability, the markets issues. I was a declarant in the first set of lawsuits that have already been filed since the final rule was passed in August. And I was happily on the winning side of that one, which said you can't file for an appeal before it actually gets published in the Federal Register.

So, as I say, I'm really interested in this and I think that the two panels today are going to be looking at the Clean Power Plan from really interesting and different lenses. Ours is going to be looking at it through the lens of how does the electric system and its embedded infrastructure, and going forward infrastructure, interact with the Clean Power Plan, and to understand that we have a panel who's going to go through some of the pieces of the Clean Power Plan, so we can have some predicates and make sure that we are grounded.

Is there anyone in the room who has not read the 1,700 pages, for example? I figure that's true, but you probably have read some condensed versions. And so we still will give you some high-level summary starting points and then try to dig into some of the delivery issues, your liability issues, the planning issues that are going forward.

And then the later panel will be looking at compliance options. The EPA final rule provides a tremendous amount of flexibility and optionality for states in terms of how they choose to comply and whether they do want to interact with other states -- either neighboring states or noncontiguous states -- in trading regimes or not. So we're going to hear about those kinds of things later on. Probably there's not neat interactions between these two panels and if there's some sloppiness that overlaps, I'm sure that you'll go with that.

So my job is simply to tee up this fantastic panel and I thank them in advance. And I'm going to introduce them to you by -- let's see, how do you do this? You push a button? Which button? Who wants to help me with --

SPEAKER: (inaudible).

MS. TIERNEY: Where do I have to point it?

SPEAKER: Oh, use the keyboard.

SPEAKER: Use the keyboard.

MS. TIERNEY: Oh, the keyboard. What a concept. Thank you very much. I can do that.

So you all know that the Clean Power Plan is the program under the Clean Air Act to address existing power plant's emissions of CO2. The reason I start with this picture is that the emissions of CO2 from the U.S. power

sector represent one-fifteenth of every emission of greenhouse gases around the world, from all sectors, from all countries. This is a big, important amount of emissions reductions and is important not only for our own ability to address our carbon footprint having been the largest cumulative emitter of greenhouse gases amongst the world's, but also because it helps us not with -- let's see -- it helps us address -- oh, excuse me, let's get Eric off of there for a moment -- it helps us bring other countries like China along to the program.

And, of course, that's been enabled in the past year through a set of discussions. So the Clean Power Plan, of course, is addressing this particular system. And I put up the transmission infrastructure because, of course, that's key for assuring that whatever states decide to do -- and then owners of affected generating units decide to do -- is enabled or challenged by this particular picture of the nation's infrastructure.

Plus, I think it looks really cool. So I had to start that way. The panelists are actually from different parts of this map. And so I'm going to introduce them and I think I'm actually introducing them in opposite order of the way that the panel is talking.

First, Erik Takeyesu -- long a for the e -- is

here from Southern California Edison. And this particular spot on the map is important, as we know, in part because California has taken pretty bold steps to address greenhouse gas emissions from its power sector and from the economy. But also because of the ongoing relationship of the California market to the West-wide energy imbalance market and the fact that there are resources around that Western interconnection that will provide further enablers of those state's ability to comply with the Clean Power Plan.

And, of course, California has done a number of studies that look at the implications of deep penetration of renewables and intermittent resources on the grid. If Erik were wearing a duck curve hat he would be doing us all a favor because we all know that they've been looking at the implications for ramping of the system are challenges, challenges that certainly can be overcome, in part, by just turning off the renewable supply. But that won't necessarily be a solution going forward that actually allows a lower carbon footprint. So Erik's going to give us his vantage point.

From the other side of the coast, Mary Ellen Paravalos from National Grid is here. Mary Ellen is in charge of the transmission part of National Grid. National Grid's footprint not only is across the pond in England, in

the U.K., but also in the New York/New England area as both a gas and an electric supplier and is part of an organized market where the region is part of a nine-state cap-and- trade program for greenhouse gas emissions. So, a different vantage point that we're going to hear about, system interactions with the plan.

David Boyd is here from the mid-continent ISO, which has its own different profile. Of course, the heavy concentration of coal-fired power plants in the neck of the woods makes this an interesting challenge. There, as well as in the South and in PJM, same kinds of issues -- an organized market that stretches across states that are vertically integrated utilities, with a variety of other power plant owners. So we have a different profile there to hear about the system interactions.

And then Mark Lauby from NERC is the whole shebang. You get to look at the whole profile and, of course, I covered Canada up there, too. Mark is going to start the presentations because of the kinds of analytic work that NERC has been doing to look ahead, to think about resource adequacy and systems operations issues. And he's going to start us off and then we're going with David, Erik, and Mary Ellen. Thanks.

MR. LAUBY:: Thank you, Susan. And I'm

delighted to be here today to chat a little bit about the Clean Power Plan, from NERC's perspective. I don't know if this is teed up? One thing you don't know about me is I had an older brother. The good news about that was he was the one who made all the mistakes and I just learned from him, so thank you, Susan, for helping me get sorted out here. (Laughter) It started with the arrows and everything else.

MS. TIERNEY: Don't touch that mouse.

MR. LAUBY:: Yeah, I got that. It's remote. So, just real quickly, what we're seeing with regards to the EPA plan, and I'm one of those who has not read all 1,700 pages of it, but we have folks that have and so they looked at it from a variety of different ways and just looked at some of the EPA projections. So why this is important to NERC -- I assume everybody knows who NERC is? Who doesn't know what NERC is? Okay, I'm from NERC.

SPEAKER: NERC is (inaudible).

MR. LAUBY:: Yes, that's right. I'm from NERC and I'm here to help. (Laughter) That happens every time, Billy, I don't understand it. So, in any event, we care about reliability and that's really what we care about mostly around the bulk power system.

So, when we look at this transformation of resources from where we are to where we're going, of course,

what's important to NERC is that the bulk power system remains reliable. So we see this transformation of resource mix that we're kind of heading down and, of course, that's interesting to us because our bulk power system, generally, is locationally developed. That is to say that where the generating plants are, we build out a transmission system and then we, from a central station perspective, then deliver that to load. Now, that model's changing and has been changing for some time. What we see with the Clean Power Plan is that that change will be accelerated.

So just a quick overview. The Clean Power Plan does set carbon dioxide emission performances for various plants using what they call, "the best system of emission reduction." And it's based on research, as well as other applications that are out in the field already. They identified three building blocks as opposed to four because energy efficiency was rather put toward a credit approach, and I've got a slide on that.

And then, of course, they translated the state goal measured in both mass and rate based on their particular mix of generating plants from 2012. This kind of lays out the three building blocks and how EPA calculates and their assumptions, and how they get to what they're expected reduction on carbon is, both in improving the efficiency of

the power plants, shifting generation from higher emitting electric generating units to natural gas and renewable plant and, of course, shifting a lot of generation toward renewables.

What we did see in this particular plan -- and there was a lot of discussion when the original proposed rule came out around a cliff, and we're not seeing that cliff anymore. It's much more of a glide path and three specific steps. I think that's helpful, as well, because based on our original study work at NERC, we were concerned about all the changes that need to happen before 2020, so this certainly helps a great deal.

And, of course, here's the timeline, so you have that in front of you as far as what has to be done in the first year, 3 years from now, 7 years, and, of course, 15 years. Basically, the goal is by 2030 to get to 32 percent reduction, I believe, of 2007.

So, of course, there are a number of different plans that can be developed by the states. They can have their own specific plan. You'll hear it called SIP, or State Implementation Plan. You can have a regional implementation plan where multiple states work together. I don't know if that's RIP or not? Anyway, and then there's the federal implementation plan, which has not been proposed yet. It's

still, I think, going through the discussions on formation at EPA.

And there's also trading mechanism available now, so you can trade with other states. So mass states can trade with other mass states or rate states can do the same with others. And there also is a clean energy incentive program. It's really trying to get early investment in wind and solar power and also energy efficiency. And there's allowances for the various states that work within that particular incentive program.

That's pretty much what happened with energy efficiency, which was in the proposal; it was that fourth building block. So there was also some reliability provisions. One, of course, is that each state has to demonstrate in their final plan that they've considered reliability issues and also there's mechanisms for states to seek revisions. So, for example, you have a particular plan in place and unexpected changes, I can't get a generating plant in place for the next two or three years. Maybe I can't get in the queue to buy a gas power plant or I maybe my load's changed. And those of you in Texas or in North Dakota can understand how that can happen real quickly, real unexpectedly.

So there's an ability to revise those plans and

also there's a safety valve. And that's really just about a short-term piece where unexpected events on your system, you need some relief for a month or two, there's a mechanism to get relief on that to maintain reliability.

This is hard to read, and I apologize for that, but try to get 50 states on a X axis and you know what you've run into. This is basically from a high-level perspective, what changed between what as proposed in the original rule and what the final numbers look like. And you'll see some places, for example, like Texas where it was a little bit more of an increase than the mass cap, and then in some states there was actually reduction, like in Kentucky or in Missouri.

So, before I finish, this just gives you kind of an overview of the plan itself. I did have a few things that I would like to inform and also ask your thoughts on. As far as what NERC is going to be doing going forward, of course, we will be working with industry. We think it's extremely important for the transition and we talk a lot about micro-grids and renewables on the distribution system, and all sorts of different types of technologies. The bulk power system is, you might say, the Christmas tree that you put these ornaments on.

It will be critical that the bulk power system remains reliable during the transition, as well as into the

final end product. And what does that mean? It means that we're going to get more and more generation, perhaps, on the distribution system and we need to make sure that we can balance that generation with load. And so that brings a host of different things to at least consider when we're going through this transformation. And I think it's critical that we do this up front so that the bulk system remains reliable and we get the most efficient end product.

And I think one key thing will be that we continue to keep an eye on what is the essential reliability services that generating plants provide us? I heard yesterday, we were talking about certain percentages of margin. Let's say 10 percent or 15 percent, but that really doesn't mean as much anymore. It's still an important metric, but we also need to be concerned about frequency response, ability to respond to events, voltage support. So those are the essential reliability services that you can think of from a technical perspective, and you heard John Underill talk about that.

But then beyond that there's this whole idea of what does the operator need to maintain reliability? And at a minimum, certainly, to be able to observe what resources are on the distribution system, to be able to dispatch that generation when it's actually energized. For example, the solar during the day or wind, et cetera. And then, of course,

control, the ability to be able to control, so we can balance the generation, no matter what side of the line, if it's in the distribution system or on the bulk power system.

So you're not just building a bunch of resources on the bulk power system that perhaps is only there for essential reliability services. So we think -- again, the CPP accelerates this change. This is a change that has been ongoing for some time, certainly now with cheaper gas, renewables being more affordable, and, of course, state mandates. But now if we see this acceleration, we need to do it in a thoughtful way.

That, of course, then drives certain research and development needs. Tools that we talked about yesterday, I think, are going to be important for planners because one thing I learned is if you don't plan something, it never happens. If you don't plan to get to this meeting, you'll never get here. So it's important that you make all the -- now, of course, there's the planners and the operators and they always argue with each other, so I'll hold that joke back.

Then, also, we need to be able to evaluate the coordination of controls. And the industry's working really hard right now coordinating the relays and working with others, their neighbors, to make sure that the controls and

relaying is all coordinated. We're going to be adding another layer of control, both at the distribution and in the bulk power system. It needs to remain coordinated.

How do we do that and how do we have these detailed models that we may need to have, getting back to three phase models, in some cases? And of course then, this whole idea of how to restore and recover after events. I did talk about, certainly, some of transient needs, like frequency response and voltage, but also then we've had experience in Germany -- you've got to make sure you stay coordinated with your distribution generation and your bulk power system generation, so more quickly can recover and restore. So those are areas that perhaps we need to think about from an R&D perspective.

NERC is going to continue to have two particular reports coming out. One will be a kind of dos and don'ts for states, so that when states think about adding certain types and certain amounts of renewable energy, for example, what they need to consider. What interconnection agreements are needed, for example? These are jurisdictional issues. NERC does not have any role, per se, in the states, but we want to make sure that we get some advice out on what kinds of things they should be putting in those interconnection agreements and things to consider.

And then, of course, we're going to assess a number of different key scenarios around these assumptions, probably about the first or second quarter of next year, so we can identify some of the things that industry needs to keep an eye on when they go through this transformation.

So with that I'm finished. And I want to thank you all and look forward to your questions.

MR. BOYD: Good morning, everyone. As probably the newest kid on the block in a new role, a recovering regulator -- I used to say I was a recovering academic; I'm always recovering from something -- and can't help but think that when Sue was saying "sloppy," she was looking at me, so I will hopefully stay a little bit focused today and give you some insight into what we're doing and thinking about at MISO right now with respect to the Clean Power Plan.

Mostly thinking about how we're doing analytical work to try and be supportive of our states as they find an optimum compliance strategy. I think it's fair to say we all could find compliance strategies, the question is, are they effective? Are they efficient? Do they preserve the value that's built into the current system? Do we maintain the reliability of the system? And I think that's where we're focused.

Perhaps, first, just a reminder that the Clean

Power Plan's not coming up in isolation. The system's already absorbing a series of initiatives and so this is a bit of jigsaw puzzle where we're trying to make sure these oddly shaped pieces fit together, that we don't undo some of the good things we've done already with MATS and with other rules.

And so, while we don't take a policy position on these types of EPA initiatives, our goal in doing our analysis is to make sure that we're responsibly complying with the rule and helping our stakeholders find the best path forward. We are interested in compliance solutions that meet the regulation, but maintain reliability and value inside the system.

So this rule will certainly have lots of wide- ranging impacts on the generation system. Gas and electric infrastructure most certainly will be altered. There's a potential for reliability impacts. Obviously lots of folks are worried about the reliability issue and for us, again, the economic dispatch piece of this is very important. How can we encourage compliance that maintains the current economically driven dispatch scheme, which is the cornerstone of the value to the tune of billions of dollars a year that organized markets bring to their customers?

We certainly think that we have a role in

informing policymakers, asset owners, state regulators, economic and error regulators. And the goal, again, is to enable a reliable and efficient implementation scheme. The work we've done started a year or year and a half ago, trying to analyze the draft rule, and it continues today as we begin to scope analytical information that we think will be valuable to our stakeholders moving forward.

Again, we're trying to look for a way to be supportive. It's an interesting relationship. Someone has to ask us to come into the room, to a certain extent. We don't go out and lobby, we don't grab our error or economic regulators by the ear and tell them this is what they should do. It's not our role. But when our regulators come to us, we certainly try to be informative.

And we've done outreach in many different manners so far: One-on-one with states, we've worked on some webinars, particularly to our error regulator friends to help them better understand what it is we do as an RTO, what economic dispatch means, and what peril there could be in a less than optimally configured solution to the Clean Power Plan.

This is a busy slide with just a few of the changes from the proposed rule to the final rule, and some have already been mentioned. The methodology changes the final

compliance obligation for states and, in the case of MISO, about half of our states have more stringent targets and about half have less stringent targets.

There's a series of outcomes in the middle of this slide that we think were helpful changes, that made compliance easier: Changing the interim compliance period, allowing states more time to put together their compliance plans, tings that we hope will enable multistate trading, or at least serious consideration of multistate trading. The safety valve issue that came up previously and the expression of obligations in both rate and mass form are all things that I think we believe made the rule better, made the rule easier to comply with.

This is a timeline of some of the analytical work we've been doing. The first two chevrons on the left represent work we did on the proposed rule. We did work here with a new modeling tool for MISO 1, which would allow us to look at both gas and electric infrastructure iteratively, looking for an optimal solution as more gas comes on to our system. We are a coal-heavy system. Those changes, as was noted before, have already started.

The low cost of gas was creating incentives for moving from coal to gas generation. But in the case of MISO, through MATS, we believed we had sufficient pipeline capacity

to handle the change from coal to gas. With the Clean Power Plan, that question is up in the air again and it was necessary to look at the cooptimization financially of infrastructure, both on the generation and the fuel supply side.

The third chevron is the analysis of the final rule, which is just beginning. We think we have a proposal for how to move forward. I'll mention that in a moment.

And then the last one would be modeling we do once we receive state plans, to begin to analyze the impact of what the states have elected to do as the move into their compliance.

There were a few lessons learned from our work on the draft rule. It's pretty clear, and I think all the RTOs have come to the same conclusion, that compliance on a broader than single state basis is more economical. A regional compliance plan, in our case the numbers were something in the range of 4- to $11 billion over 20 years of savings. That's money on the table that we hope we will be mindful of if we can do this in a regional method or a more cooperative method of compliance as opposed to single state compliance.

There will be, it would seem from the draft rule, a very significant build-out of the transmission system to accommodate the new resources, not just counting the

megawatts and the reserve margins, but the location of resources and also some gas build-out, as well. Dispatch could be effected, again depending on how we choose to monetize CO2. We continue to believe that finding a way to monetize CO2 and build that value into the dispatch price is a way that most transparently and clearly maintains the economic dispatch of the system and preserves the system as we have it right now.

So, in terms of the going forward modeling, what we've proposed to our stakeholders -- and it really is just a proposal at this point -- is to look at footprint-wide compliance and state-by-state compliance in three scenarios. One would be using the proposed federal plan as a platform. It's something that I think MISO will come to be considering business as usual as we move forward in our other transmission expansion work over time.

And then the other two plans would be bookends, if you will. One where, for whatever reason, the implementation of the Clean Power Plan is slowed or delayed, a half-compliance -- half of the mandated carbon reductions are achieved inside the timeframe and vision, whether that's technical reasons, legal reasons, it doesn't matter. It's a bookend of half-compliance.

And the other bookend would be going beyond the

Clean Power Plan to an 80 percent carbon reduction and we think by looking at those three scenarios as a starting point, we can begin to have a good dialogue about options, pros and cons of the system, as we move forward.

I probably covered this. We certainly think that we've found a good tool to do our work. Part of the early modeling was proof of concept with this modeling tool. It seems to have performed well for, again, thinking about gas and electric infrastructure in a more systematic way. And then we've also discovered that doing these studies cooperatively with our stakeholders in something of a measured, step-wise process is important.

And then, lastly, the question of rate and mass seems to us to be a very significant one. The EPA has presented both options, equivalent methods of achieving compliance through a rate-based or a mass-based compliance tool. We think that states will make choices based on their perception of the opportunity for economic development under one scenario or the other. We certainly believe that economic growth can be accomplished in both scenarios, but we do know that there are some states that are leaning towards a rate-based approach simply because of that growth opportunity.

It's not clear to us yet how we can readily

monetize carbon in that rate approach. That's one of the things we're working on now. It's intriguing to think that there might be a way to translate the two, English and metric -- kilometers and miles -- that there may be an economic way to translate the two systems. Most smart people say that can't be done, but, of course, that won't stop us from trying to see if we can find such a relationship.

Clearly, if we could achieve that kind of a translation, then it won't matter from an economic dispatch standpoint what path states go on. And at the end of the day, we feel it's our job to be prepared to assist our regulators and our stakeholders in trying to look for that best compliance option, and that's our task going forward.

So, with that I think I'll stop. Get out of the way and I thank you for the opportunity to be here.

MR. TAKEYESU: Good morning. While that's getting set up, I want to thank the committee for the opportunity to represent Southern California Edison. I'll talk a little bit about the things that are going on in California. As Sue mentioned this morning, there are a number of things going on.

California has been pretty aggressive about climate change, starting with AB32, our Global Warming Act, California's cap and trade. We're facing, or preparing for,

50 percent RPS. And we have the California Distribution Resource Plan and all the host of different things that are going on, so what I'd like to do and focus in on this presentation is a little bit about the impact to the electric system -- the power grid -- and some of the work that we have done to prepare for that.

So, a little bit about Southern California Edison's service territory. Our service territory is about 50,000 square miles. We have about 4.8 million meter customers. The peak demand in the system is just over 23,000 megawatts -- 23,300 -- which we experienced back in 2007, and we haven't seen that level of peak demand up to this point. Demand has essentially flattened due to a number of factors, one of which is the economy, the other of which is going more and more towards renewable technologies on the distribution system.

So one of the things that we did probably started in about 2011, it was to look at the impact of more distributor resources that would come into our service territory and how we can look at the power grid and understand some of the challenges with respect to the technical side, as well as cost.

So we looked at where the trend was, where people were applying for generation interconnection. And most of

which that we found was that people were applying out in the rural areas where land is cheap. Now, in Edison service territory about 75 to 80 percent of our load is located in about 25 percent of our service territory, so it's really restricted along the coast. So the bulk power transmission system is really intended to bring power from -- you know, import power -- across the Western interconnect into the load center.

So when you think about added renewables into the more rural parts of our system, you really begin to think about what the impact is on lines that may already have congestion due to generation imports that we're already dealing with. So what we found out, from a cost standpoint, the integration cost to connect more generation in the rule system was over two times the cost that it would be to go into the urban. Now, that's really looking at it from a grid perspective, but it does give us some idea from a distributor resource standpoint what some of our policy positions could be, particularly as you look at the California Distribution Resources Plan.

Now, location matters, as we saw on the previous chart. And even when we get to the distribution system, very granular locations begin to matter even more. So one of the analysis pieces that we did for the Resources Plan was to

characterize the distribution system by modeling a representative sample of our feeder.

So we took 30 feeders that represented a full population of about 4,600 distribution feeders across the SCE system. And we looked at what the integration hosting capacity limits were based on limitation for thermal protection and voltage limitations. And, really, the findings are relatively simple. It had to do with the voltage levels that we were applying the distributed generation over, whether they were clustered, whether they were spread out, and the distance of the generators from the substation.

So that, from a static system perspective, is interesting because it does give us a clue in terms of what the theoretical ability is for a system to bring in more distributor resources. However -- and as we'll get into more later -- the distribution system particularly is very dynamic. So, from a control perspective and a design perspective, how do you deal with a system that is constantly changing for a number of different reasons?

Now, I do want to talk a little bit about the Distribution Resources Plan and the stakeholder working group that is currently still working on aspects of DRP moving forward. So some of you might have heard about the More Than

Smart stakeholder working group. It's a pretty good mix of different representation, representative folks, including utilities, advocates, vendors, technology folks, and so really coming together to talk about collaboratively what we can imagine the grid to be. And how does that inform our efforts around the DRP and to what level of areas do we agree or disagree?

So one of the things that we did to begin to converge on is what are the instincts of the grid? Think about the grid 30, 40, or 50 years from now, how could you characterize that? So we began to look at this as an entire system. So there were basically four states that were talked about.

One is, does a grid just become a giant battery and as a backup? Do we handle the grid in a current trajectory, business as usual, just study interconnections as they come along? Are we really more of an interactive grid where the distribution system is a platform for more resources? Or do we begin to move towards an evolution where multiple utilities begin to leverage one another, sort of similar to the energy-water nexus?

So the current consensus is really around a more interactive grid where the distribution system becomes a platform, but as you move from the back-p up to this

interactive grid, to convergence, the value of the grid begins to increase. But it does bring about some considerations and some of that was already talked about this morning already.

In terms of the long-term balancing of supply and demand between the distribution system and the transmission, how do we forecast these needs going forward into the future? And what are the design changes that are needed from an overall systems perspective and, really, to the degree that you could depend and increase the dependability and availability of these resources?

So we then think about what does the modernized grid begin to look like and what are some of the capabilities that the grid needs to have? And we will continue to talk about the ability to monitor, anticipate the actions of resources in the power system, and to the level of degree that we can control them.

But it really boils down, from Edison's perspective, into three major categories. One is, what are the assets on the grid that need to evolve to have a higher degree of situational awareness and visibility to these resources? What are the communications and interoperability requirements that are needed? And what are the essential IT platforms that have to be developed?

So if we talk about what the operators need to do, what are the systems that we need to begin to work? And what are the data requirements that are going to be needed and, really, the visualization tools?

I think that when we look at the operator systems today, there's a pretty big gap between where we are and where we think we need to go. But it's going to be enabled then by the workforce strategy, so at Edison we're thinking about what does that workforce of the system need to look like? And what are all the different processes? So it's not really just a pure technical problem to solve, there's inherent people and process issues that also have to be addresses simultaneously.

So what I want to end with is opportunities to further explore and I think these are opportunities for a number of different folks, including the Department of Energy. One is that there needs to be a modernization of the planning methodologies and the forecasting tools that are needed between the distribution and transmission systems, so when we think about how we plan today and the amount of data that's needed to make our playing decisions.

Two, a world where we need a lot more granularity, maybe looking at 87-60 profiles and how combinations of DER -- distributor resources -- can work together to fulfill

a gap. Those are some of the higher level goals that need to be considered in terms of modernizing the planning process. And that's going to bring about the need for new metrics. So today we have metrics of SAIDI/SAIFI. Do we need more metrics? Do we need ones around resiliency and really environmental benefits associated with more renewable resources? The optimization of portfolios for distributed energy resources? And how do we evaluate, measure, and verify that those resources are acting in a way that is needed across the 24-hour, seasonal, and annual spectrum of needs that we have across the power system?

I think the architecture around data still needs a lot of development for automation technologies and control systems, and particularly around the new grid management systems that need to be designed. And protection? Do we get to a point where, when we move towards a higher level of dependency on inverter-based systems, how do our protection philosophies and coordination strategies, how do they need a change?

High-speed communication requirements for not just the field are networks on distribution, but how can we leverage high-speed communications to get into more complex protection schemes on the transmission systems, such as central remedial action schemes? At SCE, we have a large and

increasing number of RAS schemes that are getting more and more complex, some as much as 700 steps on the logic programming. So we need to think about how can we simplify that through a more centralized remedial scheme that takes advantage of high-speed communications across substations?

Design standards, how do we size equipment? When we started looking at electric vehicle penetration, we began to realize that the loading profiles of our transformers were changing and that we needed to, in essence, begin to de-rate some of our transformers because they no longer had the same cooling abilities in the evening as they did prior. So when we think about that across the power system, looking at portfolios, flattening the low profiles, what does that mean in terms of design standard changes?

And then, lastly, the workforce of the future, what are the skills, knowledge, and training that's needed that companies are going to have to prepare for?

S, with that I look forward to questions and I'll go ahead and pass it over to Mary. Thank you.

MS. PARAVALOS: Thank you. Good morning, everyone. First of all, I want to start off by saying thank you very much for having me. It is a great opportunity to be able to be here and share ideas and thoughts on a clean energy transformation with this group of folks. So thanks

very much.

I do want to share thoughts around clean energy transformation efforts that are happening in the Northeast. I'll put that in context for you as relates to the Clean Power Plan because there's a few other dynamics that are really driving what's happening in the Northeast, as well, and really give you some thoughts on how DOE can support efforts as regions go through their clean energy transformations, really, across the country.

So the Clean Power Plan, we had a summary of it with Mark earlier. It supports market-based solutions. It has flexibility. It gives states flexibility in how they're going to comply, so a good mechanism. We're supportive of the Clean Power Plan. We've worked a lot with stakeholders in the Northeast and will continue as we comply with the Clean Power Plan and also push through additional measures that we're taking in the Northeast towards a greener future.

The Northeast region, and I'm particularly talking about New England and New York, where most of my experience is, but we're very well positioned to comply with the Clean Power Plan goals and, actually, beyond those, too. And I'll show you some data in a minute.

A lot feeds into that, particularly around some aggressive and strong commitment to green goals by the states

and programs around renewable procurement standards. Very aggressive and effective energy efficiency measures we've put in place as regions and the incorporation of more demand response. All these things are really helping to reduce our carbon emissions.

We also have RGGI, the Regional Greenhouse Gas Initiative, cap-and-trade emissions program for the electric generation sector. It's in place, it's been operating for several years, and it is a ready mechanism that we've already been using to track and drive down greenhouse gas emissions in the electric generation sector, and expect we would continue to leverage that mechanism into the future.

So this will illustrate to you why we are in good shape. So, on the left is New England, with Massachusetts being a bit of an example offshoot and New York over to the right, and these are electric sector carbon emissions. And so the first two bars on each of the graphs shows you where we were in 1990 and where we were in 2013. And so you can see that we've reduced emissions 35 percent in New England over that time period, more than 50 percent in New York, and the yellow bar is our target for RGGI mechanism that I mentioned.

And the last bar is the Clean Power Plan target for 2030. The yellow bar for RGGI is actually a 2020 target,

so you can see that we are, as a region, on trajectories to be, certainly, in the neighborhood of the Clean Power Plan targets for 2030. Probably sooner, 2020, if all goes well. And, really, the dialogue, I think, for the Northeast is let's get to the 2020 levels as we are planning to do and, really, what will be beyond that? So we can expect in the Northeast that based on history that we would want to even push those down further and actually drive those RGGI targets down further.

We expect that RGGI will be a mechanism for Clean Power Plan compliance. RGGI has a benefit also of funding energy efficiency and renewable projects, so about a billion dollars of revenues were generated through the RGGI mechanism over 2012 to 2014, and those dollars get put back into the states. Much of it is funding things like energy efficiency and local renewable projects, so really it's kind of a self-enforcing or reinforcing mechanism that this system bring to the region.

So one of the main points I want to emphasize is that regardless of the specific policy programs or there's sort of RPS programs or the RGGI mechanism or the Clean Power Plan that the Northeast, as we are going through our clean energy transformation and driving to levels that are even below what you see here on the graph, that we are and will

be facing similar impacts to the rest of the country. The details will look a little different, but generally we're going to have the same kind of drivers and the same sorts of impacts that we're going to need help and really work together to get through.

Some of the big drivers for the Northeast, one, natural gas demand, particularly in the electric gas generation sector is growing, so Mark had shown a number, I think, showing a projection of 33 percent gas in 2030 for I think it was probably a national view. We are already sort of at the 50 percent level and climbing in the Northeast, so that's a big deal, a big change, a continuing trend for us, I should say. And that's on top of already the gas demand, use for home heating, space heating, oil-to-gas conversions, a lot of demand and attention on gas in the Northeast, so a big driver for us.

Another is around renewables interconnecting and integration. So we certainly have -- I think it's really a growing trend. The potential for much more renewables is very big in the Northeast, onshore and offshore wind, the PV in particular, all these things are big drivers and you hear about them also impacting the rest of the country.

Generation retirements. From a system planning perspective, boy, if a generator retires or tells you they're

going to retire, that instantly can really create a lot of reliability concerns. I mean, there are some generators, very few, that can retire and not cause Gordon and others heartburn, but most of them do because they create sort of an instant reliability reinforcement need in that area, one that takes planning to manage. And so that's a big driver for us and certainly will be for many other parts of the country.

And distributed resources, I mentioned solar PV, really a growing trend in the Northeast. Massachusetts has 900 megawatts of solar already, leading up to a target in the next few years of 1,600. It's really, as a transmission and distribution owner and operator, really impacting what we're seeing on the distribution system; beginning to impact even what see as needs on the transmission system, so definitely a growing trend.

So all of those will sound familiar because we are like other parts of the country where those are really big drivers. And so this is really going to cumulatively be very important that we are understanding and managing and planning for these impacts. There will be physical system impacts. There have been and there will be more arising from changing generation and load patterns. Really we'll have the potential for reliability impacts. Absolutely we'll

have big cost or affordability implications, achievability in actually meeting the targets in the time frame. And some of these are sort of tradeoffs of one another that we really need to understand and manage, make sure we're not inadvertently trading something off for something else.

And we will need infrastructure improvements, more grid capabilities, and Erik talked a lot about those, and technology deployments. These are going to be really important enablers to achieving, again, the reliability, the affordability, the achievability of these goals.

So a couple of ideas on DOE's role. So, first of all, DOE, I think, has a great -- is in a great position to be a big driver of the dialogue and the landscape and the policy landscape around this whole area and how we do through this transformation. So I think there's a great continued role for DOE, an opportunity there.

A couple of specific thoughts. One is around a focus and support for the electric transmission role and the improvements that are going to be needed. I heard several references to it on this panel. When I'm out and about, I don't always hear a ton of references to it. I think a lot of the attention of folks, rightly so, is in the huge step changes that are happening on the distribution systems. But these changes will enabled or not, I think, by maintaining

a reliable transmission system. And so I think there is definitely an opportunity to be talking about the role that the transmission system delivers and building an understanding and support for when we do need to make improvements to that system.

From experience, when we go in and talk to communities or regulators or stakeholders about the need to upgrade a substation or put in a new line and we tell them about the reliability benefits and it will reduce your overall bill and, oh, by the way, more flexibility for a clean energy solution, they don't say, oh, goody.

(Laughter) They tend to say the opposite. And it is such an important driver of a piece of this transformation that I think there is a great role for this committee and DOE to be helping to paint that sort of broader picture from a national perspective for states and regions as we, utilities and others, go about the business and hard work of putting in infrastructure improvements when they're needed, whether that's within states, between regions, between interconnections, between countries. I

think all of this is on the table for the kind of scale of change across the country that we are going forth and will achieve.

The second one is around modeling. And DOE, I think, is in a great position to kind of conduct or sponsor modeling that enhances our collective understanding of the national picture of impacts and interactions as we go through our clean energy transformations. Again, the elements of reliability, cost and affordability, achievability, are all angles that I think need to be understood in total.

I was involved in the Eastern Interconnection Planning Collaborative with some other folks in the room, as well. So I was sort of thinking, well, maybe this is kind of like an evolution of that or a restructuring of that to really fit this purpose. But it just strikes me that the understanding and management and planning aspect is critical here. And it's not just a state-by-state view. It's not even just a region-by-region view. There has to be kind of that national view, too, and I think DOE's in a great position to help with that.

And then lastly, DOE programs to advance technology development, particularly the ones that are really important to the clean energy transformation, I think Erik had a super list that he put up. Lots of good stuff in

the Quadrennial Technology Review, as well. And so a continued focus on those areas will be absolutely critical because we will need these kinds of technology advancements and deployments.

And also, a focus, I would suggest, on using utilities as sooner test bed sites for technology development and deployment. We already do these on some scale. I think DOE focused on really helping the technology vendors and the utilities marry up, deploy, test -- test and deploy sooner on systems will be helpful to accelerating those changes. So what DOE can do to kind of shine that spotlight and continue to encourage those types of marriages I think will be a good idea.

So those are my thoughts and ideas for the committee. I hope they're helpful and I look forward to questions and discussion.

MS. TIERNEY: Thank you to the four of you. That was terrific and it was nice to hear about the macro issues and then some concrete things that were suggestions about what DOE might do, so that was great.

In the next 20 minutes or so, next 15 minutes, I'm going to start with a couple of questions to the panelists and then after that, please start getting some other questions or comments that you'd like to share, so that we

can spend some time on that. My questions are going to be -- I'm trying to make them all different, so that we can get a couple of themes on there.

Let me start with one that occurred to me as I was listening to Erik's description of the topology of the Southern California Edison system, where so much of the load is remote from where the resources are being developed. And you described that as a situation within your own utility footprint.

And then we can think about a similar situation within a state, where you've got the same situation. New York, upstate, downstate, really different considerations, and how planning and reliability and operational issues intersect with clean power planning, I think, is interesting and challenging.

But now I want to raise a third variant of this remote sources of clean energy to distant load centers by asking you a question that has been asked of me by some staff members on the Electric Committee of NARUC, where they say how's it going to work if my state -- so let's just say that state could be Mississippi or Florida or North Carolina or something where there is not as much wind as there is in MISO. And let's say that generators in MISO want to go big and long to develop those huge, abundant wind resources, and then

create clean energy credits and sell them across the country in a trading regime with a state that has adopted a common framework model in their compliance plans.

So the question that's been posed to me by some of those staff members is I don't get it. How are you going to inject that much resource into an area where the load is what it is, in MISO, say, to create credits for very different areas? You know, is that fair? How does it work operationally in the source and sink states?

And so how do you think about that issue when you think about planning? I mean, MISO has the multi-value system planning model, which takes into account both market- driven and integrative resource plan-driven changes in the systems, but also state policies. But now some of the state policies might be completely the other part of the country.

So as you think about your own areas, how do you think about these locational issues in terms of where clean energy resources may be located and maybe they will be decentralized? And Erik and I think Mary Ellen said that there could a lot of cost-effective ways to develop those distributive resources, but how do we think about these planning and operational issues where there's really big gaps that may need infrastructure upgrades?

Who wants to start? Yes, go ahead, Erik.

MR. TAKEYESU: Okay. I'd be glad to start since it sounds like I started it in the first place.

Now, in order to meet 33 percent RPS, we invested in about 500 miles of transmission, new transmission. So I think that part of the goal and planning is to understand sort of the long-term need for transmission, but I also see getting to where we got to, dealing with the increased cost of distributive resources in these same areas where we're building transmission.

To some degree, there has to probably be a couple of components here. One is how much margin do we put in for future growth of distributor resources and would they likely occur in these areas or do we really think about more distributive resources in the population centers themselves? So I think that that's one driver.

The second thing is, I think Mary brought this up, is the challenges associated even more so in the future about licensing transmission lines, given that we're in a competitive environment in transmission, you know, the amount of new transmission that will have to be built, it's going to be very interesting to see what the overall wherewithal would be for investment in that large scale of transmission going forward into the future. It's absolutely

needed if we're going to continue to access resources that are remote. But those are some of the things that I think we need to think about.

MS. TIERNEY: David?

MR. BOYD: I knew you were coming this way. So, first of all, I think in MISO we have the geographic advantage that lets us address your question within the RTO relatively easily. That is, I think MISO's become pretty adept at watching weather fronts move across the plains so that they can -- and the modeling of wind generation has improved to the point, if you're in our control room where there's very good agreement between forecast for wind and delivery of wind, so a front comes across, the control room can watch it, anticipate it, ramp at the right times, have the right resources ready to go.

Within the footprint, the MVP portfolio allowed for moving wind from a state like Iowa, that has 5- or 6,000 megawatts of nameplate capacity and they don't use it all. And it allows them to be a market player in delivering their wind elsewhere. That's the upside.

The downside is so really there's maybe two ways to do it. One is to continue to move the wind from those wind-rich -- the stripe in the center of the country, whichever direction it needs to go. It's a little easier to

save transmission in the Midwest than it is in the Northeast. We have more success, I think, a little bit easier time, it's not trivial. So physically you could try to move it, but I think if you look at the problems that some of the large DC line proposals, even in the Midwest have had, it's a sign that we're not there. We're not at the point where we can readily count on moving large volumes of power from source to sink.

The other option, of course, is to be in a trading regime where credits that might be generated in Iowa could be sold to Mississippi or sold to some other state for the sake of compliance. And, again, I come back to the question of how the Clean Power Plan envisioned the opportunity for trading that almost seemed to encourage it, whether we have these swim lanes of rate-rate and mass-mass states as a deterrent or not remains to be seen.

So I think, in summary, we have the luxury of geographic diversity. That makes it perhaps easier for us to move power within the MISO footprint. The MVP package, is there another tranche coming? It seems like a reasonable possibility. Now the public policy driver probably is CPP more than state-based programs.

MS. TIERNEY: Any thoughts? Yeah, Mary Ellen?

MS. PARAVALOS: Just a couple thoughts are coming to mind. I think sort of creating credits and trading

will take you so far across regions until it gets to a point where there really are these physical impacts. So I tend to think we will need a level of greater interconnectedness between regions. I think that's just what we're going to need to be really offsetting fossil fuel generation and putting on renewables and making it all actually work from an operational perspective.

I think we do need to take views on how much distributed resources will be part of this picture because I think it's going to be a big piece and I think you can make some -- it would need to be sort of scenario-based projections on that, but it will be a big driver. And it needs to be -- we need to kind of put some bounds around it and think about that.

I also think about the Northeast. When we talked about MISO. The Northeast also has incredible potential for offshore wind, onshore wind, connecting additional hydro from Canada. And if that were a future for the Northeast, I think that greater interconnectedness with other parts of the country to kind of move power would be part of the picture, so, in some ways, kind of analogous to MISO. We don't have quite the geographic or low differentials that you're working with, so even from that perspective the interconnectedness would be, I think, more critical. A couple thoughts.

MS. TIERNEY: Great. Mark, do you want to add

anything?

MR. LAUBY:: Well, it's an interesting question because at least it's easy to build transmission. I'm hearing that now. Yeah, usually about 7 to 10 years.

MR. BOYD: I think I've been misquoted.

MR. LAUBY:: Yeah, right.

MS. TIERNEY: You're so funny.

MR. LAUBY:: Seven to ten years to build a line. But, you know, we do also see some experiments and how it can be done. You look at Ontario and what they had to deal with, with spilling wind or negative prices to get takers for their wind when they had too much because they had to complement that with a large nuclear plant in the evening. And either, you know, you spill nuclear or you spill wind or try to find somebody to take it.

I think the golden or silver bullet here is going to be storage. And, you know, there may be opportunities for -- in the pricing and mechanisms such that storage could play a significant role in some of the capturing of renewables and reuse of it.

But I think when it comes to, you know, multistate transmission lines, DC lines, the plans have been built out already, like you said, in MISO. I remember when they were talking about building a DC line from North Dakota to

Massachusetts, and the states were, at that time in the Northeast, not too happy about those kind of things.

MS. TIERNEY: They really like it now.

MR. LAUBY:: They do? Okay, okay. We don't want your stinking renewable wind or something like that.

But anyway, we'll have to see. There's a lot of state issues and regional issues and we'll see how it all plays out. The main thing is that it has to remain reliable to us and following various state or NERC standards.

MS. TIERNEY: That's great. I want to ask, I'm mindful of wanting to open it up, but let me just ask you one question about if you have any ideas about institutional or non-analytic things that DOE should be thinking about. And by that, certainly you've just talked about sighting. DOE has certain peculiar sighting capabilities and responsibilities, and is there anything there that you think would be helpful? Are there other institutional issues at RTOs that would provide notice or other things, say, about earlier indication of retirements or earlier indication by owners of plants about operational controls that they see coming on so that you can front-end load some of those studies or other things like that? Are there things that come to mind?

Mark?

MR. LAUBY:: I can talk from a high level on jurisdictional issues. And, of course, we had a Reliable Leadership Summit here about a month or so ago, and Gordon probably has some things to talk about there, so I don't want to steal his thunder. But there are some jurisdictional issues around state and federal government, between the gas industry and electric industry and telecommunications and the electric industry, which we need to put an eye on.

MS. TIERNEY: That's for sure. Yeah, that's a good point. Any other thoughts?

MR. BOYD: Just that I think that the final rule certainly better to find a role for the federal agencies to be engaged and supportive and cooperative, and I think that'll be helpful. I think the federalism issue, the state-federal dynamic, has always been alive, but probably never as alive and kicking as hard as it is right now.

And there are internal issues at the RTO to align retirements with queue issues for new generation coming on. Those are sort of on us, but in terms of aligning state and federal policy, anything that can be done is probably helpful.

MS. TIERNEY: Would you put your cards up if you're interested in asking a question?

Sonny, you get the first. Richard, is that one

that you're putting up? Okay, okay, Sonny, you're up.

SPEAKER: You can start in any order.

MS. TIERNEY: I didn't see these, so you guys are second. I saw that one first, so I'll go to you guys next.

MR. POPOWSKI: Yeah, thanks. I have a question for David and it revolves around the mass-based versus the rate-based approach.

It just seems to me from a regional perspective, from a MISO perspective or New England or PJM, the mass- based approach has enormous advantages in terms of calculating, you know, what is the cost or the value or the cost of carbon? How do you trade between the different MISO states? Economic dispatch, how do you do economic dispatch? I guess, isn't there an enormous advantage to using a mass- based approach like they use in RGGI and I think like they're planning to use in California?

MR. BOYD: No doubt, the answer's yes. It's a system -- we know it's a system we've incorporated before with SOCs and other kinds of compliance regimes. It's comfortable, it's easy to incorporate, but it's not our choice. It's up to the states to make those decisions or selections, and that's why we're trying to do what we can to see if there's a bridge between the two. And if not, we'll be racking our brains about how to take that rate-based

dispatch and monetize it for the sake of preserving the economy of dispatch.

But you're absolutely right, if we could control the adoption of rate versus mass, I don't think there's any doubt we'd go to the mass-based method.

MS. TIERNEY: I like to have a visual out there to show to every state where you put some piles -- two piles on the table. One pile is this tall and that's what they have to do if it's a mass-based approach, trading regime. And this is the pile that's on the other side, the steps that they have to go through. It seems to me like the rule actually is encouraging it.

Paul, then Granger, then Roy. I can't see who's over here. Is it -- okay, great, Phyllis and Gordon, and then Marilyn. Okay.

MR. CENTOTELLA: Okay, thanks, Sue. I want to pick up a little bit on Sue's first question. And before I do that I want to compliment the panel. I really thought you had some great suggestions of things that DOE should be doing and some of them are things that are in our agenda to talk about. But I want to pick up on Sue's first question and talk a little bit more about what happens with trading and what happens with mass versus rate, and the implications of that for what happens in both power system planning and

operations.

So if we look, just as a starting point, at EPA's numbers on marginal compliance costs between states as an indication of where you might see impacts of power flows between states and, you know, I pulled up just the three regions we're talking about. EPA's numbers for marginal compliance costs in California are 0, but in Arizona are $43 a ton. In Iowa are 0, but in Wisconsin are $33 a ton. In Rhode Island they're 0 and in Massachusetts they're $47 a ton, which would suggest that some folks might want to engage in some transactions between jurisdictions. And that works if everybody within those transactions is either in a mass-based approach or, alternatively, is in a rate-based approach, but doesn't work so well if one state is in a mass-based approach and the other state is in a rate-based approach.

And so one in that instance ends up with the generator in the mass-based approach saying, well, I want to take my full emissions and multiply it times the marginal cost of compliance and build that cost into my bid into the RTO because I'm going to have to displace, you know, that amount of emissions somewhere in the plan. Whereas if I'm in a rate-based approach, they're going to look at, well, I ought to take the difference between the rate that I have to achieve in wherever I am, which could be a positive or a negative

number, and build that into my bid to the RTO, which, of course, means the RTO dispatch is not now on a common basis between the mass- and the rate-based jurisdictions, which will change the power flows in the RTO, change where it makes sense to build generation in the RTO.

And somehow you got to think about that in terms of should I be building a transmission line based on this rule, which who knows whether in 10 years it'll get replaced by some sort of uniform national legislation or not? And how do you make those investment decisions? How do you begin to think about that from an operational standpoint so that this begins to make some sense in a broader economic standpoint of operating the grid? That's my question.

MS. TIERNEY: Who wants to try and answer or comment in any way?

MR. BOYD: Well, it seems funny to say, but your last question about sighting transmission is the easier of the two. I think the answer to that one is you look for transmission lines that are robust and as many futures as you can dream of at the time you do them. And I think that's not thinking that's foreign to the state regulators who sight power lines. To the former, you've hit the nail on the head and that's our conundrum and that's exactly what I hope we can crack that nut.

I will say there's also equally thorny issues about how some allocation of obligation will happen within states. When you've got coal-heavy utilities in a state and one that's already gone a long way to de-carbonize, there are going to be those same sort of allocation and obligation issues within states.

So I don't have a good answer right now. MISO, you know, we're not there. We're working on it.

MS. TIERNEY: Well, in fact, Paul, your question is obviously one that is a nut and core thing that people have to be struggling with over time. Anybody else want to comment on that?

MS. PARAVALOS: Only that the need to understand the options to the states and then modeling associated with it and not to underplay, in fact, make it a big part of this, is what's the likely potential system impacts so that we understand them? And then what are the options to mitigate? So analysis, I think, is what it comes down to, needs to be a big piece of this.

MR. CENTOTELLA: Do you think there's a role for DOE in facilitating conversations around this question? And if so, what would that role be?

MS. PARAVALOS: I think there's a role for DOE to be sort of teeing up these are the focus areas, here's what

we know what we can do. A lot of it is going to be really state and regional discussions.

To my earlier point, I do think there is a DOE role of assessing kind of the national impacts or aspects of this, so that we do understand those interregional risks or opportunities. So I actually think there's a lot there that DOE can help facilitate.

And this is not -- I mean, your question alone was complex. This is not easy stuff.

MR. CENTOTELLA: Right.

MS. PARAVALOS: If DOE can kind of provide some of that supporting glue to the conversations, I think it would be great.

MS. TIERNEY: Another thing that I think might be responsive to that would be I don't know whether it's convening or sharing best practices or advancing methods, but clearly there's a piece of this that is production simulation-type of modeling. But then there's load flow modeling at a quite granular level, and gas demand modeling and gas infrastructure flows. So there's a lot of very macro and flow analyses that are implicated by the kinds of questions that you're raising.

So I think I said next was Granger.

MR. MORGAN: So a 30 percent reduction in

emissions from this sector is wonderful, but, of course, it's only a fraction of what's going to ultimately be needed. So I've been spending a fair amount of time worrying about dead ends. That is, how do you get into situations where you get 30 percent, but then scaling up beyond that is really hard?

And so I was pleased that trading was emphasized by the final rule. But I guess I'd like an assessment from any of the five of you of how widespread is the adoption of a trading-based regime, which, of course, does readily allow scaling up, going to be as opposed to other more complicated arrangements?

And second, have any of you got ideas about how as a nation we figure out how to keep more nukes in deregulated markets in the mix? Because at the moment, we're in a very shortsighted way from the point of view of climate issues, we're shutting them down for reasons that we all understand.

MS. TIERNEY: That was one of the questions I didn't get to, too. Does anybody want to start on that?

MR. MORGAN: And, Sue, you may also have a view.

MS. TIERNEY: Well, one of the things that I observe is that I think there are near-term struggles that are going to happen in a number of states where they want to protect a particular plant that's going to have stranded costs or something. I think there may be some near-term

discussions, hurdles, problem-solving about those situations. And then a sidebar view: Across the country that really is being reinforced by modeling, that trading is economically efficient.

MR. MORGAN: So you're arguing that you think that most states will ultimately end up there?

MS. TIERNEY: I think that there's a strong pull.

MR. BOYD: In terms of the states that I've interacted with, certainly most of them are open to finding the best solution, and trading is going to be a part of it. There are a few notable exceptions where states have said -- and let's not ignore the politics of this whole conversation, but there are some states that have said I'll just turn this into a jobs program. If my electric rates are going to go up, I'll build everything I need inside my state. I'm not going to send money off to a neighboring state that might be an option through a trading scheme.

So with that exception, my experience has been most people are looking for the best mousetrap they can and I think are willing to think about trading, but they need to understand it. They need to understand what it means financially. They need to understand this rate and mass business. And there's a lot of groping right now for basic information, and I think that's a huge problem right now.

MS. TIERNEY: I think the rule itself -- well, this may be a compliance panel question, but the rule itself can allow evolution toward trading, too, so that even if in the first instance there are some of these near-term things, I think there's going to be a lot of attractiveness that ends u moving people in that direction.

So who's next? Roy, I think you were next.

MR. MORGAN: None of us know how to keep nukes, though.

MS. TIERNEY: Yeah. Got a clean energy standard, we'll go back to that. Go ahead.

MR. THILLY: I do want just to comment. The nuclear issue seems to me huge. So Wisconsin coal generation, we're up by 25 percent. One plant was retired.

But the question I had is the practicality of relying on or including distant renewables in a state plan. When the Eastern Interconnect Planning exercise went through there was a low-carbon case more aggressive, I think, than the rule: Five DC lines from Kansas, Nebraska, Dakotas, Minnesota, into PJM, not into Massachusetts. Very hard to solve it. But how could a state rely in a plan on distant renewables when the construction of DC across multiple states would pose such a huge risk of not happening or not being timely?

MS. TIERNEY: Comments?

MR. LAUBY:: I think you've hit an important issue we were talking about as far as transmission goes and the mood of the nation, as well. You know, you think of the highway projects and how they were sold back in the '50s and people thought we were doing the right thing for the country because we're allowing this freeway to come through my back yard. People don't feel that way nowadays. So they think, well, it's good for the folks in one particular state and transmission, or DC line transports across multiple states who don't have any benefits from their perspective, but it's good for the nation, and, you know, folks are not going to necessarily get behind it.

So I think it's very difficult to rely on those kind of distant resources nowadays as opposed to perhaps it was in the '70s and '80s when we were building some of these DC lines for some distances.

MS. TIERNEY: Mary Ellen.

MS. PARAVALOS: I would just say, I mean, the biggest challenge there are the sighting and permitting aspects and the need to get a level of assurance there that would make relying on that option reasonable. And in terms of the construction aspect, I mean, that's not really the problem. It is really the sighting and the permitting and

needing to get assurances to be able to rely on that plan.

Once you had a level of assurance there, as relates to that, I think it could be quite reasonable to think that one could go ahead and kind of construct it in reasonable construction timelines with some assurances around resources and vendors and that sort of thing. But that seems to me far less the tricky part.

MS. TIERNEY: Erik.

MR. TAKEYESU: And there really is no mechanism for getting that assurance, is there? I mean, for Pennsylvania to get that assurance from Iowa and the intervening states.

MS. TIERNEY: Not with our Constitution. Erik?

MR. TAKEYESU: And I also think there is going to be a challenge with how to align integrated resource plans in each area around that same resource. So we have challenges associated with building new transmission, but also getting the power flow into the areas that you need it. And how does that compete against other forms of procurement? You know, so within each of the integrated resource plans there will also be very tangible procurement goals established. So I think that that's something that probably should be in the conversation.

MS. TIERNEY: I think there's an interesting set

of things that have to be solved about the fact that you -- right now our model for delivered resources that are pursuant to the portfolio standard, most regions require that if you're going to be using a REC from a distant plant, you actually have to have it delivered into your system to have it count toward you. That's true of most of these RTOs.

But I think this Clean Power Plan anticipates a bigger physical separation between the creation of a REC and the physical delivery of supply. And that you could, in theory, create that REC without the physical delivery of supply. And then that means it is being injected into the local area with operational side effects of that thing if you don't get long-distance transmission.

So I think that those are things where you're going to have a lot of invaders from people buying your RECs from somewhere else. That's actually going to have those spillover effects in your own operational system.

Yeah?

CHAIRMAN COWART: So I'm just going to alert you to the fact that we're running out of time.

MS. TIERNEY: Do we have five minutes?

CHAIRMAN COWART: Yes, we do. But I'm realizing that a lot of the conversation we're having here is similar to the conversation that we're going to have after the second

panel.

MS. TIERNEY: Yeah.

CHAIRMAN COWART: So if we don't get -- we won't get to everybody right now --

MS. TIERNEY: Perfect.

CHAIRMAN COWART: -- but we'll pick it up later.

MS. TIERNEY: That's perfect. So I think the next person is Phyllis. You may be the last person in this hour for this five-minute period.

MS. CURRIE: Okay. Well, then I'll take advantage of that to maybe turn the conversation a little bit to consumers.

You know, I've had experience having to be out selling the rate increases that fund all of these initiatives. And I just have a question for Mary Ellen.

Can you give any sense of what's been the public reaction to maybe the rate changes or cost impacts of the achievements that were shown in your slide? I mean, it's really dramatic in terms of the emission reductions. And has there been any noticeable, you know, reaction from consumers about what might be the change in their bills or have they even noticed it at all?

MS. PARAVALOS: I think for a time there the regions were really benefiting from competitive markets in

lower priced gas and the impacts because the commodity part is about 50 percent-ish of the retail bill with transmission about 10 and distribution about 40, you know, roughly. And so I think we were sort of seeing at least acceptable for the Northeast prices, you know, being higher than other parts of the country, things that folks are used to.

The last few years, the constraints in the natural gas pipeline infrastructure have been really driving up the wholesale energy prices and having sort of spillover impacts on how we procure resources and have been a big driver of 30, 40 percent kind of price impacts on winter rates for the retail customers. So I think that's sort of the biggest thing that folks have kind of been focusing on in the last few years.

I'm not sure that it's very transparent yet the costs associated with the kinds of renewable and clean energy transformation that we will be undergoing. Renewables are more costly than fossil fuel-generated megawatt. And so there are incremental costs associated with it. And as we kind of build that up, I think it will become a bigger issue in terms of explaining that to folks, getting the needed support.

I think just right now in the Northeast, particularly in New England, it's really these constraints

on the gas pipeline and near-term impacts that are sort of really showing up in people's bills and what the average person on the street would be noticing.

MS. TIERNEY: I want to amplify that with some insights that we got when we did a study of the regional greenhouse gas initiative some colleagues and I did. We looked at the first three years and we looked at the second three years. We knew that reality included a price on carbon. And so then what we did is we developed a counterfactual case where we modeled the system in those two three-year periods as if there had never been a price on carbon. So you had a different dispatch, nobody had to buy allowances, the allowances didn't show up in prices. And the tricky thing in the Northeast, in these nine states, is that the way they develop their auction really mattered in terms of the consumer impacts.

Generators have to buy the allowances. They get into the bid prices. But then the states take that money and then reinvest it in energy efficiency. So there's those long tail-end effects on that. And that actually led to lower prices and lower bills over time.

MS. CURRIE: That's not dissimilar from what California has done, particularly for the investor on utilities.

MS. TIERNEY: Yeah.

MS. CURRIE: I think one of the issues, and this may be something that DOE should think about, is a lot of times the customer cannot connect the dots. So even though, you know, the auction revenues are given back in a one-time credit on a bill, the customer will never know which end was on the donkey. So anyway, I just think it's something that we'll have to stay attuned to.

MS. TIERNEY: And that is a perfect segue into our break. Would you join me in thanking this terrific panel? (Applause) And, Rich, we have 10 minutes?

CHAIRMAN COWART: We're looking for a 10-minute break because we are on a fast track this morning. And the coffee's close at hand.

(Recess)

MR. COWART: Good morning, once again. I think others will filter back in. One thing that we customarily do at these meetings is pass around a signup sheet for those who would like to sign up to join the work of a working group or a subcommittee. This is especially relevant, because we have a number of new members on the EAC here today.

And so what we tend to do is pass the list around more than once, because we want to make sure that everybody has ample opportunity to volunteer for the work efforts of

the committee. So I'm going to start right here with this list. You'll see the different potential subcommittee and working group options available to you. Please sign up.

After it goes around, we'll probably get a chance to send it back around.

I'm standing in today as the moderator at this panel for Carl Zichella, who actually was the author of the idea for this panel, as I recall. And in that sense I want to apologize, because I may be the only person in this room who is not actually working on the Clean Power Plan in one way or another. As most of you know, I've been working in Europe for the past few years. And I find the analogies actually quite interesting.

In Europe and under the Clean Power Plan we have, of course, different options and different buildings blocks for implementing carbon reductions in the power sector. Europe has gone through a transformation of sorts where for quite some time the belief was that carbon pricing through the emissions trading system, would be the driver of all the change that was going to be needed to clean up not only the power sector, but industry in addition.

And then there became an awareness that, well, maybe it will in the future but not yet. And then there became a growing awareness that the policies that we call

building blocks, that in Europe are called complementary policies. And they're called complementary because it's still meant to preserve the notion that carbon cap and trade across Europe will be someday the principle driver of change. And that these other policies are complementary to it. They're now starting to be talked about as maybe parallel policies, or jointly functioning policies, or different ideas like that.

And the realization essentially is that to drive change in the power section in the scale and in the timeframe that we're trying to deal with, requires a lot more than just pricing carbon. And I would like to when we get a chance in the discussion, talk about the role of energy efficiency as a low cost compliance mechanism both in Europe and in the U.S.

We have with us today, a terrific panel. I think three of them have confessed that, like me, they are actually substituting for someone else. But, unlike me, they're actually incredibly well-qualified to do the substitution. And I will introduce them all at once and then let them each speak, and then we'll pick up the conversation where we were a few minutes ago.

It became obviously during the conversation that a lot of what we want to talk about is the same for both panels. First there is Kevin Culligan from the U.S. EPA, and he's the

Association Division Director and was the key architect of the Clean Power Plan. So that's an amazing accomplishment and it's great to have you here.

Phil Assmus is from the National Association of Clean Air Agencies, or NACAA. NACAA is the association of most of the states, and 116 metropolitan areas, and four territories that have the responsibility of implementing clean air improvements under the Clean Air Act. He's the primary NACAA staffer for matters related to global warming and agriculture. And his work recently is focusing on providing assistance to states and other jurisdictions about the implementation of the Clean Power Plan.

Vince Hellwig is one of those implementers who actually has to implement what we've been talking about. He's with the Michigan Agency for Energy, having previously served, and I'm guessing this is a different agency, as the Air Quality Division Chief for 12 years in the Michigan DEQ. So like Sue Tierney, an air and energy crossover. Has tons of experience in all areas of air quality implementation.

Fourth speaker is Ben Longstreth from the Natural Resources Defense Council, a senior attorney with NRDC with experience litigating climate and energy cases. He previously worked at NRDC's climate center and on the energy program.

So I'll just let them speak. I think in that order. Makes sense to me. And then we'll turn to Q&A.

MR. CULLIGAN: Great. Thank you very much for the start off the panel. I actually think you covered in a really broad way, most the concepts I'd like to get across. First, I just want to make sure that everyone definitely heard a key architect. There were many of us. It was and continues to be a very big team at EPA working on first developing this, and now working with folks as we move the implementation stage. I think at the moment Reid Harvey, myself, Janet McCabe and a team are all at separate stakeholder meetings pretty much simultaneously talking about components of the CPP. And that's a pretty typical day that there are groups of folks who are instrumental in making this happen, talking to a pretty wide range of stakeholders.

So in terms of thinking about the plan, there are three rules. There's a new source rule that we actually talked very little about. If any questions come up, I'm more than happy to answer. But I think the real focus is on the other two rules. And in particular, frankly, the Clean Power Plan.

So the Clean Power Plan, I think as we all know, it's really a three-step process. Step one is EPA putting forth and finalizing guidelines, which we've done. Step two

really puts the ball in the court of Vinson and people like him at the state level. Phil and all our partners through the NACAA states, through the ECOS states, through the APCA states, through NARUC, through NASEO really the energy organizations, the environmental organizations at the state offices who have to put these plans together.

And then the third part of the rule, which really moves on to, I think for many people in this room may be the most interesting part, the compliance down at the unit level. And it's important to remember as much work as EPA had to put into this, as much work as states will have to put into this over the next several years that is the ultimate end goal here is to put explicit requirements for the affected existing EGUs to reduce their greenhouse gas emissions.

The third rule, those two rules are final rules, the third rule a combination of a federal plan and a model rule. So to give states and sources, as they think about what they're doing, an idea of what EPA might do if a state ultimately decided not to submit a plan, or submitted an insufficient plan. We do have both the authority, and frankly the obligation, to at that point put a federal plan in place. I think though, equally important to focus on, in that rule is the model rule itself. We think that is a pretty helpful tool for states.

I think while there are some states looking at different options, many states I think are pretty focused on either a mass or rate-based trading option. The model rule sets out, and it's actually two model rules, one for each of those two options. We will be publishing all three of these notices, I think in late October, mid to late October, then the opportunity to comment on that federal plan and the model rule. And we're hopeful that that will be helpful for states as they look at developing their own plans.

In terms of timeline, I think most of you are pretty familiar with that. States are required to submit a plan as early as September of next year. But recognizing that it's likely to take more time than that, that there's work to do in working with a wide range of stakeholders. Not just the power sector, but the communities that are affected by this, NGOs, labor, a whole range of constituencies who have an interest in this. And that in many cases it's going to take state legislation. There is an opportunity for states to ask for up to a two-year extension, to get up to three years, September of 2018, to submit final plans.

At that point the baton is really finally passed to the sources. Many of whom, many companies I know that are already thinking about and actively starting things today. But really to start to think about compliance in that 2022

to 2030 timeframe.

So like I've said, four states, they've got a couple paths. Ultimately, I think the idea from our perspective is the paths that the states can take hopefully will give sources, many if not all of the same compliance obligations ultimately. So they can take a path where they put requirements directly on the affected EGUs. We call that the enforceable measures approach. They can do that either through a mass-based program, requiring basically a mass target that collectively the sources within the state must meet. And that can be done using trading.

They can do a rate-based approach, allowing crediting for things like RE and EE. But once again, ultimately the sources have responsibility.

We also, particularly at proposal, knew there were some states interested in sort of working with some of their existing programs, some of their fairly aggressive in many cases RE targets, or EE targets and not necessarily putting all their requirements directly on the sources. We had a lot of comment on that idea. We still think it's a good idea. But ultimately there has to be a backstop that requires the sources to achieve the reductions if those other plans don't.

So there's a state measures approach that states

can use that doesn't necessarily need to put all of the requirements directly on affected EGUs, can build off of EE and RE programs. But ultimately has to have a backstop, just in case those reductions don't ultimately happen purely through that plan.

So those are the main approaches that states can take. I think in sort of building off of the introduction, one of the kind of distinctions between the two approaches, under a mass-based approached, what the real focus of the 1-

Plan is ensuring that the omission reductions happen, and then also providing some price signal to do that.

But I think we think that any state that is going to take that approach, is likely to have on the energy side a number of whether you want to call them complementary policies, I think there was another word used that had them at a more equivalent level, which I think in many ways is appropriate, like EE and RE. And there can be interactions between those. Things like allowance set asides to provide financing, use of auctions to create revenue to provide plant financing. So there are ways to have interactions between those two that can be interesting and useful. But in many ways you can sort of separate them a little bit more than under the rate-based approach.

In the rate-based approached, since there's

direct crediting for sources for things like EE and RE, you end up with a little more integration between those two types of programs.

So those are the basic approaches that states can take when they're thinking about compliance. Then when you get to sources themselves, it's trite and often-said, there's no single silver bullet. There's a pretty wide range of options. And we're hearing about people taking many, if not all of them. Ranging from things you can do at the plan itself. We focused on a building block, one that was efficiency improvements. We know there are people out there doing some more unique things. Folks in North Dakota are doing coal drying of lignite reducing CO2 in the neighborhood of 4%. Folks in Nebraska are looking at coal production with hydrogen of carbon black, and then using hydrogen as a generation fuel. Folks in Texas adding CCS to a unit today. So there are any number of companies looking at less frequently used coal units, converting them to natural gas, so that they still have them around for reliability purposes.

So those are the types of things that a company could do at the unit itself. Then there are obviously alternative ways to generate electricity or reduce the need for electricity, your RE, your EE, which we also think is going to be a pretty big component. I would be remiss if not

noting that even though we removed building block four, the emergency efficiency component from the way we calculated the state and the individual unit goals, we still think it is a very viable way of getting the emission reductions.

And that stuff can include utility scale renewables. It could include distributed renewables. It could include energy efficiency residential level, energy efficiency at commercial industrial level. Anything that reduces that need for electricity. Things like transmission upgrades, too, reducing line loss and reducing electricity use in that way.

So that's kind of the range of things that I think if we're talking about compliance, we would ultimately hope that state plans would give flexibility to use. And with that, I'll pass it along to Phil.

MR. ASSMUS: Thank you, Kevin. I'm very glad I went after you, because that was a fantastic sort of general tee up of the general structure of the Clean Power Plan, the rough framework for how compliance works. And so I can sort of start us on a slightly deeper dive on what some of the compliance options actually look like.

What I want to talk about today is a technical recourse that NACAA has developed entitled, "Implementing EPA's Clean Power Plan, a Menu of Options." I get the next

slide, please?

Just a little bit of brief background to repeat some of the information that you heard in the introduction. We are a national association based just across the river in Washington. We represent air agencies in most states, 116 localities, in three territories and the District of Columbia.

In general our members are tasked with implementing the Air Pollution Controls issued under the Clean Air Act. And specifically our members are the folks that are going to be largely responsible for implementing the Clean Power Plan, and for actually writing the permits that will affect the power plant emissions.

So this is an issue that we've been thinking about for quite a while. If you go to the next slide. Thank you. As we've thought about this, we've sort of put some of the issues that states are struggling with into big bins. The first bin is to sort of think about what technologies and policies a state could rely on to actually meet their emissions reduction target. And then sort of separately from that, once you maybe have a sense of what you want to do, or you have a list of options that you're considering, how are you actually going to go about incorporating those things into an approvable state plan that EPA will look at,

sign off on, and that you will sort of administer into the future.

And the technical resource I'm going to talk about today is entirely related to the question of what. And so sort of reference, Kevin's comments, he talked a little bit about both things that you can do at a power plant and then also some sort of renewable energy, alternative energy, or energy efficiency sort of alternative generation options.

And, again, in my mind those sort of are all in the bucket of what. And the NACAA menu of options is designed to help answer that question.

So if we go to the next slide, please. The menu was published over two months ago in late May. We didn't write it ourselves, we hired the Regulatory Assistance Project to do it, and they did a fantastic job. The end result was 465 pages long, 26 chapters, and it captured everything that we could identify as an existing technology, policy, or program that could be used to reduce greenhouse gas emissions from the power sector.

For each of these chapters, we identified a common core of information. Including things like a basic description of the technology or policy. To the extent that we could find cost estimates, we provided those. We also pointed to examples where these technologies and policies

have been successfully deployed. We tried to quantify greenhouse gas reduction potentials. We identified co- benefits, which is air regulators is something really important for our members to keep in mind. And then we also included lots of footnotes, so that people could take an even deeper dive into these topics, if they're interested.

So to see the full sweep of the menus, let's go to the next slide. I've got a screenshot of the cover, and the Table of Contents, which I hope is somewhat legible up there. If not, I think my slides might be available. And more importantly, this entire document is easily accessible on our website online, and I've included a link at the end.

But roughly the first 10 chapters, I said there were 26 chapters, the first 10 cover technologies. The next 15 cover policies. And then the final, the 26th chapter, is sort of a catch-all for emerging technologies and polices that maybe aren't as well tested yet, but are sort of a bit more kind of cutting edge and under development.

And one of the key sort of takeaways that we found from the menu, is the extent to which state compliance options are not at all constrained by the building blocks. We began developing this menu well before even the proposed rule was release. We didn't know that building blocks existed at that point. We were just trying to build the best list of options

that we could find.

And in the end, what we found, was our list sort of both covered everything that EPA identified in their building blocks, but also a lot of other strategies that weren't included in the building blocks, but nonetheless remain compliance options for states. So if we go the next slide, maybe we won't spend too much time on these, but sort of here's sort of a list mapping some of our chapters to the three building blocks that appear in the final rule.

Building block one, which EPA calls heat rate improvements, we discuss in a chapter entitled, "Optimizing Power Plant Operations." EPA's building block two, which is generation shifting between coal fired and natural gas fired units, we don't have an exact analog for that, but in a sense we have a plan on retiring aging power plants, which talks about sort of reducing coal generation and accounting for that elsewhere. So that's a fairly decent analog.

And then for building block three, which is increased renewables, we have a chapter that discusses increased generation from low-emission resources. That is an early chapter, so I would say that's in the sort of technology driven part of the menu. But there's also a policy chapter that discusses renewable energy standards as well.

If you go to the next slide, please. Here we have some options that are outside of EPA's building blocks, but nonetheless remain viable compliance options for states, some of which Kevin mentioned. Just to sort of check off the list, we have improving coal quality, switching fuels at existing power plants, reducing losses in transmission and distribution systems, and so on. And then a couple of different chapters on combined heat and power, as well.

So that's a nice sort of a quick overview. I think a final word on my last slide, before I turn it over to Vince, to actually hear what a state is doing, instead of what someone in Washington, D.C. thinks about it, just I want to acknowledge, again, that our menu did come out more than two months before the final rule, which sort of begs the question, "What did you get wrong? What did you miss?" And I think actually it holds up quite well.

As Kevin indicated, though energy efficiency disappeared as a building block, so it disappeared as part of the stringency or goal calculation, that calculation was never meant as a prescriptive target for states to meet. It's an overall goal. States have a tremendous amount of flexibility to sort of work within a very broad framework to find a compliant pathway. And energy efficiencies measures are every bit as much a compliance option as they were with

the final rule.

In addition, we saw that the proposal had some good general language in the preamble that was very clear that the building blocks were not prescriptive, that there were lots of options outside of them. If your state is doing things that sort of makes inside the fence line type reductions, or outside the fence line type reductions including shifting to generation from non-affected sources, like renewable energy. Or reducing the demand for energy from affected sources, like energy efficiency, that those things should count. But there wasn't a particularly detailed discussion of these other strategies in the proposed rules; EPA changed that in the final. And so what I've given you here are a couple of places, if you're interested, where you can look to see where the preamble talks about how to credit strategies, and how states can benefit and get compliance credit for strategies that aren't included in the building blocks.

And, again, those include things like fuel switching, combined heat and power, carbon capture and sequestration or utilization, and even biomass co-firing. So with that, I will provide my contact information on the last slide. And at the bottom, as I said, a link where all of you can check out the menu of options, download it in its

entirety, or take any chapter that you're particularly interested in. Thank you.

MR. HELLWIG: Thanks, Phil. First, I think most people know, but on September 4th, our governor announced we will do a state plan. We do not have any intention of, at this point in time, fighting that issue. Our Attorney General, when you see cases of Michigan v. EPA, that's on behalf of the Attorney General who's independently elected in our state. And our governor's made it clear that that is not on the behalf of the state of Michigan. So I have to make that stated, and make it so it's clear.

Having said that, the governor came out with energy efficiency goals for our state before the proposal of Clean Power Plan, independently of that, of up to 30%. So this is a real initiative that he believes that we can accomplish a lot and move forward with.

What we're doing now, we're involved in -- and I'm talking all the organizations we're involved in, because that will give you some background as we go forward -- we are in the Midwest Power Sector Collaborative that was formed about three years ago. And that was formed in anticipation of 111(d). It is a broad stakeholder workgroup. We have utilities. We have utility regulators, environmental regulators, and NGOs. So, as you can imagine, this has led

to some very interesting dialog and discussions, because it's a very broad group.

We had recent consensus, made comments to EPA prior to the proposal and after the proposal. So it's been a very productive group, as we're concerned.

We're also a part of the Midcontinent State Environmental and Energy Regulators Group. And that group has been looking at this since the proposal. It was formed, and we had an open workshop June 4th in Detroit, and we had about 300 attendees and 400 people on the webcast. We're going to do another workshop on October 19th in Little Rock, Arkansas, and I think it'll also be webcast. It's an open forum.

And that's a series of panel discussions and the focus of those panels are just some of the things you're discussing here, how we can make this work, and what are the elements that can go into it. We hope that will be beneficial.

As I said, we do plan to develop a state plan. I can't give you any details what are plans are right now. We also have our legislature's debating new energy legislation, so there's some questions there, until that's complete. We are forming a stakeholder workgroup. And that will be announced, I think fairly shortly.

We do appreciate some of the changes from the proposal to the final. And one of those was the spreading out, or steps versus what I've termed before the cliff, in attaining this, to give us enough time to make a transition. And we were interested in making that transition. And our state had already started going from coal. We were at one point I think in 2008, 56% coal. We're now down to less than 50%. And the transition from a business standpoint, the utilities had already started going that way, and some of our municipals. So we're seeing that to continue.

We're seeing an increase of renewables. We have the lowest carbon intensity of any of our neighboring states already. We had a 2008 renewable portfolio standard. And we're just a little disappointed that we didn't get credit prior to 2012 and before, because more than half our renewables were already operating prior to that date. But we're seeing continued expansion of that. In fact, right now in our state that's -- although unfortunately it doesn't deliver electricity on peak days, it is the cheapest form of new generation in our state by quite a bit.

We also appreciate the safety values for emergency situations. We were very concerned about that, because we've had those situations in our state that did occur in the past. We're still a little concern, some situation

that has arisen in the past, that we could not plan for, we hope (inaudible) take care it, but in one case a plant received an SSR because of (older) stability, and that wasn't something the energy regulators were aware of. Because MISO controls dispatch, and they were a little concerned about the fact that we didn't see that coming. But hopefully when you're looking at three-year average, we can deal with that.

Our state is mostly MISO, but there's a portion that's in PJM. So we're a split state in that respect. And we do have generation capacity in the PJM portion, southwest Michigan. And that has also led to formation of another discussion group, which is PJM Discussion Group, and that's being led by our Public Service Commission Chairman, Quackenbush, and your Air Director here in Virginia, Mike Dowd, is co-chair. So they're leading that discussion.

The Midcontinent Group actually goes to the Canadian border, the Gulf, and obviously I think you already know what the PJM area is. So most of those states are at the table just having a discussion. It's no commitment on any of these, to say they're going to agree to anything, but it's more of an open discussion to see where we're going. And examining some modeling.

We have modeling ongoing under working with that bipartisan council on the MCU process I talked about. PJM

has some work they're doing with both BPC and the Nicholas Institute at Duke University. They're trying to do a little bit of modeling. We're one of the four states that received the NGA grant to look at this rule. And so they're doing some modeling for us to look at what would be appropriate in our state.

And then the state just picked a contractor, and we're going to do 12 scenarios. And we're going to look at rate. We're going to look at mass. We're going to look at options both dispatch and price in our state, economic dispatch. But in addition to that, we're going to evaluate what is the possibility in the future of trades. We really don't know right now whether we'll trade or not. We don't know whether there's going to be the opportunity to. In my own opinion it'll be a few years down the road before we even know that in our state, until we get through some of this evaluation and actually start making changes. So I don't know. We probably, I can't speak definitely, but we'll probably go trading ready in case that's an opportunity.

I did comment yesterday that I appreciate the fact that some of our neighboring states who have not made investments in renewable energy, which we have, our ratepayers have, if we can trade and we have some to sell them, we'd be glad to take their money. (Laughter) That's an

opportunity we're still looking for.

We do have some concerns over, because we had already talked about, before the rule came out, we were going to do outreach to some of our (EJ) areas, impacted communities, and rural communities that we have some high unemployment. The one concern there with the rule is, we don't really know what those are. And unfortunately when EPA says talk to your region, in our case those discussions in the past have not been fruitful, because they've not been able to delineate, I can go back several years, even Indian land, as it was described in the EPA rules, they've never been able to delineate boundaries except for 1 out of 11. So then we the EJ communities they say, "Well, we're doing outreach. We want to be inclusive. We don't want to miss anybody. Do we have a boundary we can draw that we're sure we're not missing?" And we don't get an answer. So I think we need some answers on that. So we do have concerns about that. We are trying to reach out. And we do plan to involve community organizations in that, and bring them in as partners. But, again, it's how we reach enough people and are we doing it right. So that is a concern we have.

So, as I said, I can't get too specific about what our plans are, because we're still in that process, but that's where we are right now.

MR. LONGSTRETH: Thank you, Ben. Thank you so much everyone who's preceded me and thank you all for giving me an opportunity to present. I'm delighted to share some of our thoughts, but mostly I'm excited to hear from all of you. I would have gladly just had that prior conversation continue. So I'm hoping we can get back to it quickly.

I'm going to focus primarily on the two mass-based options. But I thought I would just touch briefly on a few more general points initially. And the first one is just obvious, but these are our first national carbon population limits for the power sector. And that's a really big deal. It's a very significant precedent. It'll achieve significant reductions. It's vital for us to move forward internationally, so we're really tremendously appreciative of all the work that EPA and Kevin have done.

If I could have the first slide, please. I also want to point out, and this echoes a comment was made earlier, that the plan is not radical. This shows projected emissions under the plan. And the slope is fairly similar to the trajectory that we've been on due to other factors since 2005. It suggests to us that compliance really at this point should not be that difficult. And we're delighted that some of you all are raising the need to make that curve steeper in the future.

The second general point I wanted just to raise is the reduction in the disparities between targets between different states between the proposal and the final rule, which we think will help make some of the interstate compliance options more possible.

Next slide. So there're sort of two forms. And this just shows how EPA has in the final rule, and this is different from the proposal really adopted some nationally uniformed emission rate targets for steam and combined cycle natural gas plants. You can also see here in the squares the trajectory for both of those, which again we think is eminently doable. This is important for opening up more compliance options.

Next slide, please. This illustrates the blended rate. So when you put together the coal and gas within each state into a single rate, you can see that the band across the states, is much narrower on the right axis you have the range that existed in the proposal. So EPA's brought those together significantly. And, again, we think that should help facilitate interstate compliance options.

Next slide, please. Can I have the next slide, please? And the next one. Sorry, I was thinking I would have control here.

So there are two mass-based options, as most of

you all probably know. An existing only option, meaning that the only plants covered in the mass cap would be those built before 2012, in 2012 or earlier. The second option is pulling in new plants as well. And I wanted to just focus on these two options. We think there's very substantial benefits to including both new and existing plants together. And I'll talk about those, but we're very much interested in everyone here's thoughts on that question, and how we can persuade states to take that approach, if you all agree it's a more sensible one.

Next slide, please. And the next. So the first point here is just the benefit of an even playing field. As many of you all know better than I do really, allowance prices are considered a marginal cost in the wholesale power markets. So effective sources need to include these costs in their bids.

Under an existing only approach, new generators won't have to include those costs, and so their bids will be lower.

Next slide. This just illustrates that difference. And then next slide, please.

So this just the PJM generation supply curve which we think illustrates that small changes in costs could end up having big changes in dispatch order. Some of that

would be to the benefit of the environment and compliance. But these changes, some of it also could be distorting if some plants, but not all, are covered.

Next slide, please. So what are the market effects? An existing only mass target, that only covers existing plants, could end up leaving those plants with a significant competitive advantage over new plants even where we're talking about two natural gas plants, and that have the same or nearly identical emissions profiles. Our concern is that this could lead to unnecessary buildout of new plants, potentially also retirement of plants that otherwise could still run, and where there's not, again, a significant emissions differential between the two plants.

Next slide, please. So this just, most of you all know this, but this just illustrates the areas where this is an issue in terms of the market dynamics. And, as again, you all probably know better than I, the potential for (inaudible) in the west. Next slide. So I'm here from NRDC and obviously

We care primarily about the environmental benefits. And under the existing only mass plan, our concern is the risk to shift generation from existing plants to new not covered fossil plants, rather than taking the emission-reducing steps that are contemplated in the

guidance. And that shift could lead to higher total fossil emissions than you would have had under the rate-based plan.

EPA in the guidance, we think very properly includes leakage provisions in the guideline to avoid or compensate for leakage from existing to new plants. We think that's important for sure. But it's not that easy to do and we think it's better to just avoid the issue by including the new plants in the first place.

Next slide, please. These are just a couple of sort of strategic or plan design reasons why we think existing plus new is preferable. And Sue alluded to some of these earlier. That there are a lot more requirements under both the rate scenario and the mass-based existing only. The leakage one being one of those requirements.

And then the second point is just that EPA has, we believe, an obligation to update these standards periodically. It's an eight-year review period for new sources. And that when it does that new plants become old. So even if they were not initially covered, they will be covered eventually, and we think it makes much more sense to just cover them from the start.

So those are the points I wanted to cover. And I really look forward to hearing from all of you.

MR. COWART: Thank you all very much. As you

were here earlier, you'll see, there'll be a lot of interest in these topics from the committee members. I'd like to start you off with a couple of questions. One has to do with the what could be claimed, that this is the easy part of the trajectory to 2050. That when you look at what has to happen, looking at, Ben, your slide showing this is sort of gradual reduction to under the current CPP, compared with the really dramatic change out from fossil to non-fossil resources post 2030. Are we in danger of sort of deluding ourselves that we're solving this problem? So at EPA, you know, how do you all look at this?

MR. CULLIGAN: Well, I think we would acknowledge that this in and of itself is not going to solve the whole problem. It's an important first step. And frankly you can't take a second step until you take a first step. And the engineer in me thinks that we're going to learn an awful lot in this first step, and that's going to help policymakers think about things in the future. But right now our focus is on working with states, working with sources on that first step.

MR. COWART: Any other comments from the panel?

MR. LONGSTRETH: I mean I'll certainly just respond that we were hoping the first step would have gone further. I don't know if you look at our comments and such.

But I think I'll agree with Kevin that I think once we get started our view is that this will be achievable at really quite a modest cost. And particularly, if it continues a cost trajectory of some of the solutions that we need to be making, it'll become evident that we can go much further. And I think the evidence will continue to suggest we need to, but having taken that first step, the second can be bigger.

MR. COWART: Is there any good argument against trading, for complying on a plant-by-plant basis? What's the argument that is advanced by advocates who want to do compliance solely on a plant-by-plant basis, or solely within one state?

MR. LONGSTRETH: I'll offer, this isn't NRDC's view, but I think an argument that is offered is that there're states that because of steps they're already taking, are going to end up with an easy time meeting their target. If we have a lot of trading are we just kind of shifting what some view as sort of hot air in there. If they went to a mass base approach shifting that to other states that alleviates them from doing as much. And that we could have a stronger national outcome if each state had to do it on their own.

Just for the record, our view is that we really want to show that this works. In the long run trading will get us -- show that we can make significant reductions at

lower cost, and we'll get farther on that second step that way.

MR. COWART: And Vince you made the statement earlier about trading along those same lines I think.

MR. HELLWIG: Well, we're looking at trading. I mean we haven't decided rate or mass. I mean and part of that decision will probably be looking at the pool of other states that go rate or mass. I mean that's because that may constrict what's available to trade, if we can trade.

And frankly, as far as trading when we got to go, if we look back at the acid rain program, we look at NOC (CISCO), we look at (notch) reductions, it's been a very good working program. It's reduced emissions. And in our state it's reduced emissions a lot.

I do have to say one thing, we get blamed a lot for NOCs and transport to the east, but most of our -- in Michigan, and some of the other Midwestern states, we operate our controls more than the northeast, and Mid- Atlantic.

In fact, some Mid-Atlantic states they just buy credits, don't operate their controls. We put them in our permits they have to run them in the summer. So they're not given a choice.

But the trading has benefited them in that respect, that they sold them to the people in the east, sell

all the credits, when they did have to run and they had excess credits. So I'm very much in favor of trading.

MR. ASSMUS: So I'll just add, I think EPA made a number of improvements in the final rule to make trading easier. In the context of the proposal there was sort of a single, compact isn't quite the right word, but sort of a multistate formal negotiation process that had to happen to facilitate interstate trading. And one of the strong comments that came out of the review period, was that states wanted another option. And in the final rule that's called trade-ready.

And the basic idea is that a state can keep its own individual goal, and as long as it sort of stays within certain guidelines, at the end of its individual state-only planning process it'll have a trading opportunity. So whereas before one of the potential objections might have been this is too complex, we're concerned about preserving autonomy, states now have sort of a new option where they can make all their own decisions independently, and then have that trading future on the backend.

MR. COWART: One of the long-term challenges that we face, and what's often talked about in this committee, is the electrification of transportation and buildings (heat) that today are being sourced from fossil fuels. And

so that's then adding load to the power system, but reducing emissions outside the power system. Is there anything in this rule that we should know about that anticipates that, and helps to give credit for fuel switching to electricity?

MR. HELLWIG: I'm going to address in one respect in our state, and that's revised building codes, when you say demand. But the buildings built today, meeting your codes are much more efficient. And part of those building codes are going go back to when buildings are remodeled. I think from that respect you look at commercial buildings, it's going go down. Residential, I think the same thing will happen. The demand will be reduced for that individual unit.

One of the things, we as a state that builds electric cars, would like to see more electric cars sold. I don't know how that's going to impact the grid.

But I think overall efficiency we're seeing, I don't see that as a problem. In our state the only area we have electricity growth is the northern part of the state, because residents in rural areas putting in air- conditioning, because they can afford it, and they couldn't years ago. But the rest of the state we're not seeing a big growth in demand even coming back with our industrial customers.

MR. CULLIGAN: Right. Well I mean there are a

couple paths that a state can take. A rate-based path, obviously this issue doesn't come up. In many ways the more opportunity to generate lower cost electricity, a lower emission emitting electricity, renewables, etcetera, makes it easier to meet your target rather than harder with more growth in some ways.

In a mass-based approached states have really three options. They can just include their existing sources and have other provisions to deal with, I think I prefer to call it equivalency, demonstrating the mass's equivalence to the rate-based approach, than leakage, but that concept.

They can use the mass, with the new source compliments that we finalized. Or, frankly, they could come in a make a demonstration along the lines of what you're saying in saying that the mass that we finalize with the new source complements is not appropriate because we didn't accurately factor this in, and here are their projections. And this is why that number should be different.

So we think there are a number of different paths a state could take, if this was something they were focused upon. I would also note that, you know, Vince kind of pointed out as you move in that direction you do tend to make buildings more efficient. So while you might electrify more, you still ultimately are probably using less energy. So it may not be

as big growth as people think.

You know obviously there's energy storage opportunities in vehicles that can make more renewable integration possible. So there's a lot of positive synergies, too, that can potentially make it easier, or at least opportunities to integrates things that the only focus isn't that there's more electric growth, but there's opportunities to do it in a smarter way.

MR. LONGSTRETH: I just want to echo, we concur that we don't think an issue in the rate based, and that for the mass based, as Kevin indicated, there is an opportunity to come in and say the projection you used only included this small electrical vehicle program, where we intend to do a lot.

Our strong view, and we hope EPA will concur in this, is that if a state wants to do that they need to have a contingency that would release those extra tons only if they actually come through with the electric vehicles. And it would be a very easy thing to track sales in a state and figure out the size of that. And then you could have a reserve essentially and those would be released as the vehicles arrive. You can't just say, "We went to do this." Not do it. And keep the tons.

MR. COWART: Okay. Questions from the committee members? Marilyn?

MS. BROWN: Thanks very much. Good talks. And I wanted to congratulate NACAA for its excellent report. I've been through it. And, Ben, thank you very much for teeing up the concept of the logic for promoting the use of mass with existing plus new. That's a great discussion.

I have done some modeling myself using MIMS. There are many models that other use, such as the IPM model, which was used in the regulatory impact analysis. There are now even desktop models being developed by every, I think I would suggest possibly most every state, air, regs analysis teams. And I'm really worried about the quality of the analytics going on. And sort of underscored by the fact that what we've seen to date has shown tremendous variation and consistency and conclusions from modeling, at least the proposed regs and now moving to the final regs.

So, for example, I've seen a great variation in the uptake of energy efficiency as a compliance mechanism in models. My modeling builds it out very rapidly because I helped MIMS along in better articulating some of the available options there. But other models just use a price elasticity of demand and hope to pick up efficiency with that sort of a modeling approach.

If you have more efficiency you don't build out the NGCC so much. You can in fact tamp down the growth of

natural gas with efficiency and renewable. So there really are some big implications. We may find that a big buildout of natural gas is sort of phase one of our response of the electricity sector to carbon reductions. Is that going to lead to some regrets if we in fact go rapidly in that direction?

We found a tipping point for solar between $10 and $20 a ton carbon, which you possibly won't reach in phase one. But in phase two you would. And, so again, very different conclusions from that.

We concluded that rate based was actually less costly incremental compliance. Costs were lower with a rate-based metric than a mass-based metric. The regulatory impact analysis concluded mass was cheaper. I was disappointed, because the atmosphere response to mass doesn't respond to our analytics regarding rates. But anyway, I was pleased that our analysis showed a significant reduction in electricity costs over time as you build out so much efficiency. Very different from the conclusion of other models, which see a rate and bill impact which significantly harms consumers.

So many, many dimensions along which there's tremendous disagreement. And it is fueled by the differences in the modeling approaches used.

So I have two questions. One is should we quickly tee up something analogous to the Stanford Energy Modeling Forum, and put all these models onto an even, test them against similar assumptions and see how they perform? And then undertake an investigation to explain differences? I don't know if we have time for that. But it sure would have been good if we had that in hand right now.

And then I had a specific question for Kevin, the 2012 to 2020, or 2022 period, is not going to be good for energy efficiency or for some renewables, because you can't count some of them, those investments. I've already heard utilities say to me, including my very own that I try to regulate, say, "It doesn't count what we do in energy efficiency now. Only the early action period, and that's only for energy efficiency for low-income household, or low- income communities." So a very specific question about what do you say when you hear that comment from states across the country that you've created some form of disincentive? Why not wait, hold back, and invest later when you'll get credit for it? Thank you.

MR. CULLIGAN: So on the second question, one thing that is important to remember is that while you don't necessarily get credit for reductions from actions taken today, if the actions are taken today and they're still making

reductions. So if there're energy efficiency measures that are still generating energy savings, if they're renewable projects that are still generating electricity, then in 2022 you do in fact get credit for them explicitly under for ERCs under a rate-based program. Implicitly with lower mass under a mass-based program.

And I think for renewables that that argument is a little easier, because they do tend to have a pretty long life. One of the concerns I think we've heard the most is EE projects that might have a ten-year life, if you do it today. Then you won't get as much credit if you did it in 2022, when the ten-year life would go all the way out to 2032.

I think two of the things to remember, one, the energy efficiency project that you would do today and the one you would do in 2022 are probably not actually the same. Technologies are improving. So when you have a program that has someone install something energy efficient today, they'd probably install something different in the future. And frankly, on an on-going basis, if you had a program in place you would probably take advantage of those opportunities once again in the future in 2027, 2028 timeframe. And, in fact, there are good arguments for energy efficiency independent of the CPP. There are many people doing it today because it saves money.

In an uncertain environment when you don't necessary have as much clarity over what the best investment decisions in terms of new generation are, keeping demand growth low through energy efficiency could be a fairly appealing way to go. You're not making a large, long-term investment in a generation resources that may or may not be the best choice. So I think there's real value in energy efficiency and you can get value for your renewables 2022 and beyond.

I think that people should really look through the economics and not -- I mean in some ways I feel like people are potentially overvaluing the credit they get under the CPP and undervaluing the potential short-term benefits of doing the projects anyway. That's probably a pretty project specific evaluation. But I do feel like there may be some undervaluing of that part of the equation.

In terms of the modeling, I think there are two real components. And you acknowledged both of them. One is modeling performance itself. And while it hasn't actually been done for all of the CPP proposals or requirements, the Stanford Energy Modeling Forum has looked at models for climate type assumptions for a number of years. I haven't actually been in charge of the EPA modeling for a while, so I'm not as up to date. But I know they in the past done energy

efficiency. They've looked at many of the components that would go into it. So I think that is at least somewhat helpful in terms of validation of the models against each other.

I think in many ways the bigger question really does come down to assumptions. And I think I really like the way you talked about it. I think it does everyone a disserve when people talk about modeling just in terms of results. I mean all modeling is a tool to help us understand what results might be under a different set of assumptions. Frankly, the more sets of assumptions you can look at the more people are talking about the going in assumptions, frankly that's where in many ways the most useful discussion is. Is what assumptions you're making.

Obviously the results matter, but if you can narrow that band, or looking at a fairly robust band. I think with a fairly robust band you tend to see similar conclusions over the sort of same range of assumptions.

MR. COWART: Marilyn, I have to respond to your efficiency question. I think Kevin said it correctly, but the idea that given all of the benefits of cost-effective energy efficiency deployment tomorrow, the idea that because there's an additional benefit that will be available a decade from now, that because of that additional benefit we're going

to delay getting all the other benefits tomorrow, it seems to me to be an argument that we got to resist fairly overtly.

MS. BROWN: It's out there though.

MR. COWART: That suggests that EPA would do better to take the future credit off the table and not even make it available. If that's the behavior that it stimulates.

Let's keep going, Merwin, I think you were next.

MR. BROWN: Merwin Brown. This question may have been more in the purview of the prior panel, but I want to get as many opinions as possible on this one. With my 45 years in this industry, I've seen utilities, I'll use the term loosely utilities to mean the people who build and are responsible for the electric grid, take on different posturing positions.

In some cases they overstate the problems they face and they're accused of crying wolf. And really they weren't as bad as they said they were. And there may be various reasons for that, bad assumptions, or they just don't want to have to pay and go through the problems of complying.

But I've also seen cases where the other occurs where they understate the problem that they're facing. And, again, there may be various reasons for that, bad assumptions are they don't want to deal with the political and other

issues that come up. So why this is kind of important is in order to develop a technology research program, you got to have a pretty good indication of what the real problems are going to be that will require technical solutions.

So my question to you, in your opinion, in this example is this particular industry overstating, or understating, or maybe getting it fairly accurate of what will be the problem in complying and implementing the Clean Air Program here?

MR. HELLWIG: I'm going to try and respond, because I've been in a lot of regional discussion. And I think it's not a one answer. I think it depends on the utility. It depends on the region of the country. In our case we had a constrained area, northern Michigan, our peninsula, so we face those issues. We had blackouts when one unit went out.

It's not a simple answer. And I hear in other states, I think it's more a regional issue. And I'm not saying MISO, I mean pockets within MISO are able to get MISO, or pockets within others. Some cases, yeah, I think there're challenges, transmission constraints in our case. There're generating constraints in the UP, which we hope we've solved.

But listening to other states, too, I think that it depends on where you and what the particular issue is. I

don't think there's one answer that, at least from what I've heard, there's no one simple answer for everybody. It's not that it's all good or all bad. It's going to work. It's not going to work. I think you have to look at different areas.

MR. COWART: Another other comments?

MR. LONGSTRETH: I was just going to echo a point that was made earlier about, so under the guideline as I understand it, there is trading, and then there are investments in renewable projects. And the guidelines seems very clear, that those can be with the transmission or without the transmission into the particular area.

To my view, I think a tremendous number of these problems disappear with robust trading for sure. But even without that, I think the ability to access for compliance purposes renewables elsewhere, even if the transmission wasn't there, at least as a kind of short-term fix also does a lot to alleviate particular problems.

In the long run I think we show we have a huge amount of technological work to do. But I don't -- we don't think so in the near term.

MR. CULLIGAN: I mean I think Vince's point is really spot-on. I think it's almost impossible to sort of make a generalization. There are companies that have been moving away from coal for a number of years. They probably

have a higher comfort level with doing more of it. There are companies who haven't been. There's companies who've been more invested, their states have been more invested in renewables. They tend to, I think, see opportunities to solve challenges related to growing renewable integration more. They're places that have done more energy efficiency. And I think a lot of it is historically what have you been doing, and what is your comfort level with doing these things.

And it's not just perception. It's how you perceive the challenge, but it's also frankly the in-house company, and/or state resources to respond to that. If you've been doing energy efficiency, you've been doing renewables, at the company and state level you have people who understand them. If you haven't, you don't. And it's not so easy as just saying, "Well the other states did it, you can do it." You've got to grow those resources, so it does make the challenge a little bit bigger for states or companies that haven't gone down that path.

MR. COWART: Janice?

MS. LIN: Thanks. Janice Lin. I had a question actually for this panel, as well as the previous one. And then some suggestions. But my question is how have you all been thinking about incorporating energy storage as an enabling technology to achieve either the rate-based or

mass-based targets? I know electric vehicles were mentioned briefly, but I'd be curious how you think about the world of storage, not just EVs, but also stationary large and small?

MR. HELLWIG: And I'm going to be prospective, even when you talk utilities, we have utilities where they're (developing renewables) and hoping that storage technology will improve. That would help a lot. It would take off some of the peak issues.

We have a very large pump storage in our state. And it's actually owned by the two major utilities. But they're doing an upgrade it's going to increase more than 400 megawatts. But there no anticipation they'll ever be able to build another pump storage like that. That's not going to happen, I mean just for other reasons.

But other energy technology we hope will progress. Because I think they're hoping, and but, again, we don't know. I know there are energy storage options available. They're looking at that. And you can certainly do it on a building scale. I am not sure our utilities have been looking at it on a large scale at this point, because of costs.

MR. CULLIGAN: And I think this is one of the areas where there's a reason that we're not just working with NACAA and APCA and ECOS. We're working with NARUC. We're

working with NASEO because these are not just environmental issues, they're energy issues. While it's clear integration of energy storage can help with integration of renewables. It's the greater use of renewables that then reduces the emissions. How do you factor that into a credit in ERC type program? And in many ways that's a business model that sort of needs to be developed. How do you factor it into, I think one of the challenges you probably all are thinking about, is how do you factor it into how do you return economic value to the people who are doing it? And that's frankly as much an energy issue, if not more an energy issue. Even though a lot of the benefit is on the climate and environmental side. It's something really more of an energy issue to think about that how do you make the finance -- it's not just how do you lower the cost, but how do you really make the financing attractive even if the costs are attractive?

MR. LONGSTRETH: I'll just note quickly, I don't have any solutions, but it's certainly important and actually on the question of grid-enabled water heaters, we've worked very closely with our hosts, NRECA very well there, trying to make sure that those are still available in light of some complications from some new DOE efficiency standards.

MS. LIN: May I offer some --

MR. COWART: Yeah. Please follow up.

MR. LIN: -- suggestions. So I thank you for that. I'd like to suggest that there is definitely a role for energy storage. And to challenge some of the prevailing assumptions that it's still emerging, too, it's not cost- effective. I would argue it can be cost competitive. And to encourage the DOE and maybe the menu to include storage. Not so much as a technology on its own, but specific examples for how it can be used.

And I'll give you three (examples). One is using storage in combination with distribution interconnected, or customer-sided renewables, as a means to integrate more renewables and perhaps avoid costly and risky transmission investments.

Secondly, storage can be implemented with new gas plants. In fact, in California we just recently had an application for a new peaker that was applied for at our commission in conjunction with storage, to help improve its efficiency and operational dispatch. So that may have a positive benefit on both those metrics.

And, finally, it can be used as a transmission asset to support and relieve transmission congestion.

On the cost-effectiveness, at least cost competiveness, we heard a lot yesterday from particularly Southern California Edison that's purchasing a lot of storage

in the hundreds of megawatts. I think Chris's company here has several hundreds of megawatts under development all over the world. And it seems to me what's missing are two things. One is probably more information, collectively and nationally, about how storage is being used, the cost competitiveness of it, and even more importantly modeling tools to more accurately estimate and calculate the system benefits, especially the system-wide GHG benefits. If you take volatility out of the system then all your existing fossil plants don't need to cycle as much. And analyze what those tradeoffs are between distribution investments versus transmission investments in achieving these goals. Thanks.

MR. COWART: Chris, you're next.

MR. SHELTON: Yeah, I think what to echo Janice's comments, but maybe make them a little more concrete with some examples. Because I feel like we suffer from -- there's a mismatch between reality and expectations. And it's probably there's more storage today than people realize. And I don't think we fully absorb what's actually going on in the market already, and has been for years. And we put it into the future as this conceptual possibility, so we don't spend the time really thinking about the implications of storage.

So, today, as Janice said, we have a 32 megawatt

storage facility in West Virginia. We have a 20 megawatt facility in Ohio. These have been operating for years. We have a 10 megawatt project being constructed in Maryland. We have a 20 megawatt project being constructed in Indiana. We have a 100 megawatt facility that we will be building in California. And those are all kind of real projects that we've already talked about and announced. I'm mentioning them because they're real. These things aren't in the future. There could be more in the future, by a lot of other companies, and those are just the ones that our company is doing.

So this isn't a possibility. And we don't need the costs to come down for it to exist in the universe. It's here now. So with that backdrop, how would that be considered in the Clean Power Plan? Because what I've heard from folks, I'm not an expert in it. I haven't reviewed it in detail. But since the panel's here, I wanted to get a view that if the unicorn existed and it was present in an electric system, how would it be treated, in your view, under the programs that are being anticipated at the state level?

And maybe put it in terms of mass and rate, because it's clear that a rationally dispatched storage system, like the pump (hydro) mentioned, would reduce the heat rate of that electricity system if it's rationally

dispatched. And it would also reduce the mass coming out of that system, as a system. So what are your views on how that might be considered? Because the industry is struggling right now with a lot of people saying storage is excluded as a measure.

MR. CULLIGAN: I think the challenge in thinking about this, and I think you identified it well, is the difference between mass and rate. So in a mass-based system, I think one of, in my mind, the virtues of a mass- based system is we really are solely focused on the environmental outcome. What is the mass that comes out? And all of the energy police stuff, is somewhat siloed away from that. You don't have to do direct crediting. Like I said, you can use things like allowance set asides to provide incentives for things. You could use auctions and provide incentives for things. But you're going to have a price signal that says you're better off operating a lower emitting unit than a higher emitting unit. And I think that sends exactly the price signal you want that helps to provide, as long as the energy system has the payment and options to provide value to the energy storage, the environmental costs of higher emitting, I think should just reinforce that.

The rate based I think is probably where you're hearing the, "we don't credit it." And I think this once

again comes back to business arrangements, or someone thinking about this from a financial standpoint more necessarily than a crediting standpoint. I mean if what you're doing with energy storage is enabling more renewables, in the sort of most traditional way we've been thinking about rate, you get credit for the renewables.

Well, someone doing that project might find some economic path forward, some business opportunities to partner with that energy storage provider, so that they both share in the value of those credits, because the credits couldn't have been generated without the combination of both things. And that doesn't necessarily need to be in a state rule. It doesn't need to be in an EPA guidance. It can be a business arrangement that goes on in how the value of the credits, once they've been given out, are u sed.

But I think it's worth thinking about whether there are ways to explicitly value that on the crediting side. But I think that's the challenge is most the ways we see energy storage working, renewables, peak shedding with higher emitting units not having to operate, operating at a lower heat rate, that means less from the emitting unit. How exactly do you credit that to energy storage explicitly in CPP world, I think is a little bit more complicated. But it's not to say there's not value and people could figure out value

propositions for it.

MR. HELLWIG: In our comments on the proposal, we pointed out that we thought energy storage when it's combined with renewable should be credited. Specifically our pump storage is a backup to renewables predominately.

MR. SHELTON: I mean a lot of people have mentioned renewables, but I'm not sure why when storage can be implemented at a system level and provide system-wide emissions benefits, why do we keep tying it back to renewables? It seems to me to be a little bit of a red herring. Like why is our renewables the key? Or why do storage and renewables have to be combined, for storage to reduce emissions? It's very clear that if you charge it at an off peak heat rate and you discharge it at a peak heat rate, we're done. We don't need renewables in the equation.

MR. HELLWIG: I won't disagree with you. I mean it comes down to, and I'm not an expert, but the utilities tell us that they're just looking at the cost of installation. And the fact that they don't see any way to offset some of those costs right now. That's what it comes down to.

And obviously if you run a unit at maximize capacity, it's most efficient, and you store that electricity and use it at a peak period when you're not using some other source, I agree with. I don't think it should be just

renewables. But, again, that's what the rule says, so.

It's not that it's a disincentive, I think it's just not enough of an incentive right now, at least in our state.

MR. SHELTON: What I'm concerned is all these words end up getting used to make state level plans that are missing a lot of other potential benefit.

MR. HELLWIG: And it's something we've discussed, the utilities, but again to a certain extent we have to rely on them on this.

MR. CULLIGAN: Right. And I still think it comes back to either coming up with a police mechanism, and frankly I think EPA has been clear. If a state wants to come in and offer a crediting methodology and they can demonstrate that those credits are being given for something that is reducing omissions from existing sources. We're open to it. So if someone has a specific path forward to credit them, I think there's a path to do that. But even the example of improving the heat rates in essence what you're doing, is you're reducing the direct rate for the affected source. How does that then get credited to the storage? I mean in many ways, and this might not be the only way to do it, the business arrangement or the value proposition there seems to be the utility saying, "Well, instead of doing a direct heat rate

improvement, I'm going to do energy storage that's going to improve my heat rate. And my heat rate will be lower and my rate will be lower, and I'll get credit that way." There's not a direct crediting of the energy storage per se, but there's a way that you get credit for it.

MR. SHELTON: Integrated state you could do that, in a market-based stated it would be too many boundaries, right? I think it would be a lot harder to do that.

MR. LONGSTRETH: But isn't one of the challenges, if you directly credit the storage, there's a risk that you're double counting, right? Because the generator also emitted less. So they're going to need fewer credits for their actual emissions. And then if we're also providing one to the storage.

MR. SHELTON: Right. One generator would emit more, the other would emit less. But the delta would be a net reduction.

MR. CULLIGAN: Right. And I guess that's why I go back to in a mass-based system, there is no crediting. There's no crediting of what it is that reduce that source, reduced the emissions. There's a cost to emitting CO2. The cost to emitting CO2 means it's more expensive to run a higher emitting unit, less expensive to run a lower emitting unit.

So there should be value on the system to energy storage. And that should provide an opportunity in the energy world to provide a cost incentive to do storage. Or, frankly, you could allowances, if you wanted to as credits. You could use auction revenue.

In the ERC world, I want to make it clear I'm not saying that it can't be done. All I'm saying we didn't figure out a way to do it. But that doesn't mean that a state couldn't come in with an ERC methodology that as long as they're demonstrating that they're not double counting. If their rate in a unit is going down, and it's going down because of the energy storage, you can't credit both those things simultaneously because that is double counting. I think it's just a sharing of the credit and who gets the credit. But the state has an option to sort of figure out ways to do that, if they want.

MR. COWART: Let's move down the line. Anjan?

MR. BOSE: I was trying to get my head around what I heard in the first panel. And what I heard in the second. In my mind, electricity flows along certain paths. And greenhouse gases seem to flow along other paths. And as Sue pointed out policies are made by the federal government and the state governments and how do we make decisions in this kind of an environment? The question I was going to ask is,

would it make a lot more sense for the states to group together in the same footprint as say MISO, and use the same models and decision making tools to kind of make these plans for the future?

SPEAKER: (Off mic) -- give you a short answer (on that one)

MR. HELLWIG: I guess the short answer is politics. We're having those regional discussions. We are somewhat limited and constrained by state laws, state legislatures, and governance. So we're examining that. But to say that we could come to one group agreement, and I'm not sure that that's ever gonna happen when you're looking at all those states in there. And that's really what it comes down to.

And part of that was actually -- an interesting one of the groups I was in, part of that's actually driven by the goals. Because that means that some states are looking at rate based and other states are looking at mass to meet their goals in their states. And because of their generation mix.

So these are leading some very interesting discussions, but so far there has not been consensus. I'll put it that way.

MR. COWART: Janice, I have this idea that you

wanted to make just one little point about storage, is that? So I'm coming back to you to give you that shot.

MS. LIN: Thank you. My point was I think getting to how you count or credit storage, I think the first step is to have the right tools so we can even measure and quantify the impact. And that really hasn't been done. We've started doing that a little bit in California in looking through our long term (picture) and planning process what the unit starts and avoided curtailment, for example, would be with and without storage.

And we were lucky, because our planners had baked in the 1.325 gigawatt procurement goal into our 40% RPS plan. And the results were profound. And driven primarily, and this is just storage stuck in there, not necessarily tied to any renewable project, but even the 1.3 gigawatt target under our 40% RPS scenario reduced fossil unit starts 8,000 per year, which had a huge GHG impact. It reduced renewable curtailment a lot at that level.

So I just want to come back to my recommendation. I think it's a great opportunity for DOE to work with EPA and a lot of these other, and regulatory assistance project, and NASEO, and NARUC to create the tools so that everybody can do that modeling and value it, and put it into the mass plan.

MR. COWART: All right. Thanks. Sue, I think

you have a question and also you're gonna lead a discussion, yeah, that's right.

MS. TIEREY: I think this is a comment, but you might consider it a question and see if you have any reactions. But it seems to me that for states that want to do trading, especially in mass-based program, there are maybe two sets of lenses that a state might want to look at. One of them is to actually put in place the trading regime. And think about the RGGI states as a exemplars of what I'm describing.

They have a trading regime and it's centralized in that particular case. But each one of those states has other policies, like energy efficiency, renewables, maybe storage requirements, I mean you name it they've got a different police. And the effect of those other things, they're not embedded in the plan for trading. They are setting the conditions in the marketplace in which trading will happen. And in a large part they are reducing the cost of allowances in the trading program.

And so as I think about a guidance to states, I think their task is simpler if they're interested in trading, about not thinking about how they want to put credit into that trading regime itself, and to make it have all the bells and whistles, but they might have other mechanism for valuing the

other things. In the northeast a lot of people talk about if you do X, like there's a new power plant and it's gonna reduce emissions for operating. Well it's actually probably not gonna reduce emissions. It might actually effect the cost, but the cap is gonna be the same.

And so I'm just thinking, I'm curious to know whether or not the discussions in the Midwest and including in Michigan are thinking about these with almost two headsets on, the Clean Power Plan, things that you want to put into that. And then you might not even mention the fact that you have energy efficiency or renewables, because those don't necessarily have to intersect.

MR. HELLWIG: Yeah. I'll just start with the fact that trading rate was a concept that came out of Midwestern discussions for the very reasons you mentioned away from not having set agreements, or trying to develop agreements among states. And I know RGGI's reached out to the Midwestern states. As I said yesterday at a meeting, RGGI's the four- letter word I dare not speak in my state.

MS. TIERNEY: We know that.

MR. HELLWIG: It's just it's a death nail. I'm not saying it doesn't work, I'm just saying that's what it is. And interesting enough, too, I've heard some RGGI states saying they don't want to trade outside of RGGI, because that

might reduce the amount of revenue they're getting. So that would never fly in my state either.

But yeah we don't know whether trade is gonna be practical because we've got to solve the problem. If it is, I think we'd probably go trading-ready as EPA's offered in their rule, so that it would be an open market. Whether that be mass, or rate, or whatever we end up with.

MR. COWART: Before I turn it over to you, I want to echo what Sue just said about the success of the RGGI model actually being dependent upon the success that the states had in implementing efficiency and renewables policies outside of the trading regime. And you sometimes get into these arguments, and I have been in these arguments with the European Commission recently, there are those who actually oppose efficiency standards in Europe on the grounds that if we implemented all this efficiency, the carbon price would be lower.

And this argument is actually made with straight faces by people who believe that really high carbon prices are the only way to drive change in society. And I just want to alert people to the fact that I think in the U.S. We're doing a much better job of advancing the so-called complementary policies to allows us to reduce emissions at a much lower cost than would be the case if we were relying

on the hammer of a high carbon price as our only tool.

And the EPA deserve credit actually and the entire process that you've gone through to recognize and build on that reality.

MR. CULLIGAN: And I would want to sort of amplify what Sue said. I think maybe, and she might have made this very clearly, and I maybe don't need to repeat it. But that under a mass-based approach one of the virtues of it is you don't have to show EPA how you're going to meet the mass. You have a regulatory requirements to meet the mass. It is now federal enforceable. We have assurance that that mass is going to be met. We've seen programs work before. And how you have all sorts of flexibility to change the energy policies that underlie that if there's changes in technologies you want to take advantage of, or whatever happens. And they don't require a planned review.

Whereas the state measures approach potentially the ERC approach, where you might want to then create new ERCs, because it was something you weren't valuing that you now want to value. It's more challenging to, I think, be nimble as the world changes, and let those changes happen sort of in the energy arena, and not get into the emissions arena as much. And I think there's real value to that.

MS. TIERNEY: You said that way better.

MR. COWART: Please, join me thanking the panel. (Applause) We appreciate it. And I know you all are incredibly busy giving presentations much like this in a lot of different venues, so we appreciate your coming to the committee.

Sue, you will take it from here.

MS. TIERNEY: I think we have about 15 minutes on the agenda to have the committee members weigh in on their ideas to share with the new working group on the Clean Power Plan. So, again, this is my first meeting. I'm not sure what's happened before. Here's what I understand. I understand that Carl and others have put their hands up about forming a working group. Thanks guys, very much. And that they would like this working group to focus on things that are really helpful to DOE at this point in terms of weighing in on advice.

I understand that Carl is the leader of that group, is that right? I'm looking at Rich.

MR. COWART: That can be changed. But at the moment that's the case.

MS. TIERNEY: Okay. That can be changed. Well, and he's on a surgery recovery bed. We can do whatever we want while he's over there, you know. I know the sign-up

list has been circulated. If you've let it go by without putting your name on and now you'd really like to be a member of this group, please make sure that you do sign up. It won't be your last day, you can do that.

I think at that least based on the preliminary perspective leading up to this meeting today there were at least two topics that the working group sponsors had come up with that would be of usefulness to DOE. And one of them was this issue of interaction of the system planning and operations and visualization, and a variety of other things. Maybe even institutional issues related to the Clean Power Plan and how it interacts with the electric system.

The other topic being things that DOE might do to provide either technical assistance of analytics about compliance options and their costs, their feasibility, a variety of other things. Those obviously need to be refined, if indeed they are to be part of the scope of the working group. You might have other ideas about buckets of things that the group might want to weigh in on.

I think I have a question that might be useful to ask Pat and Dave and Matt and anybody else from DOE, and these questions would be when we think about the scope, and we think about the timeliness of getting you information, what kinds of things would it be most important to give you

feedback on sooner rather than later, in light of the cycle of things in the Clean Power Plan? Another question to DOE might be how much do we advise the Office of Electricity versus other parts of DOE? EPSA is doing their analysis energy efficiency renewables. And I don't really know today where technical assistance stems from. And there might be some work that could be supported at labs that would come out of OE's budget versus somebody else's budget, so I don't know about that part.

So with that let me ask you all what our new topics to add in there. Patricia might want to mention some ideas about things that would be more useful sooner. Go.

MS. CALLAGHAN: So my name's Caitlin Callaghan and I'm the person in OE who's been doing all things Clean Power Plan for the last almost two years now.

MS. TIERNEY: Hi, Caitlin, thank you.

MS. CALLAGHAN: Hi. So I just wanted to raise a few things that might help kind of scope this conversation. The Department does have a lot of different technical assistance opportunities that it provides through a variety of different programs, OE being one of them. That technical assistance spans a lot of different things, and OE, in particular, we focus on the electricity policy side of things. The Energy Efficiency and Renewable Energy office,

they need to focus within their domain. EPSA's got sort of another arm of that, which is a little bit broader looking at the energy sector as whole. But we've assembled is actually a TA work group within the department that pulls all of these different pieces together. So that when states come in with different inquires, we can tap the appropriate people and figure out how to address those requests.

The one thing I will say that in terms of sort of scoping this conversation that's helpful just to keep in mind, and I don't know if Kevin is still in the room. But we have to keep in mind the fact this is an EPA rule and that EPA gets to decide what actually satisfies compliance. So we're trying to be very sensitive to that fact and also to the fact that the federal plan, as well, as the proposed model plan are actually proposed, so that's an area where it's a little bit sensitive for the Department to do too much. Just because we know we will going back through the process of interagency review in anticipation of EPA releasing a final version of those documents. So I just wanted to throw that stuff out there.

And then if others want to contribute in terms what they've heard and think would be helpful in terms of providing information, resources, that kind of thing for folks that are tackling this issue.

MS. TIERNEY: That was very helpful. Thank you. Yes, Merwin?

MR. BROWN: I'll probably regret saying this, because one it's based on limited data, and two it is leaping therefore to a conclusion, and maybe not a conclusion but at least food for thought. But I'm 71 years old and my career's essentially behind me anyway, so.

MS. TIERNEY: Don't say that.

MR. BROWN: But this panel, for example, I asked them a question about the magnitude of the issue involved, particularly for the electric grid, which is kind of our focus here. And I do talk to a lot of other people, various venues about this, and I think one, I'm not convinced that the policymakers and the people involved with that side of it really understand the magnitude of the issue. I'm not saying it's a wrong policy. I'm just saying I don't think they understand.

MS. TIERNEY: Which policymakers do you have in mind when you're saying that?

MR. BROWN: Almost any of them.

MS. TIERNEY: All of the above.

MR. BROWN: All the way from state regulators to federal levels, with one exception at least maybe the agency in this room which is DOE. And I think even in this case for

some reason, if I look at the canaries in the coalmine, which I would say California and Germany represent two of those that are kind of at the frontier of this, I think they're understating the problem. And for reasons I'm not totally sure. I'm not sure whether it's bad assumptions, or it's considered good politics, or good finance maneuvers.

So I offer this as just an opportunity for us to open our eyes and watch as we go forward, if you'd all accept what I'm saying here. I think we ought to watch to make sure that we aren't not being told the full magnitude of the issue of what it's going to take to make this happen. And by take, I mean it boils down to frankly we've mentioned institutional problems, there's no doubt about it, those are the biggies right now. But I do believe there are a number of technologies that are going to be dramatically needed. And by the time we really find out we need them, it'll be too late to get them in place.

So I'm just going on record as saying that, for what it's worth. I'm not gonna ask any of you to buy into it and take action, other than keep your ears and eyes open for the possibility that I may be correct in this.

MS. TIERNEY: Thank you.

MR. COWART: Can I just ask for a clarification from Merwin?

MS. TIERNEY: Yeah.

MR. COWART: Were you talking about the Clean Power Plan? Or are you talking about the real problem which is what happens after 2020 and 2030? It sounded like you were talking to the longer range problem.

MR. BROWN: Yeah. I think so. I'm talking about the overall problem of the climate change issue and what it's gonna take to (possible dropped words due to new tape) And, yeah, this is just one piece of it. But it's setting the stage and it's setting things into motion.

I guess I'll argue why I think it's what's happening with the industry posturing right now, is they are so used to having been caught overstating the problem and crying wolf, that they've kind of gone back off into the other direction because they feel a sense of lack of credibility in this kind of thing.

But I think there's also other reasons. There's political reasons, etcetera. And the only reason I say that is I talk to people who are in the rank and file of these organizations who are having to deal with this. And, while, yes, they could be overstating the problem, my radar is telling me actually they're uncovering the tip of an iceberg that's coming up.

But I do think one, there are solutions. I think

there are technical solutions to these, as well as institutional ones. But I'm not sure that the magnitude is -- I'm rambling and I'll quit. I think I answered your question.

MS. TIERNEY: Thank you. And that was a helpful addition. So I think actually I saw Anjan, Janice are you still up?

SPEAKER: You know, I know you're a legislature and I feel that --

MS. TIERNEY: Thank you very much, Jeff. Thank you. Jeff and then Wanda, then Paul, and I think that might be. You have to make very short, brief comments.

MR. BOSE: Let's see. Along the lines of my last question, what worries me about this whole process that I heard of both from the state side and from the various people in the first panel is that who's looking at the big picture. Who's thinking about the planning horizon that's 20 years from now? Because we've heard that the Clean Power Plan is kind of a glide path until 2030 or so. And what's worrying me is that it used to be before that the generation plant, I think Mark Lauby said this, the generation plan was decided on various reasons and then we sort of laid out the transmission plan. And now it seems that the generating plans are being decided more by Clean Power Plans and RPSs

and so on. And it's not clear to me that there are people who are looking at the big transmission of it, partly because transmission is getting more difficult to build.

But we are looking at long enough time spans that we ought to be thinking about the transmission lines right now, to be able to build them or 10 or 15 years from now, to be able to have them running 10 or... I worry about the fact that people, if you depend completely on local distributed resources to make this up, that all of this wind generation that's available in the Midwest are going to get stranded. And we're not going to be taking advantage of it. These are issues that only a big picture can take. You know, I don't think Southern Cal Edison can solve this problem. I don't think even MISO can solve this problem. It's got to be somebody looking at the whole interconnection.

MS. TIERNEY: I'm gonna take that as a comment. Thank you very much. Jeff?

MR. MORRIS: Thank you. I think I have a comment to offer, too. And I'll try to be as concise as possible. You know on the ground in the States there's a whole slew of acceptance. I'll use the five stages of grief maybe as the backdrop. But there are some states that are gonna try to barrel ahead, and I probably come from one of those states out in Washington. There's some states that are gonna fight

this to the bitter end, you know, both legally. There are some states are between them might have executive branches that want to embrace it, but the legislature that probably passed this authority to the executive branch in 1972 when the Clean Air Act was passed way back then.

And I think what this group should do and what DOE should do is provide tools that provide as much factual based transparency around decisions. And if you look at the McKenzie Abatement Curve for greenhouse gas reduction, as a state policymaker there's a universe within that curve of stuff that qualifies underneath the Clean Power Plan, but what we don't have is to know if we fight this to the bitter end, on a Gant type chart what options, from a cost perspective, are not gonna be available to us if we wait? Because the biggest disconnect with policymakers is the time it takes to actually plan, permit, and construct something. And if you wait until the bitter end and there's this compliance state, you may not have low-cost options and people need to know that they're doubling down on cost for their constituents and ratepayers if they wait.

So that's the example. I'm not saying that what the magic bullet, but that's an example of kind of factual based data that's lacking and provides transparency in the decisions that people are gonna make. And there's a couple

other complexities, too. I think scope's important on this, because like in our state, we have 63 electric utilities, three are regulated, the other 61 are publics of different type. Some of them have their own resources. You know, a utility commission can decide to rate base or do cap and trade with the regulated ones, but the publics are gonna have to decide on their own, unless the legislature steps in and forces them to do it a certain way. So that's the complexity.

There's a tax question. I was kind of talking here, because I'm not sure it's within the scope of DOE, but when you unbundle and monetize values around a regulatory construct and it's not with the delivery of power, you've created a whole separate sales tax issues for states. And that's not really been taken out by either EPA and the rule making, or anyone that I've seen so far. But there's a sales tax implication when you do that. So I'm sure within the scope of the DOE, but there's all these loose end at the state level that need to be cleared up. And I think anything that's transparency and provides data, is gonna be useful.

MS. TIERNEY: You know that is the first time I've heard that said. And you're probably the first legislature from a state that I've been in a meeting with (laughs). Nice job of adding that one to the table. Wanda?

MS. REDER: My comment's really building on some

of the things that already been stated here. But, you know, I do think that DOE has an opportunity to provide a technical overlay from what the policymakers probably have had in this journey. And I really think that it's the obligation of the DOE to look at the reliability and resiliency in the process. And perhaps some scenario analysis looking forward on what could happen from a really big picture perspective would be useful.

I would encourage DOE to peel back the layers of the onion and look at it from a use case perspective so that you are understanding what's difficult? When are we on the hairy edge from an operating perspective and conditions. And what kinds of either technology from grid transformation do we need to provide. And that may fuel some of the portfolio that you invest in along the way. And the same way with the tools for transparency.

But, again, back to the idea that I really think the reliability and resiliency of the infrastructure is core to DOE's purview and that should be a focal point as you think about the big picture and the technical overlay.

MS. TIERNEY: Thank you. Paul?

MR. CENTOTELLA: So a couple of comments. First of all, specifically on Clean Power Plan it strikes me that number one, you've got a historical situation where in the

States air regulators and energy regulators typically don't talk to one another very much. And secondly, even in places where they may be talking to one another most state and regulatory commission don't have models that can do production costing and could actually tell them in any detail what the impacts of particular policies might be.

So it strikes me that as good as there are some energy knowledgeable people in U.S. EPA, it would be very to helpful to have some sort of liaison between DOE and the EPA in terms of educating air regulators about some of the things that you know that aren't necessarily known either in the states or in EPA. And I think that might be something that would be a nice interagency cooperation as you move forward.

MS. TIERNEY: Thank you, Paul. I just have one comment to make myself. I was really privileged to be a member of the four person peer review panel that went along side of the California, the six utility studies on deep penetration of renewables. And it included Dan Arvizu from ENROL, formally from BPA. And Severin Borenstein.

The reason I mention that group is that people had different angles on the problem, technical, economic, operations, policy. And one of the conclusions that we came to after seeing the modeling done and hearing the utilities interact about the operation issues was that policymakers,

and sorry Jeff, I'm going to say this in your presence. Policymakers sometimes get enamored with a goal. You know let's do 50% renewables by date X. And then the people who have the operational responsibilities go off and have to figure out how to do that. But there are these real institutional public policy things that have to be also adopted by, in order to make it work.

And so maybe something that DOE can also do is connect dots in a transparent way for public policymakers in states about those other institutional and policy issues that have to accompany the more concrete operational plans of things. Without telling them what to do, but of course just identifying these are the kinds of things that will either rub things raw or facilitate solutions.

So with that, we will include Carl back in the conversation. We'll figure out what this working group's gonna do. And Rich, it's back to you.

MR. COWART: All right. Thank you. I need to ask whether any member of the public has signed up to make a statement. The answer is no. We have no additional business at this time. So this meeting can be adjourned. Thank you all very much for putting up with an early start this morning, but we can -- oh yes. We're gonna have one thing. One additional announcement before you depart.

Thanks for being here. Thanks for your work on the committee. And I look forward to seeing you next time and on numerous phone calls in-between now and then. Janice, has an announcement.

MS. LIN: Thank you, Richard. Given all the discussion on energy storage in the last two days, I wanted to extend a warm invitation to everybody here to come to our green connected storage conference in two weeks in sunny San Diego. In fact, some folks in this room are coming and speaking at this event. But it's the largest gathering of the ecosystem on grid connected energy storage and all its applications. And we this year have great, great program. It's three days of everything you wanted to learn about and what's current on how energy storage is being used in the grid. So I hope to see you. And I'll send a quick e-mail with more instructions and a discount code. And contact me if you need help, because we have a scholarship program, too. Thanks.

MS. TIERNEY: Hey, Rich, can we give a big sendoff to this almost former regulator? (Laughter) Her last one hour as a regulator. (Laughter)

MR. COWART: I'm happy to recognize her new status. But as a member of this committee, she just comes right back. (Laughter)

HONORABLE WAGNER: Just change the name and get rid of the honorable part. (Laughter)

Mr. COWART: Congratulations on your service and we look forward to your future service.

HONORABLE WAGNER: Thank you. (Applause)

MR. SHELTON: Richard, the Energy Storage Subcommittee is doing a working group from 12:00 to 3:00. It's in our building. The AS Building is right through those windows, that building you see, it's the 9th floor there. And lunch should be there by the time you get there.

(Whereupon, the PROCEEDINGS were adjourned.)

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CERTIFICATE OF NOTARY PUBLIC

I, Carleton J. Anderson, III do hereby certify that the forgoing electronic file when originally transmitted was reduced to text at my direction; that said transcript is a true record of the proceedings therein referenced; that I am neither counsel for, related to, nor employed by any of the parties to the action in which these proceedings were taken; and, furthermore, that I am neither 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.

Carleton J. Anderson, III

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