NUCLEAR POWER: IS THE FUTURE BRIGHT?

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Panelists
Scott Brown, Vice President, Market Initiatives and Analysis, Exelon Corp
Susan Mathiascheck, Senior Director, Environmental Policy, Nuclear Energy Institute
Steve Piper, Director, Energy Research, S&P Global Market Intelligence
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David Sunderwirth: Good morning everybody. Welcome to Clearwater for the 27th Annual NDT Conference. My name is David Sunderwirth. I work at Bank of New York Mellon and I'm going to be your moderator for today's panel. We're going to focus on some of the key regulatory and market issues that are impacting the industry today. There will be a Q&A session at the end so if you could please hold your questions.

I'd like to start out by introducing our panelists, hopefully some of you had an opportunity to meet them either last night or at dinner or this morning. Each of our panelists has an outstanding resume but in the interests of time I'm going to be brief in my opening remarks. We do have complete biographies on each of our panelists outside, so please help yourselves.

To my immediate left, Susan Mathiascheck. Susan is the senior director of Environmental Policy at the Nuclear Energy Institute.

To her left is Scott Brown. Scott Brown is the VP of Market Initiatives and Analysis at Exelon.

Sitting next to Scott is Mike Twomey. Mike Twomey is VP of External Affairs at Entergy Corp.

And rounding out our foursome here today is Steve Piper, Director of Energy Research at S&P Global Market Intelligence.

Welcome to each of you and thank you for being here today. Before sort of jumping into the presentation, I just kind of wanted to level set where we are in the industry today. We have 99 units currently in operation. That's down from about 104 a couple of years ago. What I think is worth noting there is that most of the recent closures or announcements have been largely a function of economic considerations, as opposed to operating issues.

On the bright side we have four units currently in construction and they should be coming online in about two or three years' time. In fact, in September of 2015, I think TVA's Watts Bar 2 came online. And although it's not fully operational yet, I think the significance there is that it is the first new nuclear facility that has been built in this country in approximately 30 years.

On the policy front, it's been an active year in 2015. In August of last year, the EPA finalized the Clean Power Plan or as we like to refer to it, as CPP. The Clean Power Plan establishes emission target reductions and provides a flexible framework for each of the states on order to achieve those particular objectives. The final version of the plan as most of you know, will achieve a 32% reduction in emissions in the electricity sector and that should be achieved by 2030.

So let's get started here, and I think the place we'd like to get started is government policy. So I'll start with you Susan and then we'll sort of work our way down the line to Steven. As the largest generator of clean power in the energy stack it would seem to me, and hopefully everybody else here, that nuclear would be ideally positioned to benefit from the Clean Power Plan. And yet that doesn't seem to be exactly the case. So I was hoping maybe you could sort of tell us what you feel are the major gaps in the Clean Power Plan as it relates to the nuclear industry.

Susan Mathiaschek: Sure, well, the Clean Power Plan is a significant step forward obviously, for carbon reduction. It's the first regulation of its kind and EPA did a monumental job turning it around in the last couple of years with the Obama administration. But it doesn't really get us where we need to be in terms of carbon reduction to make the US short-term and long-term goals. And one of the pieces that's particularly frustrating for those of us in the nuclear industry is that we provide the single greatest source of zero emission electricity, right? It's nearly 63%, it's more than everything else combined even when you consider the recent build-out in solar and wind. But it's not going to stay around forever if current trends are any indication, we're fighting very hard to save plants and we're seeing them blink out, which is very scary if you wanna reduce carbon.

Environmentalists as well as industry folks are focusing on this issue and it's a huge one. I think the biggest problem with the Clean Power Plan is simply that it assumes that existing zero energy resources are going to stay around. It explicitly says that it cannot take into consideration existing nuclear because that wouldn't be reducing emissions, that would just be keeping emissions where they are. Well, I think if you got a baseline that's pretty good, you want to keep that, you don't want to lose it. So that's one thing that the Clean Power Plan could have done better. Now admittedly, EPA is working with some awkward tools. So they're trying to fashion things to address carbon reduction in a lot of different ways but one of the concerns that has arisen with the plan, is that it's not actually stringent enough in many ways. And principally, it allows you to shut down a nuclear reactor, depending upon how the state plan works, the devil's in the details, a state could stop this but it's not clear that they have to. Shut down a nuclear replace with an emitting resource like natural gas, and that's perfectly fine under the plan. It's completely illogical, it's clearly not what the goal of the plan is, and yet it's something that can happen under this plan. And it's again precisely because the EPA couldn't take into account maintaining this existing resource.

David Sunderwirth: Scott.

Scott Brown: I agree with Susan that it's not explicit in the Clean Power Plan, that you can go to section A and it says you will feel this impact, or you will reward this activity from the nuclear

industry. And we all in the industry ask for that. We advocated for it. In the end that was not in the final rule. Exelon still sees the Clean Power Plan as a critical part of the overall energy policy. A big step forward, we've worked and continue to work with the EPA to try to get those rules to be more stringent. One thing that it does have, it gives you lots of choices. It gives each state choices and the devil is in the details. There is an application within that, that if a state were to adopt and use what's called a mass based solution and was to make it so that it recognized both new and existing plants and that's way too detailed for what most of you'll deal with. But know that the math would be, if that was accepted by every state, the math would be such that if you did lose a nuclear plant, there would be quite a consequence. You would have to replace it with an equivalent zero-emission resource. But that's one of four choices that a state can make and there's no guarantee that, that will happen. So one area we're working on is trying to work with states, work with regions to get them to adopt that. The challenge we have and probably the theme you'll hear today is, is it enough and is it on time? The reality is that the carbon cavalry as we refer to it is probably not going to show up until 2030 or beyond. And in the meantime, we've got an industry that is not being recognized for one of its most valuable attributes which is it is the largest producer of zero emission energy in the United States, counting for somewhere upwards of 70% of that. So, the challenge we've got is, again, I think we could make it work if we got the support. But, the reality is, the timing of it is such that it's not going to have an impact for a number of years.

David Sunderwirth: Mike, your thoughts.

Michael Twomey: No, I agree with that. I think that the biggest problem with the Clean Power Plan, from the perspective of the part of the business that I'm working on, which is, I work on wholesale nuclear power plants for Entergy, primarily up in the Northeastern United States. And at best, the Clean Power Plan does nothing. It doesn't do anything to support those plants. Indirectly you might see an increase in wholesale electricity prices as a result of the Clean Power Plan implementation that might benefit some of the plants. But for the merchant nuclear plants, I don't see the CPP as being much more than a carbon prevention plan. Excuse me, a coal prevention point that's really what it is. It was not designed to address nuclear plants and we have been talking, Entergy with others, has been talking about the importance of these nuclear plants to a diverse energy portfolio. And quite frankly it has not been a priority for the administration. So I step back and say you can't really blame EPA. Right, they've got a limited number of tools available to them. The real question is: have policy makers simply ignored, pretended, that all of these existing nuclear plants are going to continue to be there without paying attention to the concerns that we've raised about markets, you've got choices that are made across different markets. Where certain renewable portfolio standards have encouraged states to adopt policies that encourage the utility, for example, to sign long term PPAs. Well above market. Why? Because they want generation that's not carbon emitting. But when it comes to a nuclear plant, an existing nuclear plant in the state, very little is done. New England, for example, a collection of New England states just a year or so ago, announced a clean energy RFP, in which all of the utilities in those New England states were encouraged to sign contracts for non-carbon emitting resources. Except nuclear, which is the largest non-carbon emitting resource. And so we've been pushing on policy makers, trying to make sure that people understand the consequences, the environmental consequences, the reliability consequences, the economic consequences of losing these incredibly important assets. And up until very recently, end of last year, very little traction with folks because they just assumed that those plants would continue to operate and I don't see

anything on the horizon that will help the merchant nuclear plants survive. At least not on a federal basis. There may be individual states that are trying to do something as a, I'll describe it as a bit of a band-aid approach, but I don't see any national policy that's even in its infancy, that will take the steps that are needed to ensure that these assets continue to operate.

David Sunderwirth: Steve?

Steve Piper: I would certainly echo the sentiments of the group here and we have a little bit of history to work from in the competitive markets, roughly 25% of the country in terms of electric load is already under some form of carbon regulation, right? Between RGGI in the northeast and the California carbon program, I don't know if too many people actually realize that a fair amount of the country is facing carbon pricing as we speak. But if we look at where nuclear plant retirements and financial distress are concentrated, it's in exactly these regions, right? $5 per ton carbon tax, just to throw out some round numbers, is not providing much relief to nuclear plants in the northeast. $10 per ton carbon taxes are not providing very much relief to plants in California. So to, I think go back to maybe Scott's point, if the CCP is to provide a sig nificant boost, and we sort of map it in terms of a carbon tax, you need a number of $20 a ton, you need a number of maybe $30 a ton to certainly provide the kind of return on investment that today's fleet really needs.

David Sunderwirth: Thank you. I heard a number of points that we're going to come back to later in our presentation. This next question is for all the panelists as well. Earlier this year the Supreme Court surprised everybody when they issued a stay and voted to postpone the implementation of the Clean Power Plan. So, my question is, how does that stay impact current EPA litigation and does it really matter with respect to the industry? And Steve, if I could ask you maybe to kick us off on this one.

Steve Piper: Sure. I mean, there's no question that the stay is favorable to the litigants of the plan. Particularly those states and utilities with a lot of exposure to coal, as we have discussed. And certainly the way I tend to view it, John Roberts, Chief Justice Roberts was a swing vote on the court. I think he has voted very much as a pro-business conservative. You think about his vote on the Affordable Care Act. He didn't want to disrupt what was in flight in the insurance industry over what was really a legislative technicality. Clean Power Plan, a very different story. A long-term regulation that had a very real potential to disrupt the utility business, the electric power business. No question about it, and so voting for the stay I think was a very reasonable call for him. The question is of course now, what happens next in the light of events that have unfolded.

Michael Twomey: Well, Entergy, as many of you may know, has a utility business. They're an integrated, vertically integrated utility in the south, and for that part of our business the Clean Power Plant is important, it has the potential for having profound changes in how that utility segment works. For the whole set of nuclear plants, I worry about a lot of things that could affect our ability to continue to run those plants. And I will tell you that I think about the Clean Power Plan almost never. It's just not something that I think is going to change the outcome for those plants. We're looking at a three to five year horizon here on whether those depressed wholesale energy markets are going to recover. If they're not going to recover in the very near term, then those plants are not going to continue to operate. I mean, I look around the audience and I think I'm safe in using the analogy, that this is like the old episode of I Love Lucy where Lucy and Ethel were making salad dressing for $5 a bottle that they can only sell for $3. And that's where we are.

If the cost of running these plants is greater than the revenue that we can get. And that is a problem that needs to be addressed in the next 36 months or 48 months. And I, quite frankly, don't see the Clean Power Plan having any impact, positive or negative, on that equation.

David Sunderwirth: Scott.

Scott Brown: Now, I think Mike's correct. As we said earlier, that cavalry's got a few yards to run before it's going to be seen. We've got a slightly different view at Exelon. We've got 20 gigawatts of nuclear. We've got a slice of that that has challenges that need short term attention and we'll talk about that a little bit on the panel. But we still think that long term, the US focusing on what is the most important social issue facing us today in the environmental arena needs to get taken care of. And although the stay put back some of the work, it still is the law of the land. The Supreme Court found that carbon is a pollutant, it needs to be regulated. That's not going go away. There are litigants that will say don't do it. Well, believe me, and I think many of you know this from previous environmental law. There are litigants like NRDC, EDF that will be filing lawsuit after lawsuit after lawsuit to hold the country accountable for implementing what the Supreme Court found when it comes to carbon. So that's going to continue, we're going to need to go forward with it. But like I said, even if it wasn't stayed, its impact is 2030 and beyond. So we really do need to focus short-term so that we've got the resources to be able to comply when it comes to 2030. And I think that's an area where we're focusing right now. Again, we've got people that will work to get that carbon rule right, EPA continues to work on the details. But the shorter term is how do you come up with putting a value on that attribute of zero carbon, and zero emissions, not just carbon, these plants are known for. And we think there's work to be done there, I think a lot of that is moved to the state level. And there are a number of states, over 20 states have rules on the books that commit themselves to a carbon reduction. You often see the headlines about renewables, because they're kind of interesting because people want to say I'm going to be 50% renewable by some date. But many of them also have carbon reduction rules and many of them lie dormant, and that'll be a key part of states recognizing that they need to prepare themselves for what will eventually be the law of the land.

David Sunderwirth: Susan

Susan Mathiascheck: Yes, I have to agree with everything my colleagues here have said. I think the Clean Power Plan is not going to help us in the next few weeks / six months. The stay is an important piece of that, because procedurally it means that if and when the plan goes into effect, it's going to be further than we thought. We already we're talking about a 2022 date for when states had to start complying. That date is likely going be pushed off further and we just found out yesterday that the DC circuit who hears the case before it goes to Supreme Court has deferred their oral argument date from this June until September. They're doing that so that they can have the entire court, that's nine judges, hear the argument rather than just the three that would ordinarily be on the panel. And everyone is claiming victory about this. It probably simply means a little bit of what I think the stay itself means, which is that this is a big honking deal. This rule is a major battleground for some of the folks who don't think we should be decarbonizing and a lot of the environmental groups. It's really the first big sequel to the Mass v EPA case, if you heard that a few years ago, which basically said the Supreme Court, somewhat surprisingly, said we've got to regulate carbon. And the fact that the DC circuit is openly acknowledging and taking this unusual step that we're going to full court to hear this thing, is really just an acknowledgement of how

important this rule is long term. And I'm not giving up on it as part of the carbon piece, I think we all recognize on this panel that carbon reduction is not going away. Exactly how it's going to get implemented, we don't know yet. But we know it's been declared a necessity by the government, it's been declared a necessity by the Supreme Court. Even if the Clean Power Plant is remanded, struck down, modified, changed, doesn't come into effect for a few years, the long-term effect is going to be significant. And it's going to be something that we collectively, on the industry's behalf, we're going to have to figure out how to make work for nuclear. And it may not be a help to some of those plants that we have concerns about right now, but it's going to be around for a while. And if it's okay. Sure.

Michael Twomey: One thing that amplifies what she just said is, while we're talking about carbon reductions, and we're litigating about carbon reductions, there was a good article in the Boston Globe yesterday, that finally picked up the story that we've been talking about at Entergy for five months. Which is, they ran a story about the fact that for the first time in 10 years, New England's carbon emissions went up in 2015 compared to 2014, went up by 5%. And begrudgingly, the Globe admitted that it was because of the closure of Vermont Yankee at the end of 2014.

So while there's a lot of ink being spilled on the Clean Power Plan, and how we're going to affect carbon emissions, in New England at least, carbon emissions are up in 2015. And they're going to be up again in 2016 compared to 2014. And when Pilgrim closes they're going to be up even more. And the urgency that needs to be brought to this issue, hopefully is gaining a little bit of momentum. But it needs more momentum than it currently has, at least from my perspective.

Susan Mathiascheck: Absolutely.

David Sunderwirth: Yes, and we're not going to be able to fill that gap completely with natural gas, so, because there are carbon footprints that go along with that.

Scott Brown: And it's really the simplest math you can do, right? [LAUGH] You're taking something that provides energy and has zero carbon emissions, and when it goes away, there's not another resource that can meet that requirement that doesn't emit some carbon.

David Sunderwirth: Susan, I'm going come to you next on this one. And just sticking with some of the legal challenges to the plan for a moment. As you noted Mike, several industry groups in the 27 states are currently suing to overturn the Clean Power Plan, largely arguing that the EPA overstepped its authority under the Clean Air Act.

Susan, can you outline for us what are really the core issues before the court? And then I'm going to ask you to comment a little bit on the implication of Justice Scalia's untimely death and what that means for the Court now that they're evenly split between conservatives and liberals.

Susan Mathiascheck: Sure. Well there, I would say, two major categories of issues and one of them is much bigger in my mind than the other.

The first issue is simply that when 111D was amended in 1990 when the Clean Air Act was amended. You had a House Bill. You had a Senate Bill. They had different language. Congress didn't fix that before codifying the language. So we have "codified" language that refers to another provision of the Clean Air Act and suggests to some readers, depending upon who you are, that if you are already regulated under this other provision. Then you can't be regulated under 111D.

Now, other people say no no no no no, if you are regulated for the same pollutant under this other provision, you can't be regulated under 111D. That's kind of a big distinction. I think in the end that's not going to be that huge an issue. I could be wrong. Some people want to construe this strictly but it simply doesn't make any sense that you would regulate and this is what EPA is arguing in any event. That you would regulate for constituent A, and then get out of jail free for every other constituent. Doesn't make a lot of logical sense. And their number of technical arguments about how you interpret a statute in this situation when you have two conflicting versions. That also probably suggests that the DC circuit and the Supreme Court aren't going to get too hung up on that. We'll see. There are a lot of smarter people than me who have taken the other side of that issue. We'll see.

The second issue which to me is the really interesting one is all focused on the fact that EPA has decided the best system of emissions reduction, which is what they have to establish under this rule, includes an analysis of the grid as a whole, not an individual power plant. We tend to think of pollution control as you put your catalytic converter on your tail pipe and that fixes it. It's not what EPA is doing here.

EPA is saying the best system of emissions reduction includes, for example, switching from coal to natural gas, switching from fossil fuels to renewables. So we're going to build all of those assumptions that you've done those things into the number, that your state has to meet.

And there are a lot of people, all the 27 states that are challenging the rule, who say EPA does not have the authority to do that. They cannot look at the grid as a whole and decide how we're going to generate electricity. It's an overreach, it's beyond the statutory language in the 111D, it's an infringement on state's rights, etc, etc.

Those are going to be really where all the, I think, interesting legal arguments are. And it's very complicated, much more so I think than what I have said. And I probably have completely confused you already, so, just think how complicated it really is.

The bottom line with Justice Scalia not being there is I'm not sure it's going to make that huge of a difference. Justice Scalia obviously was a staunch conservative, he's a strict constructionist when you get into statutory language, he wants it to say exactly what it should say.

But without him on the bench, we still have a lot of issues that really don't reduce to a strict conservative / liberal litmus test. There are a lot of people who think that the DC circuit could overturn this the cartoon version of court analysis with MDC sort of says no they would never do that. They're just a bunch of liberals. They're going to rubber stamp it because they like Obama, that's one view. I'm not sure I would bet the farm on that. Some people are, some people aren't.

I think the other important thing to remember though about Justice Scalia is now that we are moving further in the timeline, particularly yesterday with this delay that we got moving the oral argument back, that means we're probably not looking at a decision by the Supreme Court until well after the election and probably into the new term.

So, what's really going to matter is who we get as a replacement justice. And I think that odds are not yet decided or set on that. We'll see if we have to see what happens with the election and who gets nominated.

David Sunderwirth: Thank you, Susan. We're not even going to touch the election for now.

Susan Mathiascheck: [LAUGH]

David Sunderwirth: But I think regardless of whether CPP is upheld or not, I think we can all agree that carbon reduction is, sort of, inevitable here in this country, and globally. The real question I have is, sort of, what is going to be the role of nuclear going forward? I know that in New York and in the State of Illinois you guys are grappling with this issue right now. Interestingly, the heads of several large government agencies at DOE and FERC, even the EPA have come out and said that shuttering some of our nuclear capacity will have negative environmental consequences. So, despite these high level pronouncements of support, it's been tough sledding for the industry, not only here in the United States, but in other industrialized countries like Japan and Germany. We can touch on that later.

On the other hand, you have countries like China, where their quality concerns are a huge issue right now. And they're all in. I mean they've said that they're going to be building 60 new nukes in the next ten years.

So again coming back to you Susan, what are we missing here? And this really, you know, kind of gets back to a little bit about what Mike was saying before. Do policy makers at the national and local level really understand the challenges that are facing the nuclear industry, and I guess more importantly do they understand how high the stakes are?

Susan Mathiascheck: Well I think that's kind of the $64,000, million dollar, billion dollar question here. I completely agree with Mike that we have gotten to a crisis point and our regulators have been a little bit slow on the uptake. I think they weren't willing to believe that plants were actually at risk of shutting down. But I also think that there's a real opportunity here and that regulators are coming to the table.

I think both Mike and Scott have been involved in a lot of discussions with folks trying to move regulators, move federal regulators, state regulators to the table to address this issue. I think we've got to remember we got a short-term game and a long-term game. And the bottom line is for the long term game if we do not have a market signal for carbon, game over for carbon reduction. Not just nuclear, carbon reduction right. If we don't have a realistic value for carbon pricing that attribute is going to go away. And if we don't have nuclear plants, the math does not work for carbon reduction. It's that simple.

And China gets it. And I think the regulators in Illinois, and New York, and Ohio are understanding this. Federal issue is a little more complicated as you may know, there's been some trouble getting activity going in congress that can gin up Bipartisan support. We're going to keep working on that issue.

I know NEI and our member companies have been at DOE, have been at the NRC, have been at FERC, working every angle. FERC is working on market reforms to try to address this concern. The ISOs and RTOs are putting in payments in some areas for capacity, there's a lot of activity going on. DOE's having a seminar this week on how to preserve existing nuclear. We got to get to the point where we are willing to bite the bullet and get a real number for carbon in to the market so that we can value that attribute and protect the plants.

David Sunderwirth: Thank you Susan. We're now going to sort of turn to the local level and you Scott and Mike, we'll be coming to you guys next. I do find it interesting that the states are sort of taking the lead on some of this.

So on May 5th of this year I think Illinois announced that they are going to initiate a new standard, I believe the name is the Next Generation Energy Plan. I know Scott, you and I spoke about that last night.

I'm going to ask you to comment on two things. One is, how does that plan work, how is it constructed? How's it going in the legislature right now? And then also if you could just comment briefly in terms of that template, is it something that could be rolled out to other states with nuclear capacity within their regulatory borders?

Scott Brown: Sure, Dave, I'd be happy to. In Illinois, you misspoke slightly, you said Illinois introduced and we can only hope that in the end they introduce so now, I'll go to that. Actually, Exelon and a number of other constituents put forward last week a comprehensive legislative package in Illinois known as the Next Generation Energy Plan. I'll go into some details.

In that is a zero emissions standard that's targeted towards nuclear plants in Illinois but just to drop back we've got six units in Illinois. It's somewhere between 10 and 12 gigawatts of power. It's the largest source of energy in Illinois and in the Midwest so obviously the largest zero emission resource in that footprint.

And these plants have dealt with challenging financial issues for the last number of years. We've worked with the local regional regulators to establish a more robust capacity market, which rewards the capacity element of a plant making sure it's available and that's in place now. We also have continued to work on the environmental attributes to do that.

We had previously proposed something called a low carbon portfolio standard. It's designed to look like a renewable energy standard that would be available, it needs legislative approval, and just, when you think of the numbers you talked about what is the price of carbon and what is the cost?

A renewable plant gets an equivalent carbon payment of a couple of hundred dollars a megawatt hour. Because the state has decided it would like to have that technology in place and it wants a certain amount of it. And the legislature passed that rule. Most states in the United States have that. So it's a form of identifying an outcome that is useful. So the low carbon portfolio standard was meant to do the same but it would include nuclear as a resource that could meet that requirement. It wasn't exclusive to nuclear.

[COUGH] Unfortunately, that legislation has been around for a couple of years and really hasn't moved forward, so we've continued to work with constituents there and have introduced this now, the Next Generation Energy Plan.

As part of that, there's a zero emission standard, it's actually fashioned off of something that's been proposed in New York, where you would take the gap between what the cost of a plant is and where the market is at, and allow a credit to fill that gap. That credit would be based on delivering zero carbon energy for a period of time and it can be set on an annual basis. It includes not only the costs but the risk of operating the plant. And that would provide that gap year by year to allow

that plant to continue to operate. If the market were to recover, if the carbon, the Clean Power Plan we talked about, were to come into place and put that price in the marketplace, that zero carbon emission credit, and it's part of the emission standard, would go to zero, and would go away as you go forward. So, it's a unique approach like that.

We've proposed it in Illinois as part of its comprehensive legislation.

It would be available to 16% of the output, that roughly covers two of our most challenging units.

Because also last week, we announced that during our earnings call, you in the finance industry, know that earnings calls are you used to introduce big things.

David Sunderwirth: [LAUGH]

Scott Brown: We introduced the fact that two of our plants, the Clinton plant and the Quad Cities plant, that we are partial owners with MidAmerican, are at a position where if this legislation is not passed, we intend to proceed with the retirement of both those units. The Clinton plant would be in May of 2017, which is roughly a year away. The Quad Cities plant, because of other commitments it has, would be May of 2018.

Now, think about the consequence of that and this is about getting both legislators, regulators, labor, citizens and not only citizens of the state but the region about some of the consequences. If those two plants are to retire, the equivalent power replacement would lead to about 16 million tons of carbon that would be emitted every year over what you have right now. So again, you've got carbon goals in Illinois, you take that away and you're already behind and you've got to build up. Energy prices, because of the replacement power that will go with that will increase significantly, somewhere between 150 million to $300 million a year depending on what happens with natural gas. Those aren't our numbers, those are actually a study that was done by the state of the Illinois and their four agencies who put that number to print over a year ago. And then put on top of that what is that cost of carbon.

The Obama Administration and EPA have a study that has put a cost of carbon, a societal cost of carbon out there. The loss of those two plants, that societal cost of carbon will be about $10 billion over the next ten years. And that goes through all the macro economic analysis that you can look up and research. So this is real consequences what we've put forward in this legislative package are a solution to that. What it would come with is a commitment to continue to operate those plants. And we'll see where it goes.

The date of the legislature in Illinois, when they go sign [INAUDIBLE] by design is May 31st. That's only a few weeks away. Unfortunately Illinois does not have a budget right now, they haven't had one for a couple of years. So there's a likelihood that session will be extended but you know, our CEO has made it clear that we are serious about this and we need to do things that will secure the probability of those plants, or we won’t be able to continue on.

Our solution there is this next generation energy planning or hopefully the legislature will act on it for all the things we've been talking about here this morning.

David Sunderwirth: Mike, similar question for you concerning New York State's Clean Energy Standard and, specifically, around recent efforts to support the announced closure of the

FitzPatrick Plant. And then maybe if you could talk a little bit about the disparity in treatment you're receiving between Indian Point and Fitzpatrick, two units that are operating within this same regulatory compact.

Michael Twomey: Well, that's right. And New York is quite a challenge, I'll say that. Entergy owns the Fitzpatrick nuclear facility in upstate New York and we own Indian Point in Westchester County. And then the story around those two plants could not be more different. We met with members of the administration, members of the Public Service Commission, two years ago, to talk about the need for a clean energy standard that would compensate nuclear facilities for the reliability benefits they provide for the environmental benefits they provide. For the economic benefits they provide. And we got very little traction. It was very little interest in terms of what's a priority for the state.

And so we continue to advocate in front of the ISO, the New York ISO is the independent system operator that sets the rules for how people get paid for the power they produce. And we pitch to them the importance of having pricing rules that would properly compensate people who are participating in the market. Not a priority for them to address the concerns that we raised.

And it is an interesting dynamic because at the same time there are people falling all over themselves to adopt policies to encourage wind development and solar development because of the non-carbon emitting benefits and certainly there are non-carbon emitting benefits for those facilities but the nuclear issue has been much more complicated.

So we announced the closure of Fitzpatrick last fall because we'd gotten to the point where the plant was losing money. The plant was expected to continue to lose money. And we have a fiduciary obligation to our owners, not to continue to lose money. So, we made the difficult decision to close that plant. And I would describe the CES, at some level, is really, in New York, the Clean Energy Standard, is a bit of a reactionary policy decision.

In other words, it was not a forward looking progressive decision to be on the front lines of this. It was a reaction to the potential closure, not only at Fitzpatrick but of some of Scott's plants. And the recognition by the administration that there were going to be serious economic consequences – Upstate New York is very challenged economically, there aren't a lot of large manufacturing facilities that employ a lot of people at high wages and this will be a body blow to some of these communities. The CES has really been a bit of a reaction to that. Remarkably, it is described as a clean energy standard that is designed to preserve existing nuclear.

Footnote, but not Indian Point. So, written into the rule are standards that make Indian Point ineligible. Even though Indian Point is the largest producer of clean energy in New York, only by a little bit.

[LAUGH]

But it is in fact the largest facility in New York that produces the most clean energy and there's a long standing history of opposition to Indian Point that’s affected this proceeding, it makes it very complicated for us to participate in this proceeding. I've said in other places and I know I'm on tape, the exclusion of Indian Point is arbitrary and unlawful. And we intend to take whatever steps we need to take to ensure, that Indian point is included. And actually I think the story around Indian point is emblematic of the challenges for the nuclear industry as a whole.

Which is you've got a group of environmentalists and mostly Democrats who have this irrational fear of nuclear technology and have a persistent fantasy that wind and solar is going to power the entire United States. And so it is very difficult to get any policy decisions made that support nuclear power. I won't roll this particular state under the bus but we had constructive discussions with a state in New England about a clean energy standard, and whether it would include nuclear, and the political reality for these folks was that they couldn't get a clean energy standard through their legislature without every single Democratic vote, because they didn't have the numbers.

Because of other concerns that people have about adopting those kinds of policies on the Republican side. And they said they couldn't get every Democratic vote if they included nuclear. So the math for them was they wanted to get something adopted. So, they at least proposed a policy that excluded nuclear and included only renewables - it never went anywhere by the way - but, had it been adopted, it would have provided no benefit to the nuclear plant, which was more than 80% of the clean energy in that state.

So, these policy decisions are difficult to work through and New York I think, it's a long road. I mean, I do think that there are some people in New York who are genuinely focused on trying to do the right thing, to reduce carbon emissions. But there are other layers of this effort that are primarily economic, primarily reactionary, that are afflicted by the anti-Indian Point syndrome and as a result I'm not sure how this is going to end up. I'm not sure if we'll end up with anything in New York, quite frankly, at the end of the day.

And for Fitzpatrick, what I have said previously is, it's really too late for any policy to be adopted in New York under this program that's on the table that would change the outcome. Because as we sit here on May 17th and the plant was supposed to be refueled three months from now. As we sit here on May 17th we don't know how much support would be provided, we don't when the support will be provided, we don't know what the terms and conditions that would attach to receiving support would be, we don't know how long the support would be provided. And so it makes it very difficult for us to change a business decision when there's so much uncertainty.

And so we're in the strange position where the current proposed clean energy standard probably doesn't affect Fitzpatrick. And by definition excludes Indian Point. And we're one of only two nuclear providers in New York. And so we've got a thread through this proceeding, in a way, that protects our rights, that protects our employees, that protects our owners.

And I will tell you that I spend a lot more time worrying about those issues, going back to the issue before, than I do thinking about the Clean Power Plan.

David Sunderwirth: It's interesting, because the politicians seem to focus a lot on the negative externalities of carbon or coal. And yet there doesn't seem to be as much conversation around the negative externalities associated with premature closure of a nuclear plant.

Michael Twomey: Well, that's absolutely right. I mean, one of our frequent critics, the NRDC has been shopping this plan that claims you can get to 100% renewable power in the US combined with energy efficiency. The underlying assumption in their program is that 100% of the existing nuclear facilities continue to operate. That's the only way they can get to their numbers. And when asked about that they don't have a lot of great answers but it's difficult math. Even they can't get where they want to be if you don't have all of the existing nuclear facilities continuing to operate.

David Sunderwirth: Thank you Scott and Mike. Good luck in both New York and Illinois. We'd like to shift gears here in a moment and sort of talk a little bit about market dynamics.

Sort of as a backdrop, nuclear power still represents approximately 20% of the generation in the United States. Unfortunately some of the increases in nuclear generation that are coming online as a result of the new facilities at Vogtle and TVA Watts Bar 2 and Sommer, are probably going to be largely offset by some of the retirements we've heard of, Pilgrim, Fitzpatrick, and then I think just recently, Port Calhoun is in the news as well. The consequence of all this is that in the long run it looks like growth and generation is really going come mainly from natural gas and renewables and certainly natural gas if prices remain at current levels. And this along with some scheduled retirements will probably drive nuclear as a market share generation down to about 20% by 2020, which isn't that far away.

So Susan, I'm going come to you and then I'm going ask for Mike and Scott to chime in here. Nuclear has so many attractive attributes, especially when compared to natural gas and renewables. So how do we acknowledge those attributes from a policy perspective and price the benefits of nuclear in a manner that's going to keep the fleet economically viable.

Susan Mathiascheck: Well, I think there are always at least two sides to economically viable. You got to address supply. You got to address demand. And I think industry is working very hard. I know NEI's spearheading a movement called "Delivering the Nuclear Promise" on making sure that we are operating as efficiently as well as safely and reliably as we can. So I think industry is looking very hard at how to be lean and mean and operate in a very productive and efficient way.

At the same time however, we got to figure out how to get paid for what we're delivering. And low carbon is a huge issue but it's also reliability, it's 24/7 power, it's grid stability. There's a whole host of attributes that nuclear provides. And right now we're not getting paid for any them except electricity.

So we're competing with you know carbon emitting resources that are very inexpensive, i.e. natural gas. And we're competing very heavily subsidized renewables. Until we can level the playing field and identify a real market price for carbon that gets built into that mix, and one would hope for the other attributes as well, including grid stability and reliability and so forth, it's going be hard to make the equation work. If we're not getting paid for what we're delivering, we're going stop delivering it. And that's happened all over the place, Kalani, Vermont Yankee, all the plants we've been talking about here. The trick is finding a system for setting that price. FERC has some of the pieces, the ISOs have some of the pieces, the states have some pieces. And until we get a unified structure that makes sure that we're getting paid for those things, it's going to be hard. You guys are in the trenches on this, you know better than I do. How do we do it?

David Sunderwirth: Mike.

Michael Twomey: Well, we proposed in New York that the state adopt the clean energy credit. What's currently on the table in New York is a multi-tiered recommendation from the staff of the New York Public Service Commission. That essentially creates renewable energy credits for certain technologies and zero emission credits for nuclear. And they're established differently, they're priced differently, they're administered differently. And it's a continuation of this approach that nuclear is really just different and shouldn't be compensated the same way. And in many

ways, it's almost a return to rate-based regulation, is books and records review, an alternative pricing scheme.

And what we've said is, look that's, it's too complicated, it misses the point and it's unworkable. What you need is just a clean energy credit for all technologies. It's fuel neutral, it's technology neutral, and what it does is it compensates generators on an inverse proportional basis to their carbon emitting condition and it's market based.

So you value a megawatt of power generated in a nuclear plant in the same you do at a solar facility or a wind farm – taking into account your capacity factors. And if you set up a market based, technology neutral, fuel neutral process then you will compensate the nuclear facilities for the carbon profile that they have. And it's easy to administer, what it requires you to do is admit that nuclear is a beneficial technology and a generation source that should be preserved. Quite frankly that's a policy adoption that is difficult for some of the folks that we deal with to accept but we think that that's the right way to do that.

I mean, just to compare, in Massachusetts, a few years ago, it didn't go forward but the Cape Wind project was a big, supposedly going to be a big success story in renewable generation. What the governor of Massachusetts at the time, the former governor, not the current governor, in the context of approving a merger of utilities, essentially twisted arms and got the utilities to sign up for $187 a megawatt hour, $187 a megawatt hour power from Cape Wind for 20 years with a fixed escalation of 3.5%. So by year seven the price was going to be $300 a megawatt hour and by year 15 it was going to be $400 a megawatt hour. And by and large, people in Massachusetts were okay with that. Not some of the large industrial rate payers, but a lot of policymakers, both sides of the aisle, were okay because we weren't going to have as much carbon emitted by having this great wind farm. And we were willing to pay $200, $300, $400 a megawatt hour at a time when the price for power was probably in the 40s. So five times the price of power, six times the price of power, eight times the price of power.

And in the meantime Pilgrim Nuclear Facility is sitting there generating power 24/7 base load and all we get is the $40 a megawatt hour. And we didn't ask for $200 a megawatt hour. We might have been able to keep that plant open if we had been able to sign a PPA for $60 a megawatt hour. But because of the politics and because of the situation we have with nuclear and its perception, that plant is going to close and as a result the carbon profile in Massachusetts is going to be substantially higher than it was. And of course, Cape Wind collapsed under its own weight, in any event.

Scott Brown: Yes, I mean it's economics 101. The preferred solution, the most efficient solution, quite frankly would be a national carbon tax that gets administered across the board. If we wait for that we'll have a lot less plants by the time it goes, so the reality tells you that unfortunately if asked, and we can go all the way back to one of our previous CEOs, John Row, who was one of the most outspoken in the industry on that's a reality where we should go.

Let's put that aside, now as I said, you get down to the states and you go, we agree that a technology neutral, attribute-based approach will be the right way to go, I see nuclear a lot more like renewables.

Sorry.

Susan Mathiascheck: It's okay.

Scott Brown: A lot more like renewables than traditional fossil fuels. And if a state decides that it wants to accomplish that, it really should be included and we'd like to see that go forward. But the reality is, we're in the fourth quarter of a game for some of these assets that you need to make a final decision on whether there is going to be the support or not. As I said to you last night, we can look any policy maker in the eye and go through a laundry list of actions that we've taken around each and every one of these plants to say, here's what could be done. We're down to the need to act on what's on the table.

And if not, we'll have to take actions accordingly and unfortunately, with these plants, once they are turned off, you don't turn them back on. There's not a mothballing in this industry as you do with some of the traditional fossil plants. So, the consequence, they're not there. And one just needs to look at Wisconsin, and the impact to the local economy around the Kawani plant. It's been well documented.

And that's why you do see labor, you do see the towns, you do see the employees of these plants that are second to none in quality people, and people that are the best at what they do stepping up to ask for this. But one of the messages I'd like to leave you with today is the financial industry needs to get there as well, because this will have consequences through what you all do as well. Especially those that are involved in managing the decommissioning funds. As these are assets that weren't expected to be utilized in this kind of time frame. So this is something we're all living with and we do need to make sure that action is taken sooner rather than later.

Michael Twomey: Yes, I mean to put a finer point on it, this group really has been charged with taking care of the cow when its contribution to the meal has been milk. And you're about to be taking care of the cow that is contributing to the meal in the form of steaks, because we're going to have to start spending the money in the decommissioning trust funds for these facilities and deplete those funds. And that probably happens over the near term if we don't see some policy changes.

David Sunderwirth: Thank you, guys. Steve, I haven't forgotten about you. So I'm coming to you with some questions.

Let's talk about regulated markets versus competitive wholesale markets. I think we can all agree, that's made abundantly clear here today, that the nuclear fleet as a whole is very important when it comes to meeting our greenhouse emission targets not only domestically, but internationally as well. Unfortunately merchant plants tend to be more exposed to wholesale price fluctuation, especially when compared to their regulated brethren.

So it's made even more urgent by the fact that 50% of the nuclear capacity operates within the competitive wholesale market. So Steve, I'm going to read this question for you because it's kind of involved, but how do you think about the intersection of market design and energy policy within the competitive wholesale markets, without further disrupting or distorting the tension between renewable support mechanisms and a desire for a fair and open market access?

Steve Piper: It's an interesting question, it's a real dilemma and I think the panelists have really touched on it. Anything you do in the current context is kind of the nub of the dilemma that tends to make the existing new clear fleet a little more costly. Same things for renewalables, by the way,

it just kind of increases that spread between new natural gas plants, right? They're cheap to build, whether you're talking about peakers or combined cycle plants. And natural gas is historically cheap and we are in a structural surplus of natural gas. That's driving a lot of the dynamics that we see today, obviously. But early on it was good times for nuclear plants, right. The price signal in the hourly market, security constrained economic dispatch, hourly price spikes that were meant to compensate capacity.

And natural gas prices could routinely go to $10, $15 in MCF. That policy really favored incumbents, and it favored nuclear plants in particular.

So if you go back to the late 90s, the early 2000s, those early days of, for lack of a better term, called competitive wholesale markets, tended to favor incumbents and nuclear plants in particular. The policy makers sort of quickly realized that no new capacity was being built. And, it started to really evolve those rules, and kind of jerry rig rules to encourage new entrance into the market. The forward capacity markets in particular.

And in that process, they really started to put big red targets around nuclear plants in particular with mitigation rules and limitations on what kinds of cost recovery you could bid into those capacity markets. It really constrained the ability of those operators to capture greater revenues. From those markets obviously, look, the cost of gas continued to fall. The experience with CCGTs and improving cost profile there, allowed them to really come in and undercut the whole competitive economic proposition of nuclear plants. And so, as much as the emergence of cheap natural gas has really put strain on the financials, the kind of evolving capacity market structure has also, maybe contributed more to the distressed economic situation, the inability to earn or return an investment that nuclear operators face today.

David Sunderwirth: This, this next questions going to be more from a investor's perspective. Historically investor owned utilities have been viewed as safe investments particularly in times of economic uncertainty. That being said how are investors today looking at companies with significant nuclear exposure. And particularly in light of our clean climate concerns and then after that I'm going to come back with one more little sort of thought.

Steve Piper: Certainly I think investors like scale and like well-run companies and that those factors probably more than offset any perceived risks, in particular with nuclear plants. And good to have Entergy and Exelon here, compared to the peers that we track in our equity indices, Exelon and Entergy have outperformed. Obviously their nuclear operators are underperforming, but they're not really tied to their nuclear operations.

Southern company, it's all about Kemper County and the IGCC and what a mess that's become. You know, NRG, their yield-co platform is hit on hard times. So you can identify really factors not related to nuclear plants. And I think as a whole, investors don't have a problem per se with nuclear exposure.

David Sunderwirth: And you're touching on another issue that we'll get into a few minutes, which is the whole issue of fuel diversity, which I think is playing into that. So from S&P's perspective, no discernible differences in equity evaluations among companies with and without?

Steve Piper: I think if anything, it tends to be a positive. Now, it can be event-driven, certainly. Of bad outcomes, their particular nuclear plant can certainly have negative consequences. But I think

on a general going forward basis, scale is viewed as a positive and is viewed as a stable and safe investment.

David Sunderwirth: Okay, thank you. For our last round of questions what we like to do is sort of explore the inner play between natural gas and nuclear. I think we all understand that from an environmental perspective, natural gas is preferable to coal generation particularly when natural gas prices are low. However, I think it's also commonly understood that in order to achieve our climate change reduction goals, we're going to need to have to dramatically reduce greenhouse gases going forward. And I think the accepted target is roughly 80% of 2000 levels by 2050. And translate that, what that really means is that we're probably going to have to eliminate much of the fossil fuel that we're using today for generation. And that includes natural gas. So in some very real way we need to be thinking beyond natural gas. So Steve, I'll come to you on this and then I'll ask Scott and Mike to chime in as well. I think that we are all aware that in 2015 natural gas I think exceeded coal in generation stack for the first time in about 30 years.

My question is, how do we decarbonize the environment, achieve our clean power objective when CPP and low natural gas prices seem to incentivize the building of new natural gas to replace retired coal and in many instances we're now seeing nuclear. Does natural gas, do natural gas and renewables have the scale to really replace the coal generation that's being retired, and is that really desirable? Multi-part question, I'm sorry.

Steve Piper: No, no great questions. And there was certainly natural gas is having a moment as I described earlier. And maybe that moment will go on for a few years. Like you said, exceeded coal in 2015, probably going to do so again in 2016. And the nationwide emissions reductions that kind of could be seen from switching from coal to natural gas added to that excitement and is likely to kind of really limit the growth of emissions from coal going forward. But when combined with our shared commitments that the Obama Administration put together with China, it seemed like a real possibility that these two fossil heavy countries sort of come together and start to bend the curve on their carbon emissions trajectory.

But what we're seeing, if you go to the Conference of Parties, Paris last year, that has almost taken a backseat. It's yesterday's news. At least in principle they endorsed even stricter targets, something closer to the 80% that you highlighted earlier. Within that framework, if we're going to be more ambitious about our carbon goals, the Clean Power Plan and the agreement with China by themselves aren't going to be enough. We're starting to kind of see, I think, a normalization of the carbon emissions dialogue. It's maybe a little less controversial, on climate science. And, more urgency around meeting more aggressive goals. At the same time, if natural gas has to accommodate a massive turn-down in coal demand, it's not going to stay cheap. There's no way it can do that, it can't accommodate that much demand without being some very serious price increases. And that those two factors, the urgency of greater reductions, and the likelihood of larger price increases the more reliant we become on natural gas, starts to create a window where nuclear power can maybe work its way back into the mix so to speak.

Scott Brown: One item to build on again natural gas it's a wonderful technology. We own a large part of our fleet has natural gas, we're building two state of the art plants In Texas right now that'll have heat rates that would knock the socks off anything that's out there right now, which is all good. They don't use water, they're air-cooled, so they deal with water issues which is kind of the fourth-leg of this industry-

Michael Twomey: Right.

Scott Brown: Is the issue of managing water and what it means to produce the energy that the country needs to move forward

I think that the tell for me on this is that you've got to again create the expectation of performance. Natural gas is a just in time delivery resource. It's connected to a pipeline, by the time it gets there, it turns on. If that pipeline isn't performing, if there are other sources that need that pipeline like home heating, you may not have the resource to be able to turn on.

So what is your solution?

If you price everybody off of that lack of performance requirement, you're going to drive everybody down to that, and you are going to lose a lot of your resources that you would count on during that. So how do you require that gas resource to either take steps to have back up or have other arrangements to have back up?

The same thing with renewables. Again, renewables, once they're built and once they're operating and if their source is there, whether it be the sun or the wind are wonderful. But if the sun's not shining, if the wind's not blowing, they're not producing anything. So what is the cost and the consequence of giving you the reliability levels, giving you the cost points that make sense for that. If we don't hold all resources accountable like that, then you are going to see those that can produce over time, not be able to economically do it and go away. So it's that balance that we need, that to me is diversity. It's not just fuel diversity. It's really performance expectations that then allow different resources to compete. If you can get that into the rules, markets are very efficient at pricing them. And in the meantime what we've got to decide is, do you build some bridges until you can get to that point. And that's a lot of what we talked about today is building bridges that keep you in the options to be able to get that kind of output.

David Sunderwirth: Thank you. Mike?

Michael Twomey: I agree with both Steve and Scott. There's a complexity here for nuclear and Scott mentioned it earlier, that doesn't attach to any other technology. Which is that once you close a nuclear plant, for all practical purposes, it's gone. It's not technically impossible, but it's financially impossible to continue to keep the licensing basis up when you're getting no revenue. So Vermont Yankee is gone, Kewaunee is gone. We can't change our mind five years from now and say we really wish Kewaunee were back online. And that puts a hard stop on some policy discussions. And we're a supporter of competitive markets. But to your policy question, you really have to decide which lane you want to be in. Because if you have a vertically integrated utility with a strong regulator, then you can make policy decisions about fuel diversity, about costs. You can have a system planning group with a man or a woman in the corner office, with a propeller hat on making decisions about what's the right thing for the system for the next ten years.

Because the energy infrastructure is a ten, 20 year commitment. And if you have that model, you can make those decisions, you can factor in your carbon reduction objectives into those policy decisions – that affect the infrastructure decisions. Or, you can have a market where you design the rules, you set the price, and you can achieve the objectives by making decisions about what a, for example, carbon price would be. What you can't do is have a hybrid competitive market where some people get PPAs, some technologies are excluded. Where you have rules about nuclear that

are either hostile to the technology or unhelpful to the technology. And the decentralized nature of the competitive market is something that has to be tackled. You know, FERC has a piece, the ISO has a piece, the state regulators have a piece. Nobody has ultimate responsibility. And I sat in a room with a bunch of our lawyers who were telling me all the reasons why this group didn't have jurisdiction, and this group didn't have jurisdiction, and this group didn't have jurisdiction, so nobody was responsible.

And my perspective is, we're all responsible, because when the lights go out and people can't get the power they need, they're going to show up in everybody's offices with pitchforks and they're going to demand change. And, we have to work through these difficulties. And, get to a point, I read an article last week, and God knows, it may not have been accurate.

[LAUGH]

But, that California is facing some potential blackouts this summer because of their situation with their infrastructure. With San Onofre closed, and they've got the issues related to the SoCal Gas plant. And we may be hurtling toward that future. You mentioned that natural gas is more than coal for the first time. In New England, the electric generation sector is pushing 70% reliance in natural gas.

David Sunderwirth: Yes, that makes sense.

Michael Twomey: And when I went up to meet with a group of people when we closed Vermont Yankee, a more senior person told me that one of the reasons the New England governors embraced commercial nuclear technology in the 50s and 60s was because they were worried about energy security and not wanting to be at the end of the pipeline, and not national energy security but regional energy security.

And they embraced that commercial nuclear technology early, because they didn't want to be at the end of a pipeline that started in Texas. And you know, I think that that wisdom has been lost in the last 40 or 50 years. And if gas prices go back up or if pipeline infrastructure can't keep up, then I think there's going to be some hard questions that have to be answered.

David Sunderwirth: Thank you.

I think that kind of wraps it up for our panel for now.

We want to leave some time for Q&A and I want to thank my panelists for being here and we'd like to open up for some questions.

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