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RAPPORTEUR'S SUMMARY [*]

Session One.
Carbon Policy—Looking Under the Lamp Post

After Climate-gate, after Copenhagen, after Cap-and-Tax, and after the election, the new conventional wisdom sees comprehensive carbon policy in the United States receding into the distant future. State initiatives are inconsistent and may be unsustainable without a broader consensus. In the search for consensus, a new conventional wisdom focuses on what is pragmatically achievable. Perhaps more R&D and technology innovation, investment in demonstration, and greater end-use efficiency that comes at little or no cost can receive bipartisan support. Agreeing to do what is not controversial, otherwise beneficial, or free, seems like a wise policy. But is this policy enough? Or is it like looking for the lost keys under the lamp post? Is more necessary? Is there a meaningful carbon policy that does not involve a (substantial) price on carbon? If more is necessary, what policies or strategies today should be designed or implemented to help us find the keys to a successful and sustainable carbon policy?

Moderator: We have an interesting topic to talk about, which is carbon policy, imagine that. Imagine that we are going to talk once again from a set of new perspectives about carbon policy.

If we had been having this same panel just a year ago, it would have been, I think, quite a different discussion. We would have been looking at quite a different set of prospects. We would have been talking about a different subset of issues.

But that was then. This is now. CO2 and greenhouse gases continue to be emitted into the atmosphere. The economy continues to struggle. And we continue to press ahead in search of some coherent policy post 2010 elections. So we are very lucky to have a distinguished panel to offer some different views on that.

Speaker 1:

I'm going to immediately disclaim any possibility of suggesting that there's going to be coherent policy. But I will try to see what we do have out there. So I've called this "Carbon policy, when there is no carbon policy," because, as a matter of fact, a bunch of things are happening. Some of these things would be happening even if there were federal legislation.

[*] HEPG sessions are off the record. The Rapporteur's Summary captures the ideas of the session without identifying the discussants.

Some of them will happen precisely because there isn't federal legislation.

I'm sure some of you people in the room know Gina McCarthy. We like to take credit for Gina in Massachusetts, because that's where she got her start. She runs EPA's air program, and she is very clearly taking the position that she's not going to pretend that she wouldn't have liked to have had climate legislation, but they're doing a bunch of stuff.

Gina is very clear that they're moving forward on a whole bunch of initiatives, and that a lot of these initiatives, they expect to have climate impacts, even if they're not really about climate. And nobody should think for a second that they're not aware of these ancillary impacts of traditional air regulations, (or some of them aren't air regulations). EPA knows what the impacts of these things are going to be, and then they get there, you might say by hook or by crook.

So you can categorize things in two ways: things which are explicitly about climate change, and those which are not explicitly about climate change, but which are going to have impact on climate emissions one way or another.

So to go quickly through some of these, the first thing is, of course, the Tailoring Rule, which is the EPA stationary source rule under the Clean Air Act, essentially applying *Massachusetts v. EPA*. Starting in January, we are going to be regulating sources of greenhouse gases, largely large power plants and other large emitters. The first step is only for facilities that would need a permit under the Clean Air Act anyway, but eventually moving on to sources that are only in because of new emissions of greenhouse gases over the threshold.

I will give a very brief editorial, which is: nobody can pretend this isn't going to be a mess. Those who are in favor of more aggressive regulation and wanted legislation would say, "yeah, this is going to be a mess. We wanted legislation. And we could have done it more efficiently then, and we would have had cap and trade."

I won't take a position on which camp I'm in generally, except I will say those who are in the business know that this program is a mess. The NSR/PSD (New Source Review/Prevention of Significant Deterioration) program, and the permitting-- many of you have to face this. If you're in the trenches and doing this stuff day to day, actually complying with these regulations is a nightmare. And from a business point of view, in terms of rational planning and doing things efficiently and being able to predict outcomes, it's a nightmare.

All of the companies that have been the subject of EPA's new source review enforcement efforts push the limits, and they hire smart lawyers, and they try to minimize their compliance costs. But they're not all out there simply trying to avoid the law. The law is a mess.

So that's my quick editorial comment. In the absence of climate legislation, where EPA is forced to regulate under existing authority, that existing authority is a really messy tool. But it's out there, and absent congressional action to preclude EPA from regulating, it's going to happen, and there's no choice.

Once you are subject to this program, this is all about BACT, best available control technology. EPA just came out with its guidance on that. It's sort of funny, the different interpretations of EPA's guidance show the problems with regulating this way because of the uncertainty, because some people read that guidance, and basically say, "You know, this doesn't really do anything or say anything." Whereas in my view, I am quite worried that EPA is going to look at this guidance and use it in ways that will require substantial changes. And the way I get there is, I'm putting this together with a couple of recent EPA permitting decisions on BACT, one of which said that if you are going to have a coal plant, that you need to at least look at IGCC. And another one said, if you're going to build an IGCC plant, and you can just fire gas, you need to look at gas. Well, does that mean that if you're going to build a coal plant, BACT for a coal plant is now natural gas? It's not impossible.

And the other thing is, there's a lot of discretion. Individual states implement this on their own. You're going to get inconsistent results. It's going to take some time to shake out to figure out what BACT means for greenhouse gas emissions.

Next, I'll talk about carbon capture and storage, which EPA is trying to encourage. I do love that cartoon. I don't have that much to say, other than that clearly, if we are going to have green gas regulation, and we're still going to have a significant coal fleet, there's clearly going to still be a push for this. And I see this only as increasing, following the elections and where Congress seems to be headed on these issues. So there's going to be push for it, which means the EPA is going to be regulating it, because they don't want to realize that they've kind of missed the boat and have some disaster on their hands.

Next in the overview, we go from the federal to the state and regional programs. I'm from Massachusetts. We are very proud of RGGI (the Regional Greenhouse Gas Initiative). It's not clear, again, how much RGGI's actually doing in terms of its impact on emissions, given where the economy is and given where the cap has been placed. But these regional programs are in effect in various places, and they would have gone away at a certain level if there were federal legislation. I was a big fan of them going away. It's going to be hard to integrate all these different programs. But in the absence of federal legislation, they're not going away.

Then we have what I think in the long run is almost the bigger piece of this, which is not just regional cap and trade programs, but state-based economy-wide programs. So they're not just power plants. California and Massachusetts' programs both have original names. They're both called the Global Warming Solutions Act.

I think all of you have a blog post I just did yesterday, on what are the different pieces of climate policy, and it really is a little bit of this and a little bit of that. And I realize when I talked about the economy-wide initiatives, I didn't even really talk about things like what people would talk about as green design or sustainability. But one of the things mentioned in this post yesterday was, there was just this 9th Circuit decision two days ago, Monday or Tuesday of this week, affirming a regional California regulation which requires folks in the construction industry to calculate greenhouse gas emissions and potentially reduce them, offset them, pay a mitigation fee. And there are similar efforts in Massachusetts.

On the federal side, the Council on Environmental Quality is working on, they're now overdue, but are certainly still expected to come out with a guidance document on how to apply NEPA, the National Environmental Policy Act, to greenhouse gases. We already have a policy in Massachusetts. California has one. New York has one. Several other states do. These policies essentially require, for any new development, assessment of greenhouse gases and efforts to mitigate those. I actually see land use planning with NEPA and state analogs as a part of that, as being a significant piece of what you might call a carbon policy going forward. My clients in the real estate industry, it drives them nuts. But it's the future. That's one piece that I just don't see changing. And it's going to have potentially, depending on how these things play out, significant impacts, if on the federal side under NEPA, you see significant consideration of greenhouse gas emissions, that affects big transportation projects, all sorts of infrastructure projects, particularly coastal development. So I see that as a big piece of carbon policy going forward.

Lots of states say that they're doing something about carbon. I was interested to see just in the couple of weeks after the election, New Mexico still just came out with some climate regulations that are going to limit emissions in New Mexico. Different states have differing degrees of skepticism, as we might say, about climate. But there are a lot of states representing a significant part of the economy that are going to continue to act in this area.

Obviously, an issue that a lot of people in this room know a lot about, and more than I, is renewable portfolio standards. It doesn't look like that's going to happen at the federal level at this point. I never understood why, when climate legislation died, people had thought that our renewable portfolio standards or renewable energy standards, whichever you want to call them, would have any legs on the federal side. I'm not very good, really, at predicting federal political trends, but I'd be surprised if we saw a renewable portfolio standard or renewable energy standard at the federal level any time soon. But again, these are going to happen on the state side, and they are going to drive things from high greenhouse gas emitters to lower.

So now we get to those things which are not explicitly carbon related. And the biggest of those on the federal side is the Clean Air Transport Rule. It doesn't affect the entire country. But it does affect a significant part of the country. And there is no doubt that implementation of the transport rule is going to have a significant effect in driving out older, less efficient, particularly coal facilities, because these are going to be fairly stringent new regulations, and some facilities will decide to shut rather than comply.

Another issue of the sort of "be careful what you wish for" phenomenon the Transport Rule replaces what was called the CAIR Rule (the 2005 Clean Air Interstate Rule), which was a Bush era rule, which although environmentalists appealed, generally had substantial support among environmentalists and was a much better rule than this. And the reason it was a much better rule was that it allowed regional trading, interstate trading. That was struck down because the Clean Air Act doesn't permit interstate trading in this context. There are some areas where it does, but the general notion that the point of the CAIR rule was to address complaints from downwind states about upwind emissions, and the statute was pretty clear that if you have a problem with upwind emissions from a particular state, that particular state has to reduce emissions to comply. And the court simply said, "Sorry, it may be good policy, but it's not what the Clean Air Act permits. Go back to Congress."

There were, I don't know what you'd call it, nascent congressional efforts to amend the Clean Air Act without dealing with greenhouse gas stuff to provide for essentially the CAIR rule. It hasn't happened yet. Don't know whether it would happen. You could sort of imagine it might happen, because in that area regulations are going to happen anyway. And they might as well happen in the most economically efficient manner. I suspect that's more hope rather than expectation on my part. But it's conceivable that Congress could act to provide for essentially a more efficient transport rule. But otherwise, this is going to happen, and it's going to result in some small facilities shutting.

Mercury Maximum Allowable Control Technology (MACT), is another set of rules [that could impact carbon emissions]. We don't need to go in to the details, but again, it is just making the economics of smaller, older facilities more difficult to sustain.

Two 2010 studies of the economic impact of regulations are the Credit Suisse Report (October 2010) and the MJ Bradley Report (August 2010) Some people here may have their own results, and may even know more than I or than these studies reflect.

The Credit Suisse report came out six weeks ago, predicting somewhere between 50 and 70 gigawatts of coal plants retiring as a result of the transport rule and the mercury MACT rule. MJ Bradley has a slightly lower number. I don't think anybody in the industry doubts that significant shutdowns are going to happen.

The next set of regulations to look at are an EPA proposed rule to regulate coal combustion residuals under RCRA (the Resource Conservation and Recovery Act). Here, too, I wouldn't predict where EPA is going to end up on the coal combustion residuals rule. I can actually imagine them taking the less stringent approach in not regulating under subtitle C of RCRA, but there's no doubt, if you get a theme here, there are a lot of people out there who don't like coal. And there are a lot of efforts to make coal more difficult. And this is one of them.

And again, the thing to remember here is, this isn't all about EPA, because in the absence of EPA, you've got a lot of citizen groups who have statutory language they can look to, and they're going to be filing a lot of litigation. It's already started. There are a number of cases. So just one more thing to keep in mind.

The next policy piece--again, really directed at coal, not about emissions, not about greenhouse gases--is changes to the NPDES (the National Pollutant Discharge Elimination System), the Federal Clean Water Act regulations for these facilities that are coming in 2012. It is a major focus on citizen groups. I don't know where EPA's going to go with it, but there's no doubt that the regulations are going to happen. Yet another sort of cost to bear.

Finally, mountaintop mining. There, too, it is clear that there's been a change. How the election affects this is a difficult question. When a new senator from a coal state did an ad shooting a hole in what purported to be a copy of a cap and trade bill, you know that there's going to be pressure on EPA to keep mountaintop mining alive. But there are pressures on the other side as well. And I don't expect EPA to just roll over on this one.

Again, it's important to keep in mind the role of citizen suits in all of this. They challenged individual facilities. The cases that I mentioned earlier about BACT were the results of citizen suit challenges to permits issued by state regulators. Those are going to continue. So they'll have individual facility challenges. They're going to have litigation about mountaintop mining. And there are some folks who have explicitly basically said, "We're here to put coal out of business." And they're not going to stop.

It's important to keep in mind that Congress may act to preclude greenhouse gas regulation. If they don't, we're going to have it. And on all these other areas, the statutory provisions are already there. So Congress would have to act affirmatively to change those provisions, if they really wanted to cut the legs out from under the citizen groups, which is why my takeaway here is, be careful what you wish for.

I never really understood the terms of this debate in a lot of ways. In the absence of climate legislation, EPA has no choice but to act. People are complaining about EPA. But *Massachusetts v. EPA*, the Supreme Court decision basically gave EPA no choice. It said it [carbon dioxide] is a pollutant. They've got to regulate it. They don't really have much choice under the New Source Review part of the statute but to do what they're doing.

My real concern is that I think that the tailoring rule is vulnerable, but not because they're regulating greenhouse gases, but because they're excluding sources that are less than the statutory number, which is 250 tons. If the tailoring rule gets struck down, I don't think we're going to see every boiler in the country regulated. In the context of the CAIR rule, the Court learned not to strike down these rules, so it's essentially going to leave them in place until EPA can come up with something different. But there's a decent chance that a court will say, "Yes, EPA's got to regulate greenhouse gases, but no, you can't do the tailoring rule, because you can't exempt all these sources." And that will really throw it back in the lap of Congress, and God knows what happens at that point.

But in the absence of climate legislation, we have current EPA regulation. If there's no EPA regulation because Congress acts to preclude it, well, then there's citizen suits. The Supreme Court just this past week agreed to hear the public nuisance case, *Connecticut v. EPA*, which is basically a question of whether people can bring public nuisance cases for climate change.

My prediction is near certain as it can be in the world of litigation, that if Congress doesn't do anything, that public nuisance litigation will be precluded. The Supreme Court will say, "There's a federal program in place. You can't bring these cases." If Congress acts and precludes that federal program, I can imagine the Supreme Court going the other way and saying, in the absence of a federal program, then there is public nuisance litigation. And God, that's a world that I don't want to see. That's a world that helps nobody but people like me. Because there's going to be this litigation. And defending it….I actually hate litigation. Litigation is stupid. But this would be fun litigation to defend if I had to do it. But it's not going to be good for the energy sector. It's not going to be good for the economy.

And again, that gets to my bottom line, which is, businesses, I don't have to tell people, like certainty. And we don't have it now. And depending upon which way Congress goes on some of this, we may even have less certainty than we have now. So that's not a pretty picture, but that's where we are.

Question: I wanted to ask a bit about the public nuisance litigation. What are the rules for that? Is it sort of broad, that you can just sue anybody that you consider polluting in any form? Or is there some structure to that environment?

Speaker 1: There are rules. That's what the law is about. You know, at a certain level, the snide answer is, it's a free country. Anybody can sue anybody. That is part of what's going on. I think that the people that are bringing this litigation, sure, they'd love to recover damages, but a lot of it is simply to increase the pressure, to increase the uncertainty and the leverage they get just from having the lawsuits.

At a more technical level, but not taking up too much time, and I think this is sort of what you're getting at, one of the big challenges to these lawsuits is what we call standing. Do these people have standing to sue? Have they been harmed? I honestly think that it's kind of crazy, that the courts could conclude that they don't have standing. The Supreme Court absolutely could face that issue as well.

Basically the Supreme Court has two issues that are before it when they take this case. One is whether the plaintiffs have standing. The other is, even if they have standing, is the lawsuit essentially precluded by the federal program? On the standing side, there are two pieces that people like me wonder what the heck we're doing here. One is, can you tie the damage you're saying you suffered to the actions of any particular defendant?

And what the courts have said who have let this litigation go forward is that a tiny little bit is enough. You don't have to bring everybody in. You don't have to make it 100%. You don't even have to say more than 50%. But if they contributed to the harm, then you can haul them into court.

The second piece of the standing test is what's called redressability. If you win, it's supposed to remedy your harm. I never understood how they get over that threshold. But some very smart people who are called federal appellate judges so far have said that they've gotten over the redressability threshold.

I could see the Supreme Court, even if Congress acts to preclude federal regulation, so that the Supreme Court can't preclude the nuisance cases, because there's a federal program, the Supreme Court might still say that there's no standing. They have not been that sympathetic to citizen standing in recent years. But it's not a slam dunk that they would knock it out on standing. I'm not on the court.

Moderator: I used to have a boss that always would tell me, technology will tell you what you can do. Economics will tell you what you should do. And then politics tells you what you will do. And that's a pretty good start, if we substitute politics and move to policy, it's a pretty good start on where we are. I think politics is telling us a lot about what we can't do right at the moment, and that is to have an overarching coherent policy expressed in major legislation. But let's, if we may, follow down that path that my great mentor laid out for me and go to technology for a moment.

Speaker 2:

I am going to talk about what we should do, and we've talked a little bit this morning about the messy adaptive regionalized process of trying to get there. This talk is about a study that the California Council on Science and Technology is doing, we're right in the middle of, actually, or towards the end of, to try to understand what California's energy system might look like if we were going to meet the governor's executive order for 80% reductions in emissions by 2050.

Everyone knows about California's AB32, but Governor Schwarzenegger also signed an Executive Order S305, which does require 80% reductions, which is unusual, and that gave us some cover to actually look at what it would take to do that. What this level of reduction means is that we're going to go from about 475 gigatons of carbon dioxide equivalent emissions per year down to something closer to 80. And we're going to do that in 40 years. That's a big step.

Meanwhile, the state is going to grow, hopefully. Population-wise it probably will grow a little bit faster than the rest of the country. And we hope at some point that we will have economic growth again. So if we just continued the way we were going, it would mean we'd need about twice as much energy as we use today to meet those needs. So that actually means that we have to do more like 85% reductions in energy intensity than we have today, because we have to have growth at the same time that we're cutting emissions by 80%.

So what we're trying to do is look at what a target energy system would be. The "U.S. Energy Flow Trends" is a plot for the United States that's produced by Livermore National Laboratory. And on the left you see all the various sources of energy, all the ways in which that energy is transmitted over to the right hand side, which is the end use, and the big grey bar at the top is the wasted energy, due to inefficiencies, and also just laws of thermodynamics.

So what we're trying to do is account for the entire system as one system. One thing that electricity producers need to really understand is that increasingly we're going to connect what has largely been a disconnected system, the transportation system and the electricity system. But we're increasingly going to be connecting those. So we have to think about the whole system at once. Where do we get it all? How do we transmit it? And how does it meet all of our needs? At the same time, each of these sources has various carbon flows, and this is the thing we're concentrating on to minimize. So we're growing and minimizing the carbon flows down to nearly zero.

There is a similar plot for California. You'll notice that the rest of the country, or on average, is a bit slimmer on transportation. And when you get to California, a larger part of our energy goes to transportation. So that's the difference between us and the rest of the country, and you might want to keep that in mind as you try to understand how what I'm going to say applies to beyond California.

So the idea here is that we're going to try to get a target system that meets our needs. And the thoughts that we have here are that if you don't know where you're going, you might not get there, and so we want to figure out not how to make reductions, which is what everybody's talking about-- our first speaker this morning talked about how we get started on the path of reductions. This is an entirely different approach, where we say, what is it, where do we want to go? And if you don't figure that out, then you could head down some paths that are dead ends.

There are a lot of things that would reduce emissions now that will have no place in an energy system in 2050 that has literally no emissions. So our goal is to try to identify those targets. This is the guts of the whole project right here. And the bottom line is that if you're not going to have emissions, you can't burn fossil fuel without sequestering it. And that's really the nut of it.

So how can you do that? Well, we have a logic for figuring it out. And the first part is that we try to build in as much efficiency as possible. And at the same time that we're building in efficiency, we electrify. So all the possible ways in which you can electrify, you do. The reason you do that is that it's much easier to decarbonize the electricity system than it is to decarbonize mobile sources of burning fossil fuel. It's pretty hard to take the emissions out of your car and sequester them. So it would be better if you ran your car on electricity and then sequestered the carbon, if you had any carbon from the electricity production. So we electrify, and in one step we electrify, and we also make everything very efficient. In some cases, the electrification itself is more efficient. It just uses less primary energy.

Then we asked the question, how are we going to decarbonize the electricity system? And we posed three different ways of doing it: with nuclear power, with fossil fuel burning and carbon sequestration, or with renewable energy. And the fourth part is that whatever you choose, you have to be able to follow the load, and we are treating that as a separate sector, because each of the different ways in which we posit providing electricity have similar and different needs for load following, and if you do it with natural gas, you're going to produce emissions, and you have to account for those. So we account for those separately.

Then, after you've done that, you still have a remaining use for fuel. And that is because we can't electrify a lot of transportation or high quality heat, and so in that case, we try to primarily use the biofuel that we have, and we look at how much emissions we can expect from that biofuel.

So that's the logic that we followed. And in doing it, we looked at these sectors, and the analysis says how much can you do by 2050? And what would be the emissions when you try to do that? And for the technologies we evoked to make these portraits of the energy system, we put them in bins. We didn't use bin four, which is just research concepts. We primarily tried to use bin one and two, things that you can buy at scale today, or things that are in demonstration, and then in some cases, we had to invoke bin three. So at the end of the study, we're going to be able to say how much technology, not only what the target looked like, but how much technology in each of these bins we had to invoke. And I think that's one of the advantages of the study, that it shows just exactly where technology innovation is going to be needed to meet these kind of targets.

I'm going to give you a quick flavor of some of these. I want to also say that this is a committee on the order of 40 people. We had two Nobel Prize winners when we started, but Steve Chu became the Secretary of Energy. We have representatives from every major research institute in the state that does energy research. The process right now of having the smaller group of authors, which is about a dozen people, produce those results and send them to the rest of the committee is just about to happen. We're in the last throes of arguing out our standards, so that everybody is on the same page, and everybody is doing their analysis the same way.

And so what you're going to see at the end is, I have three different slides of results that all took place within three different days. Just to give you a feeling for how this discussion is going.

This particular slide just shows you what happens when you invoke efficiency and electrification at the same time. For each of these sectors that use electricity, that use energy, we tried to electrify as much as you can, and you see that the electricity demand is going to go up because of electrification and down because of efficiency. And the demand for fuel will go down. And that's the net result.

Here's an example of bins for the building efficiency technologies. We divided technologies into bins based on their stage of development—from commercially available (bin 1) to only at the theoretical stage (bin 4). And you can see in this case, people are saying, we're going to get about 80% of the way there with technologies that are already available more or less. And that's really encouraging. And in some cases, we're seeing technologies all the way there with, say, a bin two technology. But my guess is that in the end, we're going to see, and this is just my guess, but it's going to be about 50 or 60% of the way there with bins one and two technology, maybe as high as 75 or 70% there. But you're not going to get all the way there without invoking some bin three technology.

Here is a table related to total energy demand--this is the piece that you really need to pay attention to. Basically, electricity demand doubles at the same time that you have to decarbonize it. This is the challenge of 2050. If you're going to eliminate emissions, even if you do all the efficiency stuff you possibly can (and I don't know if you noticed, but it was like a 40% reduction or a 40% decrease in energy intensity that we invoked through efficiency), even so, because you're going to electrify, you're going to double the demand for electricity. This is one of the key messages of the report.

Right now, probably only 20-25% of our electricity production is without emissions. We have to double it at the same time that we eliminate those emissions.

Looking at examples of the breakdown of technologies available for the electricity supply now from nuclear power, they can get there all the way with bin two technology, which is basically Gen III reactor technology.

When it comes to coal or gas with CCS as a source of electricity generation, part of the problem is that you only capture about 20% of the emissions, and so it's not an emission-free technology, so these emissions go into that accounting for how much emissions you have.

For renewables, you can alto think about how renewables will come forward in terms of the same bins. It's a very complicated field. But again, a lot of technologies fall in bin one and bin two, but a significant number will be invoked out of bin three to make this happen.

It really gets interesting when we get to the fuel supply, because we've now [in our plan] electrified all the light duty transportation. You can't electrify airplanes. You can't electrify heavy duty trucks. And so you have to run them on fuel. And biofuels are highly uncertain. We don't know how much supply we're going to have in California. We don't know how much the world will supply, or how much we'll be able to import. Brazil has very high ambitions for producing a lot of it. We also don't know how much the emissions will be. Right now, the average is about 50% of fossil fuel emissions. So you can produce biofuel, but you still get 50% of the emissions you had with fossil fuel. And it's going to take an enormous investment--a trillion dollars was estimated for 500 plants in 40 years to build up what we need to meet California's needs.

So the biofuels are highly uncertain, but they also turn out to be the nexus of uncertainty and importance, because you can't meet the standard unless you make this happen. Our biofuels people on our committee are very optimistic. But you'll see soon that whether or not we meet the standard really revolves around their optimism.

So now we've put together the demands for energy, and all the ways you could supply energy. And now we want to make sure we can actually follow the load. We look at it in a sort of simpleminded way. One approach is to do it with natural gas and have emissions, and we know how to do that. In fact, when the RPS got bumped up to 33% in California, everybody went out and started to invest in more gas plants to follow load. So this obviated the emission gains. But we do know that a lot of work is going on in energy storage, and the fact is, if we can actually change the way in which we provide electricity so that instead of having the supply follow demand, we have more of the demand following the supply, then we will be able to reduce the need for natural gas. And of course, energy storage, if that worked perfectly and was inexpensive, or it was affordable, we could solve that whole problem there.

All of the technologies we looked at have a load following problem. Nuclear power, for example, just looking at that, it's just base load. You can run it in load following mode, but if you do, you lose a lot of efficiency. So some of the other ideas that are out there are to overbuild nuclear power and use the excess to desalinate water, which would be a co-benefit.

So all of these things are in play in our study. And this part of our study is probably the least developed right now. So what we've done for this is just have an estimate of how much natural gas you would use if you had to load balance entirely with natural gas. We are right now just picking 50% of that and hoping to refine the estimate.

This is probably a good point for me to say that this is a meta-analysis. We're not doing new analysis here. We're basing everything that we do on analyses that have been published elsewhere. So we're finding some areas very difficult go get good information on, and this is one of them. So, for example, our estimates of technology bins for load following are really not done.

Now I'm going to show you some results. These are really tentative. You should just take them as something in flux, but it's kind of interesting to see where we are.

First, we didn't have a good estimate on the biofuels, and we didn't have a good estimate on load following. So we said, well, if we figure out how to do load following, and there are no emissions associated with that, and if there's plenty of sustainable biofuels, and the biologists figure out how to do it without emissions, that will be our low emission case. And if, on the other hand, we have to do all our load following in natural gas, and if the biofuels stay at 50% of the emissions of fossil fuel, that will be our high emission case. And these are the results.

We now have nine different portraits of the energy system, and the first one, for example, is we meet all of our electricity needs with nuclear power beyond the renewable portfolio standard. California has a 33% renewable portfolio standard. We assume that that's met throughout, because that's the law. So we assume that that's always met. So if we provide the rest of the electricity with nuclear power, that's case one.

Case two is, we use fossil fuel, and two is with coal, and three is with natural gas.

Four would be, we provide all of our energy with renewable energy, and each of those four cases have biofuels.

So then we get a little bit more interesting, because we looked at the idea of burning the biomass and sequestering the carbon. And that produces a negative emission. And so you can see here that the ranges are enormous. We go from having emissions of zero to having emissions that are well over twice, almost three times the standard.

We felt this wasn't very useful, so we've been pushing now to have the biofuels people give us a better estimate and the load following people give us a better estimate. So I don't have much news on the load following, but the biofuels guys have come in, and here was the first estimate, where we assumed that you could get all the biofuels that you wanted, and that they would be sustainable, and that they would have an emission of 80% of fossil fuels today. And all of these make the standard, except the renewables/CCS. And the reason that doesn't make the standard is that we assumed you couldn't bring low energy density biomass into the state and burn it, and then sequester it. But we could have biomass burning with sequestration by wire, and so we then redid the results, and these are the latest that have come out, and you see that every single one of these meets the standard. So what this hinges on is whether or not biofuels make it. And the biofuels are, from an emissions standard, the nexus of uncertainty and importance, and the key to whether or not we make that emissions reduction standard. Our biofuels people are very optimistic. It's the Energy Biosciences Institute at Berkeley. But we also have Chris Field from Stanford looking over their shoulder. And I think they've come down pretty hard in the last day or so, saying they think they can do it.

These conclusions are mine, because the study's not done, but I think many of these will be maintained. We will have to do very extreme efficiency measures, and they're going to be hard to do. And we have to electrify. I didn't show you numbers, but if we didn't do the efficiency measures, and instead of doubling the electricity system and decarbonizing it at the same time, you would be quadrupling it and decarbonizing at the same time, and that's really too big a lift. So basically, you have to do this efficiency measures.

We think that nuclear power is a pretty attractive alternative for just getting a lot of load out there met easily, and as I mentioned, biofuels are uncertain and important.

One issue is where you put your biofuels. People have been trying to tune biofuels for light duty transportation. We think they should be reserved for heavy duty transportation and aviation, because we're not sure how much they're going to be there. So heavy duty transportation and aviation should get the first priority on biofuels.

We see significant barriers, policy gaps, etc., to get there, but we haven't done much to discuss them yet. The really amazing thing is that almost every way we looked at this, you can get there. So there are a lot of ways to get there. That's good. But you can't get there without technology development.

As for the lamp post issue that the title of this session brings up, I think we actually have about four sets of keys that we're looking for, not one. And one of them *is* under the lamp post, and you should just pick it up. Certainly all that stuff that we know how to do, we should do. And some of these technologies are in demonstration, and we can pick those up, too. But there really is a lot of technology needs, and I see from my perspective that these low emission or zero emission biofuels and load following are the primary ones if we're going to meet the standard.

Question: One clarifying question is, on biofuels and their use, because some of them--and this is true with the US in general, but it's also specific to California--to what extent are the incentives put in place that have a parochial aspect in terms of what biofuels or ethanol products they are promoting? Certain of the California incentives have a please-invent-in-California aspect to them. To what extent are those going to impede you getting to biofuel objectives?

Speaker 2: Well, we have a low carbon fuel standard. Is that what you're talking about?

Question: No, there are certain incentives that I think California's adopted that promote California-specific ethanol and biofuels. The same thing is true in renewables, where Massachusetts was able to promote Massachusetts renewables. Others are somehow poisonous.

Speaker 2: Yes, well, that's a policy issue there, right? And that's a problem. I mean, it's a problem with the ethanol standard in the United States that if we really wanted ethanol, if that's what we were about, then we would import it from Brazil. And we put tariffs on the Brazilian imports.

But again, this report is about the technology and about the ability to meet the energy needs with the technology. There are other things that get in the way of that. Economics gets in the way of that. Energy security gets in the way of that. I think those are impediments that we would list in our technology study as things that are going to get in the way. I would agree with you.

Question: A really small question. On your slide on carbon sequestration, it says, "without saline reservoirs." Help me understand that.

Speaker 2: OK, so California has a lot of old oil and gas reservoirs, and we know a lot about those. And they've been somewhat depleted, and you can pump carbon dioxide into them. And we know that they trapped oil and gas. So we know that they provide a seal. The saline aquifers have much more capacity. So we have hundreds of years of capacity for CO2 sequestration in California and saline aquifers, which mostly underlie the Central Valley. But nobody ever cared about those. So they never characterized them. Nobody wanted to pump the saline water out for any reason, so they didn't spend the millions and billions of dollars to do geophysics and boreholes and to characterize all these reservoirs. So the leap from being able to store carbon dioxide in depleted oil and gas reservoirs and storing it in deep saline aquifers is going to be a leap. It's going to be economically more expensive.

Question: Some of your scenarios or portraits depict no nuclear. Can you elaborate on why?

Speaker 2: Well, we did three different basic scenarios for electricity supply. One was nuclear. The other was fossil with CCS, and the third was all renewable. So then we did some variations on how you treat the biomass. That's what that plot is about. So the three basic cases are one (Nuclear electricity with biofuels), two (Coal/CCS with biofuels) and three (Natural gas/CCS electricity with biofuels), or actually, one, two and four (renewable electricity with biofuels), because basically nobody thinks that you can--well, you could do it with coal, actually, because coal makes the standard. But because natural gas has about half the carbon signature of coal, you can get there a little bit easier by sequestering CO2 from gas.

Question: OK, I guess I was just thinking about the state of California currently, with the existing nuclear.

Speaker 2: Yes, California has a law against building new nuclear until there is a way to store the nuclear waste. So we will probably come out in favor of saying nuclear power is an attractive alternative for California. Yes.

Question: My question is also on the nuclear plants. In California, did you factor in, whether the once-through cooling issue would impede building new?

Speaker 2: Yes. They did. And they actually think that you don't need water at all. You can do air cooling. So you lose a little efficiency, but that, they felt, was overcomeable.

Question: There's a range of emissions estimates on these. Is there a range of costs?

Speaker 2: No. This wasn't an economic study. I mean, we will have some soft evaluation of cost. Here's how we are thinking about it. We asked people in their projections to talk about what reasons they could invoke for things costing more than they cost today, costing less than they cost today, or staying the same. So for example, if you think things are going to cost less, you are invoking an economy of scale. If you think they are going to cost more, you're probably invoking either a new externality, like, for example, water, or you're invoking a limitation of resources. So we asked people to invoke those and to discuss them. But we didn't think that it was really possible to project what the costs would be 40 years from now. On the other hand, we have a kind of soft guidance to keep the overall cost of the economy about the same. So the idea here is, if your energy intensity is improved by a factor of two, prices could more or less go up by a factor of two. And that's a soft concern. But this is not an economic projection.

Speaker 3:

I'm going to take a slightly different tack. I'm a technological optimist. I've been in this business for about 35 years. And I asked myself how good are we at dealing with problems 50 or 100 years from now? And I hope I will be able to convey a message about that.

First of all, just to make sure that I get my position on the table, there's nothing better than a carbon price to stimulate carbon reductions.

And as an example, I would point out the SO2 program has probably been a success by almost any measure. But we don't have that, and I guess the working assumption is we won't have it for quite some time.

So what do you do? You look for second best solutions. You look for twofers, where you can get a political consensus to work on the problem. This is not Katrina. We don't have to deal with it in a week or two. We have time, although I guess that to some is heretical. And the other message is, incentives do matter.

Now, can we pick winners? This is my technology piece. And I will very quickly go through some examples of my argument saying that you probably can't. My favorite is the emissions problem at the turn of not the last century but two centuries ago, when there was an emissions problem in large cities. And the *Times of London* predicted that by 1950 there would be nine feet of manure in most of these major cities. Strangely enough, at the time they made this prediction, Edison had a working electric business, and Vance had built a car that would eventually solve at least the manure problem.

There are some other interesting paradigm shifts over the time frame of 50 to 100 years. Obviously, at the turn of century (two centuries ago), we had Morris and Bell competing with each other. Telephone wins. But now we have the Internet and cell phones, which is really strange. I'm not sure anybody would have predicted it. We had an electricity battle. These were fierce competitive battles. The industries ended up being regulated, but at the time, they were to a great extent competitive.

There are some other shifts that may not be obvious. We have constantly been surprised this entire century, over the last century, by how cheap fossil fuels are. We did see a shift in our approach to the energy regulation over the last century.

One of the other interesting questions is, in a matter of about 50 years, we have introduced the computer and revolutionized it several times. Just to show you, over this course of about 50 or 60 years, everybody in this room probably has a computer in their pocket that's faster and has more storage than the initial supercomputers.

In the area of nukes, in the early '50s, we thought that they were going to be too cheap to meter. They tended to have enormous cost overruns, and they have probably resulted in the most expensive electricity we're generating.

Natural gas started out the century with negative prices. For most of the century, we bought into a resource depletion argument for natural gas. My favorite example is that in 1980, the average natural gas price forecast for '95 turned out to be off by a factor of five. I was actually at EIA making those forecasts at the time. But this is the average forecast of the people who were doing it. My claim to fame is that going back and reviewing the data, I was the closest to reality.

So my argument here is that natural gas shouldn't be considered a depleting resource, because if you look at the identified natural gas just in the US, we have somewhere around 106,000 years of identified natural gas supply at current consumption. It's really a question of how we develop the technology to get it out. And we've been constantly surprised for the last 50 or 60 years over natural gas.

Now, when it comes to forecasting, the nice thing about computers is, they're really fast, and they're really small, and they have lots of storage, but the computer models have become oracles. They spit out numbers, and it's very hard to figure out exactly what they mean.

So my takeaway is that we have to be very humble about what the models are telling us and about what we can predict into the future.

We do have a consensus energy policy here in the US. It doesn't include carbon to a great extent. Certainly, if you can tie your energy policy to decreasing oil imports or pollution, that's a positive. Natural gas has been our bridge fuel for at least the last 30 years and continues to be. Wind and solar, energy efficiency, demand response, we have a policy, and these things generally go in the same direction, although the gradient isn't probably as strong as we'd like it.

There are interesting synergies that you want to put together if you want to develop these programs. For example, wind generation and batteries seem to go hand in hand. And the batteries could very easily be economically in the cars that we drive.

When it comes to the Independent System Operator market design, the independent system operators, if you were paying attention, issued a 130 page paper about how good they are doing. I read the first 50 or 60 pages, and it didn't tell me anything. But I do believe that you can pretty much document with relatively hard numbers that the ISOs today are saving the electric economy over $500 million a year, which is approximately half their actual budget. And I think if you work a little harder, you can probably justify their existence in the savings that they've brought to the market.

Another area that I think is very promising is moving from preventive to corrective reliability. That is to say that our current approach to reliability is to build more assets. We are I think on the verge of being able to move into a corrective phase, which says that instead of putting more assets on the table, that we take actions after the event, as opposed to before it. I believe that these things can save us about 20% in terms of cost, and certainly, if you had prices for carbon in there, that would help.

Transmission investment is another area of change. All of a sudden, because the wind tends to be where people don't live, we've had a big push to understand how transmission investment can help us bring renewables to the market. We've also had a revolution in transmission, not complete by any means, but we have merchant transmission, not on a large scale. We have multistate planning, which didn't usually happen in the past. But we don't model it very well, and we don't really understand how to price these long distance transmission lines. And that's something that if you're going to bring wind in from the distances [you need to understand]. And we don't even know to a good rough approximation whether or not the Dakota wind or off shore Atlantic wind actually wins the day in terms of a cost/benefit analysis.

Coal plants, you heard earlier from Speaker 1 that they're taking a beating at EPA, and they're taking a beating in the siting process. In 2007, there were 230 projects identified that were on the drawing boards or in some state of advanced completion. Three years later, about half of them had been canceled. So we have a coal plant policy or a carbon policy.

The question then becomes, what do you replace coal with? If you replace it with more nukes, the interesting thing--although Speaker 2 said we can dispatch the nukes--first you'd call the NRC (Nuclear Regulatory Commission). They don't particularly like dispatching nukes. So you get this asset with high up-front capital costs, which seems to be quite a burden, and very low flexibility. And if you have solar and wind generation in any great proportions, what you're going to need is the rest of your fossil fuel plant to balance the system. And so the other issue is whether or not you can have combined cycle as your base load--or base load may not be an interesting concept in the future.

Another innovation that happened, if you're going to need flexibility, if you look at this graph of total and marginal costs for a combined cycle combustion turbine, you can see that until very recently, ISOs would dispatch their combined cycles at quantities over 450, whereas the actual dispatch was everything to the left and to the right of that number (shown by a yellow line). Now the dispatch models can handle that full range, which could accommodate a lot of these variable energy resources.

So what are some strategies that could work? Electric cars, with dynamic pricing for charging, natural gas vehicles, certainly, energy efficiency and demand side participation, which are probably the two biggest problems in the market today. We have to separate out the efficiency and the equity issues. The consumer representatives find it very offensive that we would actually charge people the cost of what it takes to generate power.

There are some risky bets. Carbon capture and sequestration doesn't have a lot of upside in terms of technology.

And to end, I just would like to give you a quote from a very famous political scientist, "There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its outcome, than to take the lead in introducing a new order of things." Niccolo Machiavelli.

Question: You just said that you didn't think carbon capture had a lot of upside. Could you expand on that?

Speaker 3: Well, I mean, after telling you I can't predict technology development, you look at it, and it's pushing stuff into the ground into reservoirs, transporting it through pipelines. Those are very well developed technologies. They don't have, in my opinion, the promise that photovoltaics have, and maybe some other technologies. We know it's expensive. And I don't see a huge upside in terms of technology development. And so putting a lot of effort into it is just going to cost money.

Speaker 2: I just want to comment on that quickly. I think you need to differentiate between the actual storage part of it and the separation part. There's a huge upside on the separation part, and that's where most of the expense is. So it's like 30 to one cost on separation versus storage. I personally believe that that equation is going to change when you get into the saline aquifers, but that's what they calculate now. And so the separation costs have a very large upside.

Moderator: Well, we've been through a nice overview of what is actually taking place, particularly led by the EPA, but also in the states. We've talked some about the range of technological solutions out there. Speaker 3 has done a very good summary and given us a really touching plea for humility.

And humility takes us to the role of the utility company in all this. We're a humble lot in this business, because the utilities are the emitters here, primarily, the largest segment, and are also, I will say, the folks who are most deeply, seriously and immediately affected by the uncertainty that everyone has touched upon. So what do you do when you are an emitter, when you are looking for solutions under the lamp post or otherwise, and you have a lot of constituencies with a lot of varying interests to be answerable to?

Speaker 4:

Before I begin, we are one of those companies that's being sued in a number of places for climate change damage, and so –

Speaker 1: I'll give you my business card.

Speaker 4: Thank you. [LAUGHTER] So our attorneys always become very nervous whenever I leave the office. And they always want me to remind everyone that I'm speaking only for myself. And in fact, they'd be very pleased if you came away with the impression that I was simply crazy. [LAUGHTER] So I'm not responsible for anything I say.

So with that, we are, as noted, an electric utility. We've been quite involved in this issue for a number of years. In fact, I sometimes say that we are our own evil twin, depending on, for nearly everyone, because if you don't like the idea of carbon legislation, there's a lot about us to dislike. If you don't like the idea of CO2 emissions, there's a lot about us not to like. We've been trying to advance new technologies, but we also have I think perhaps the two last coal plants to be permitted in this country that are actually under construction.

The situation we're facing in the US in general, for the entire U.S. generation fleet (not one company), we have about half, 500,000 megawatts of electric generation, 300,000 of that is coal in the US. Most of those are quite old. Almost none of the pre-'60 vintage plants have pollution control equipment, and they're responsible for the largest share of SOx and NOx emissions and so on.

So we're anticipating that between now and 2016 there are going to be from 30 to 60,000 megawatts of coal retirements in this country. The question is, what do we do to replace that capacity?

This timeline of pending regulations is the famous "train wreck slide." I don't know if you're all familiar with this. This is driving some of my NGO friends crazy. These are just some of the regulations that are facing coal in the coming decade. The bar there is a timeline, 2008 on the left, out to 2017. It shows you the ozone and SOx and NOx related regulations. It also shows the regulations for mercury and hazardous air pollutants. It includes the Clean Air Interstate Rule, coal ash regulation (which I understand is causing massive headaches right now and uncertainty in terms of how that's going to be regulated), CO2 regulation (we're still not exactly sure how that's going to unroll), fine particulate regulation, and finally water regulations.

Interestingly enough, the water issue is the only component of this train wreck slide that the clean energy group companies (primarily in the Northeast, not exclusively, but they're the ones who are typically natural gas and nuclear companies)seem to be really worried about. They like to talk about all those other things that impact coal, but they are very worried themselves about water.

So when we talk about this "looking under the lamp post," as I interpret it, it was sort of, OK, we can do whatever we can, as long as it doesn't cost anything. The question I have is, was cost really the fatal flaw in the climate policy? In terms of the rate impact, at least according to the analysis that I had done, for the last iteration of the climate bill that never really got anywhere with Kerry, Graham and Lieberman, the electricity price impacts in Indiana, which is something like 95% coal fueled, would have been between 5-10% for an electricity price increase in the early years. And that would have gone up over time as we invested and the CO2 price went up. But as a starting point, we didn't consider that too bad. Now, that would have been $6-12 a month on a household energy bill. The gasoline price equivalent is a penny per gallon for each dollar per ton CO2, so if we had a $20 price, again, about 40 cents a day if you were driving a fairly large vehicle 40 miles a day. So the typical household impact would have been 60-80 cents a day in Indiana.

The real economic cost, if you look at the NPV, is somewhere between 22 and 40 cents per day. That's the EPA's figure. I probably would have assumed that that was a little bit low, but in any case, that was not something that we would have considered as bankrupting the economy.

This is a set of graphs, I think, that was very powerful in the political debate. This came from the National Association of Manufacturers. This was based on their analysis on Waxman-Markey. How many of you have seen these charts before or are familiar with them? OK. They showed that the loss in employment by 2030 of the high cost scenario would have been about 2 ½ million jobs. Loss in disposable income by 2030 would have, in the high case, been about $1,300 or $1,200 per household. And they projected a big loss in GDP of half a trillion dollars by 2030. This was pretty powerful, I think, in the political debate. We often heard these numbers from opponents, and they were cited quite frequently.

If that wasn't bad enough, we had the Heritage Foundation that was out with what I call the "wheels coming off" scenario, which basically was an analysis of Waxman-Markey, but with nothing working. There were no offsets. There was no technology that deployed. There was no CO2 price constraint. So basically it was just, you have to meet this cap, and the only way to do it was by ramming prices through the roof until people shut down, unplugged things, didn't drive and that sort of thing. So it resulted in a CO2 price that was I think north of $70 a ton right out of the box.

And with that kind of a price shock to the economy, it did show a pretty big drop in employment right away of about two million jobs. That's the graph on the left there. That eased. But then, the employment drop grew again. A similar order of magnitude to the NAM study.

So this is the GDP chart. And the top ten order of magnitude is the Heritage Foundation. So again, these were big numbers in the political context. But the analysts, in the appendix of their studies, would include all the numbers. They show what the base case was.

This graph, "NAM with Context," is the "no policy" case for employment and the high cost scenario case for employment. You can see these two lines lie right on top of each other. The difference between these two numbers is 2.4 million jobs. That's the difference between these two lines.

Same thing with the household income and the projected GDP impact. Now, when we're making an investment, we do a cash flow analysis, and on a thirty or forty year investment, when we get differences like that, well, that's a rounding error, and who cares?

As it was noted with these financial models, or economic models, it's kind of garbage in, garbage out. These are best estimates and so on, but not necessarily a huge difference in the constraint. So the Heritage Foundation "wheels coming off" scenario, the exact same thing. So we would argue that in terms of a real economic discussion, that this was not necessarily a high cost.

Now, this is a macroeconomic study. The difference between that and if you are a steel plant operating in Indiana, and you're going to be looking at a 50% rate increase from a full auction of a CO2 allowance, that's a different conversation. The microeconomic impacts for an energy intensive manufacturer could be a lot different than the macroeconomic impacts here. So we don't mean to belittle that. That's a worry. That's a problem. There were things in the legislation that were intended to deal with that and to provide some aid.

But those aspects were never either quite believed, or they didn't penetrate within the conversation.

So then again, "under the lamp post," what about energy efficiency? Is it really free? You're probably all familiar by this time with the McKinsey study, which personally drove me a bit crazy. But here are all these supposedly free reductions in CO2. A lot of that is energy efficiency. We were a little bit skeptical.

EPRI has come out with a fairly new study, an assessment of energy efficiency possibilities. On this chart, this top line is the baseline forecast for demand growth. This lower line is what they consider to be the realistic achievable potential. This is the technical potential, the bottom line. You can see there's a huge difference there between those two. This is somewhat collaborated with studies we've seen elsewhere. So we would agree that there's certainly some energy efficiency out there, but it's not as though we are up to our knees or hips or eyeballs in all kinds of free reduction possibilities. So if we're thinking about that as something to get us through some sort of a climate knothole for some time, that's not probably going to be the place to look.

Along with that, I just stole this chart from Karen Palmer, who's a researcher at RFF. And this is a preliminary piece of work that they're doing. She just showed this in Cancun this week, so I swiped it from her. This is the percent electricity savings by cost of energy efficiency programs, and this comes from a study that they've done of energy efficiency programs around the US. On the x axis is the percent of energy savings, and on the y axis is the cost per kilowatt hour saved.

So depending on the model that's used in this analysis, you see there's a fair amount of very low-cost energy efficiency things that can be done. But that does not go very far out. That supply curve is not endless before it starts to go vertical. So that's not really one of those big freebies that we can count on.

The other thing that we've been hearing in the political conversation is (I think this came out of the Breakthrough Institute), don't worry about this cap and trade stuff. Don't worry about all these things. Let's just go with a big, massive R&D program to the order of, I think they said $20 or 30 billion a year.

So the question I have is, is $20 billion equal to or less than zero in today's political environment? I don't know if it is or not. I think that if we're talking about energy innovation in this space, it's typically around the issue of integration of technologies. There are few big breakthroughs in this industry, because, as I like to say, this has been around for over 100 years. I mean, we've had engineers doing energy and burning things and trying to lower costs for a long, long, long time. So none of these technologies that I have listed here that people talk about frequently are really very new. They've been around.

I don't believe that the smart phone is a good analogy, primarily because of the issue of thermodynamics. We can't create energy. It is. And every time we convert it, we lose some. So that is an issue. We can create information. We can create entertainment, which is a lot of what the smart phone is about. I'm amazed at how many people are watching videos on these things nowadays, and from what I understand, the video streaming has been a big, big driver in terms of the development of Internet technology and that sort of thing. We don't have an equivalent. Maybe if we find an entertainment application for energy storage, we can get something like that. But I just don't see it at least for now.

So within this sector, at least if we're talking about these big R&D things, these are going to be big, probably massive projects, if they're going to be creating value in terms of advancing the technology. So when we're doing that, particularly in an environment where we don't like rent seekers, which is something that we've been accused of--actually anyone who is trying to advance climate legislation became a "rent seeker." So in that kind of an environment, any of these big projects, somebody is going to end up being a rent seeker. Again, in this political context, is that going to be acceptable?

In 2011, I think that there may be a possible focus on technology, and I think last year in 2009 or 2008, it was climate. This past year it was energy security. Those are all yesterday's news. Now it's going to be technology. That may be politically acceptable to talk about. We'll have the plug in hybrids, energy efficiency, renewables. There's still probably going to be some "drill, baby, drill" talk out there, but I don't know how acceptable that's going to be with BP.

The jobs issue failed miserably, because I think people kind of figured out that the jobs don't really matter unless they're here in the US.

We've been seeing some gains in some of these energy technologies in batteries and turbine blades, because they're big and heavy. But again, we're in this political context where the libertarians are taking aim at anybody who's a rent seeker, which is all of us.

These graphs, showing two scenarios for the electricity sector with market based policies, are from EPRI, from their merged analysis. Have you all memorized them already? Was that a yes or a no?

OK. This is an analysis that they've done. This is out of an economic model of the US electrical system projected out to 2050. They looked at two scenarios. One was a limited portfolio, where you couldn't build nukes. You didn't deploy CCS. OK? So basically, the portfolio included renewables and natural gas.

This second graph is the full portfolio, where you allowed the model to build nukes, and you allowed the model to build CCS. These economic models of this system, if you allow them to build those two technologies, that's what they build. That's all they want to build, especially nuclear. So we always have to constrain the models, and the consensus has been that the only new nukes that will be built are those at existing sites that were sited for maybe four units, and only two units were built there. So that's how these models were constrained.

If you don't allow nuclear or CCS, coal just goes away. It's replaced with natural gas. You get a good bit of renewables, lots of demand reduction, and some solar here. Even then, the carbon constraint is there--gas is still too high-emitting, it begins to go away at this point (closer to 2050).

If you allow nuclear and CCS to deploy, CCS begins to deploy. Conventional coal goes away. You see less gas, a lot of nuke, no solar, and less demand reduction. Now why is that? Because the retail electricity prices here (and this is a US average, which is a little crazy) are 80% higher than in this scenario.

So with respect to the whole technology thing, Lugar, Senator Lugar from Indiana, tried to thread the needle and propose a compromise this last year with his "diverse energy standard," which was basically a renewable energy standard that included clean coal or CCS and nuclear, and energy efficiency. A 50% requirement by 2050. With a $50 alternative compliance payment, so a sort of safety valve associated with that as well. It was considered a fairly aggressive technology target. We modeled this this summer. The assumptions in the model are already obsolete, so I'll say that right away. We tried to include our interpretation of that earlier "train wreck slide" that I showed you, all those regulations that were hitting coal. We've reinterpreted those since then, but in any case, we modeled it. We used the IPM model.

We looked at a scenario with a carbon price beginning at $20 and going up at 5% real per year. We looked at the Diverse Energy Standard, and we looked at the no policy standard, just sort of the train wreck, the existing regs hitting us and nothing else. So with that, first of all, if there is no legislation, no policy, what we find is, we get no new nukes, no CCS, very little wind, and we get a lot of natural gas. That red bar up there is all the new natural gas that would be deployed in this no policy scenario. And we get some coal retirements. These particular model runs showed about 25,000 megawatts of coal retiring in that no policy scenario.

On the other side of that, on a CO2 world, with the 80% reduction US by 2050, you had nuclear here, CCS on coal here, a lot of wind, a good deal of natural gas, this column here, and a lot of coal retirement, with a big part of that before 2025. Lugar's policy, on the other hand, did the same amount of nuclear construction. A lot less carbon capture on coal. But the big difference here is, this is pre-2025, so it was a very good driver of carbon capture before 2025.

The CO2 price didn't do anything. It was too low before 2025 for CCS. So Lugar was actually a better technology push, at least in that technology. Wind about the same, although it pushed wind higher than the CO2 price in the first decade. Less natural gas and sort of the middle line for coal.

So for pushing technology, CES is probably not a bad policy. It didn't do very much for CO2 emissions. These are the emissions from the fleet, with a CO2 price, top line business as usual. This is the CO2 emissions from the Lugar policy. So it really wasn't going to solve that problem, but it was going to at least keep all those technologies moving, and it would make, as we saw it or see it, this future CO2 policy an easier lift, because the technology we have is still a running start.

It was not free. The equivalent CO2 price would have been $7.00 a ton. So again, in the political context, is that close enough to zero?

So with that, I don't know that the economics really do matter, to be honest, in this debate. The impacts on the macroeconomic side are not massive. On the microeconomic side, yes, they matter to individual firms. Things can be done for that. But communicating those in a political context is very difficult. Also I'd say, at least what I think I'm seeing is that the only advocate who is considered the noble participant these days, is the person who's saying "Don't do anything." Which also makes it very difficult.

You cannot advance, in our view, the new technologies, or perhaps even the old technologies these days if the requirement is zero cost. All of these things are going to cause some increase in price for rate payers. And that in this environment may or may not be a very easy lift.

Question: You showed us the graph with the limited portfolio and the full portfolio. Can you give us the demand reduction on both--what percentage are we talking about there in the portfolio?

Speaker 4: Well, you know, I've gotten so dependent on spreadsheets, I can't do math in my head anymore. But it looks like about 30% total on the limited portfolio and 1 ½ out of 6 ½ on the full portfolio. So 20% is it?

Question: I think the slide before was the cost of energy efficiency, or maybe a couple back? Those are annual savings? Is that right?

Speaker 4: I believe so.

Question: Because I mean, 2.25% annually relatively inexpensively on the lower model would be gigantic energy savings over 20 years. I mean, that would be 80% savings.

Speaker 4: I don't know that that's the case. I stole this very quickly. But the point that she was making is that this is not a linear relationship, and it's not as deep a well as commonly talked about, particularly in the advocacy community.

Question: Well, I happen to be a member of that advocacy community. So I'd love to take a look at that, because the empirical estimates that I've seen actually go in the opposite direction where utilities that invest more in energy efficiency, the cost actually goes down over time, rather than up. But obviously you can't do it all at once. But if that is an annual estimate, that would actually be strikingly good news, I think.

Speaker 4: Yeah, I think that they do very good work. I would recommend particularly looking up Karen and talking to her more. They have done another study where they looked at previous claims of energy efficiency gains by different parties and saw that most of the claims are pretty highly inflated, whether it's utility making the claim or an advocacy group, or even a commission at times. So some of these programs, when they're audited more fully, are not producing the results that people often talk about.

Question: I'd love to see those results.

Question: In one of your slides, you show a figure for "demand reduction." And I'm wondering, does that include energy efficiency, which in my view is clearly, it's like, but distinguishable from demand reduction. And if it does not include it, do you propose to include it? Can we go over those two scenarios?

Speaker 4: As far as I know, "demand reduction" here includes the economic potential of energy efficiency given those prices that would be produced by those technology sets. And I'm not intimately familiar-- I've not taken apart these models, but the cost of producing the power creates a price, and then there's a certain amount of energy efficiency that is economic, given that price.

Question: Right.

Speaker 4: That's what the model assumes, or that's how the model is working, as far as I understand.

Question: A comment with respect to the prior question. What I understand is that with energy efficiency, the rates may go up, but the bills will go down.

Speaker 4: That's frequently claimed. I don't know that.

General Discussion:

Moderator: I think we can all begin the discussion portion of the morning program with the observation that it was certainly uplifting to listen to everyone comment on the state of CO2 policy and on the prospects for its development as we go…but perhaps "uplifting" it might not be. Challenging it is. But we do, nevertheless, have to concentrate on trying to create, modify, improve upon some kind of a coherent policy as we go, and I hope we can touch on that in the discussion session.

Question: I have a question that I want to pose to the panel, but it's going to be a slight recharacterization of what everybody said, although I think I agree with most everything that was said. Speaker Two's summary about the technology and the list of things that you have to do if you want to meet these goals was a useful way of focusing. And I think the question is, do we have technologies that we have available or can imagine within some reasonable period of time that would allow us to meet the targets that we're talking about? Or is this something that's just impossible? And the answer is that I think we've got the technologies, and we can certainly do it if we had to. When the question was asked about what happens to prices and how much is this going to cost, to a first approximation, and Speaker Four said, well, the percentage share of the economy that will be spent on energy will be about the same, and we'll get a 40% of 50% (I don't remember the exact number) reduction in energy intensity, and therefore the price goes up about twice—so you maintain the same percentage share. And I might quibble with the numbers a little bit, but I think to a first approximation, that would be my answer, too. So I don't think that's a big problem. And then Speaker Four said that economics doesn't matter when you look at these big macroeconomic numbers. The differences are in the rounding error, and so we're misfocusing if we're focusing on the problem of the economics, and that's not what is causing the difficulty. But what he was talking about is the macro and the micro.

Let me say just my own view of this matter. To a first approximation, we have to get the question right. So if you look at the macroeconomics, and you look at GDP, if we took all of those people who are producing that entertainment that everybody's watching, and we made them stop doing that, and we had them start digging holes and filling them up, and we paid them the same amount of money they were getting paid for producing those terrific movies, GDP would stay the same. So there would be no impact on measured GDP. Now, we'd be a lot worse off, because we wouldn't have the movies. All we would have were lots of piles of dirt around that had been loosened with put back and the holes in the thing. So our net consumption would go down. So it's the consumption, not the GDP, and a lot of these macroeconomic models, although they have it embedded in the bowels, when they come out with the report, they show you these GDP numbers, which to a first approximation shouldn't move. They should be the rounding error. But the consumption side of the story is not necessarily the same thing, and in fact, we might be worse off.

But with reasonable substitution of the type that Speaker 2 was talking about, and this ratio, and how much you're spending, that number is relatively small. So it's not costless, but it is relatively small, and I would say it's on the order of 1 or 2% or something like that, if we went all the way, which I consider to be completely affordable. When it comes to the jobs effect, again, the net jobs, that's all just a distraction to a first approximation, at least with a closed economy. To a first approximation, the jobs effect should be zero. So again, that's not the right way to think about the problem.

So my view of this is, we could do it. We have the technology. If we would, let's say, take Speaker Two's numbers, just double the price of delivered energy to everybody and do all these adjustments that we're talking about, that would be fine. It would be a slight reduction in net consumption. No reduction in GDP--a slight reduction in consumption that we should be willing to live with. That's the right way to characterize what the scope of the problem is over this long period of time.

The difficulty is, is that the macroeconomic story is not the relevant story. It's the microeconomic story that's relevant. And it is at the moment completely unacceptable to propose to people that they double the cost of their energy. That political solution is just not acceptable. And when people say it has to be free, I don't mean the GDP or the net national product part of the story, which I think is relatively small. I mean that the political system is not prepared to accept the microeconomic effect. And what we have here is a description of a target on the technology, and we have no policy trajectory to even get started to get to that target.

As a matter of fact, what the lamp post metaphor was supposed to be is that we've rejected all the places that might have such a policy. And we don't have anything that's underway that is actually going to deal with this fundamental problem of doubling the cost of delivered energy in order to adjust the whole technology and everything in order to make the energy system carbon neutral. And I'm very frustrated by this. And I don't know what to do about it.

Now, one possibility is, I'm wrong. So this focus on the microeconomic problem that we really do have to get those incentives out there. We really do have to do that, or we're not going to make it. It's not that there's no technology that we'll be able to take advantage of. There are lots of things that we could do, but we have to face the fact that we're going to double or maybe a little more increase the cost of energy to customers. What can we do to get the conversation back?

So, if I'm right, what can we do to get the conversation back to, how do we recognize that it's going to be expensive? Meaning, the price of energy is going to go up by a lot. But we can afford it, and it's worth it.

Speaker Two: I will volunteer, but I don't think you are going to like the answer. I really have talked a lot about there being three sectors of motivation for energy, energy security, economics and environment. If energy security is not going to do it, right now, and we're not going to get any friends from economics, which I think is the case, then you're going to come back to the climate problem, and the other projects that I work on right now are on geo-engineering, which is how do we change the climate of the Earth intentionally? And frankly, in that effort, I see a tremendous opportunity to get people to focus on the fact that they'd rather not have this problem. The thought of geo-engineering is so horrifying that it really does help people to understand that they don't want to have this problem. So I personally believe that spending a lot of time talking about adaptation and how expensive that's going to be--I also serve on the California state task force on adaptation, and it's pretty frightening how much money that is--and how much money is involved in adaptation, and how scary geo-engineering is… I mean, to me, those might be the leverage points. They might not be in the energy system.

Speaker 4: You know, I think we were very focused on the micro. And I say we--I was our representative to US Cap, and we fought very hard for addressing the micro, because we were focused on Indiana, really, as sort of the canary in the coal mine. That's how we looked at it, because of the 95% of the electricity from coal. And so we fought and fought and fought over the allocation issue. And it was an intra-utility battle as well.

We didn't do a good enough job, in the opinion of many people, but we thought we were making incremental progress, and certainly with the latest, it was Kerry-Graham-Lieberman, we thought we were getting fairly close. But because of the difference in cost of service versus market oriented markets and such, it was complicated.

We also had provisions in the legislation for the energy intensive trade exposed, such that they had allocations that would have compensated them for their increased energy prices, plus their own direct emissions. Many of them did not understand that, or they did not believe it. So we were unsuccessful on that front. The other problem with that particular aspect of the policy is that those allowances that would have paid for that were coming from the allowances that were not going to be given to the oil companies. And that created a little bit of a political problem. But there were big efforts to try to deal with those issues, but they, through our own ineptitude or those who were trying to advance the policy, we just did not do a good job in either explaining or being believed.

Speaker One: I think it's also worth going back to looking at the acid rain legislation. I mean, that was a major environmental effort. It was very complicated at the time at a certain level. It had significant local costs. But we got it done. 20 years later, it's old news. Everybody likes it.

I guess I tend to be an optimist on these things--a frequent point of dispute with all my friends in the environmental community, who I think are just congenital pessimists. I say that half-jokingly, but actually I think that's a relevant part of the debate. I think the environmentalists tend to lose these arguments because people don't like doom and gloom, and you've got to figure out a way to make the arguments more positive.

I would just say, in 2008, the Republicans thought the world had come to an end, and they were going to be in a permanent minority. You know, things change. And what is now what people see for the foreseeable future, they may just not be seeing very far. And in a couple of years, things may have swung back. And I think legislation's going to happen.

I do feel--and I'm not the scientist, so I may be wrong on this-- I think if we're at some tipping point, and we've got to act decisively in the next couple of years, then we've got a major problem. But I just don't believe that. I'm not persuaded of it. I think within a few years, something's going to happen. I think it's worth following up on what Speaker Four said on the bill. I honestly think that in a very big, very complicated bill, all of the major pieces of that bill had majority support. But you just couldn't put all those pieces together and get majority support for the whole thing. There were just too many moving pieces, and they ran out of sort of global momentum. But there are going to be winners and losers, and they take steps to minimize that, and I actually think that Kerry-Lieberman, indeed, calibrated reasonably well the adjustments it had to make to at least minimize that. And I do think that they essentially did enough on each individual piece to get a majority to say, OK. But they couldn't get a majority for the whole thing.

It's funny, I do end up coming back to Speaker 2. Unlikely as it seems in the short run, I think people have to be persuaded that there is an environmental problem that has to be solved, or it's not going to happen. I just don't see it happening otherwise.

Speaker 2: Just don't read the book, *Ultimatum*, for those of you who haven't read it. It takes a nuclear war in that book.

Moderator: Well, that's encouraging. Any other optimistic notes? If I can be a panelist for just one minute, I think Speaker 1's comments are very perceptive. That Kerry-Graham-Lieberman package that had the components that Speaker 2 described was very close. And if I've ever seen one where I thought the inside the beltway gossipy sort of politics just went awry, that bill was there to be passed, and there was support, including from the utility industry. But a lot of tactical blunders came together.

I tend to think something as big as geo-engineering, that's a decades-long horizon to educate people and engage them on that. I tend to think that in the near term, you let it rest a while. But I do think the fundamental formula that Speaker 2 summarized is probably still the most compelling case--to put together energy, security, competitiveness. Look at the way the venture capitalists and others were weighing in in support of Kerry- Graham-Lieberman. Obviously the climate piece is part of it, and when you pull all of those together with some cost parameters, that is still going to be the best formula. I think it's just that the political winds shift. And they'll shift again, and when they do, at least my thought is, that's going to be the right time to come back.

Speaker 3: Just to add to that, I think that the lesson we learned over the last couple of years is that in a down economy, a program like this just isn't going to sell. And you've got to get the economy back on its feet and growing, and then people will feel a little bit more generous, especially because they don't see this problem as anything--the flyover states don't care about the sea level rising as far as I can tell. To me, and I didn't study this closely, it looked like the process went sour when the economy did. I mean, literally, the number of people who believe in global warming is negatively correlated with the jobless rate.

Speaker 2: Probably the most effective thing we've ever done on the climate front is have an economic decline. That's not very exciting, either.

Speaker 3: I mean, it makes absolutely no sense, because if you look at the surveys, the percentage of people who believe in climate change decreased as the unemployment rate went up. And there's no obvious reason why that should be the case. It's probably a spurious correlation.

Comment: "Climategate," a cold winter…. I mean, there were --

Speaker 3: It's also very hard to sell policy that says high variability is the result of climate, because that's a very difficult thing to measure.

Moderator: It does sound like we are back, though, to the idea that if you survey the technology and forecast the economics, then politics will tell us what we will do, and that's where we started this discussion.

Question: Has anyone figured out what the economic breakeven point is for consumers--residential consumers, mainly, but also small commercial and industrial customers? How much are they willing to allow their rates to go up? Or do we have to wait until the economy improves in order to be able to figure that out? In California, we periodically get worried about a ratepayer revolt.

Comment: The polling I've seen suggests that at about $5.00 a month, people begin to say, that's too much.

Moderator: And that's a very imprecise tool.

Question: The problem with this discussion, at least from a regulator's perspective, is that we always look at it holistically, and you talk about, well, at a GDP level, it's a rounding error, but when you go down, if you look at it even from a state perspective much less as a national competitiveness issue, the key issue is that electricity is really fundamental. It's one of the fundamental elements in economic activity, at least in a state like Texas, where you've got a lot of manufacturing, a lot of industrial, a lot of large commercial.

And because we live in a global economy, anything that increases that cost materially, as compared to some other jurisdiction, whether it's Oklahoma or Turkey, will affect the amount of economic activity. And we see it actually on the positive side right now in Texas. Every time California does something, we get more inquiries about companies that want to relocate to Texas. But if everything just increases nationally, rather than coming to Texas, they'll go overseas. And I think the fundamental problem is that when you talk about cost increases like this, what do you ultimately do, unless you just say there's not a problem with what I would call the continued de-industrialization of the country. And maybe you don't see that as a problem. I don't know, those who are big fans of green business would say, no, this is the replacement for it. But frankly, looking at it from a quasi-politician's perspective, the problem is that most of those green jobs in fact do not pay--our folks who work in the petroleum industry and the petro-chemical plants make north of $20 an hour. The folks working in green energy, whether they're assembling solar panels or installing weatherization in homes, are making substantially less. And unless you address that fundamental issue in some way, I don't think you're going to see a lot of movement. Again, particularly in a down economy. But you're not going to get an up economy by imposing those costs. At least that's the argument that is persuasive to a lot of folks who sit where I sit.

Speaker 2: That is the problem. That's the whole problem of everybody needing to jump at once to have this work. And the question really is, how does society change? Do you do it with the price signals? Or do you do it with mores? My observation would be that people are increasingly negative about the ability of the Conference of the Parties to come to an agreement that would have a worldwide, everybody-jump-at-once conclusion. And so increasingly, people are starting to talk about messy regionalized processes that are based on building social mores, where it's just socially unacceptable [not to address the climate problem]... And I sit in committee meeting with climate negotiators, and they don't believe that the everybody-jump-at-once thing is going to happen anymore, and they believe that the way in which things are going to move forward are the development of regional processes and social mores that convince people that it's not OK to keep destroying life on Earth.

Question: Well, let me ask a question, if I may, to you. In your study, and it may have been in order to have a study vehicle, you had various scenarios, like on page number six of your presentation, where if I read it correctly in bullet point number three (about how do we decarbonize enough electricity to meet resulting demand), I think I hear you say, nuclear or CCS or renewable, but isn't it the fact that to have any real impact, you've got to be able to use it all.

One of your studies, for example, had renewable and nuke. Well, as Speaker 3 mentioned, one problem with that is, that doesn't work from a reliability standpoint, because nukes aren't really flexible. Whether it's gas or storage or something else, you've got to have something to balance the load, at least in jurisdictions where between peak and --

Speaker 2: Yes, I think that's a good point. I think that the two fulcrums of whatever plan we end up with are going to be the load following issue and the biofuel issue. Those two things are going to drive what we end up with more than most people realize. That's my opinion. And I agree with you about the load following. To the extent that you end up with an industrial ecology type approach, where maybe you've overbuilt your nuclear power, for example, and decide that you also have a water problem, you might choose to desalinate water in the off peak. Something like that will determine what portfolio we end up with.

Speaker 4: To your point about the interregional and then global competitiveness, again, the legislation did include provisions to give allowances to energy intensive firms, or facilities. These were intended to cover the increased cost of energy, plus their own direct emissions. What was innovative about that approach is that it would be adjusted for the output of the facility, so it wasn't just set to a historical baseline and then set to decline. If their output increased, their allocation would increase.

So in effect, it would have been almost a subsidy to keep operations on shore. But that was not something that was widely talked about. Along with that, there was a provision, I think in Waxman-Markey, which was a problem, to have a Border Tax Adjustment--basically a carbon tariff on goods coming from countries that came from countries that had no policy. I considered that a double dip, combined with the allocation. That should have been corrected in Kerry-Graham-Lieberman. But the way it was envisioned is that that policy would phase in as the allocation would phase out, I think, after ten or 15 years.

I see you shaking your head. I mean, that was the problem, because people didn't believe that that would actually occur. But that was intended to be the stick in the closet, to threaten countries like China, or provide an incentive, I should say, to countries like China, to eventually become part of a global regime, so that that competitiveness difference would be zeroed out. But the complexity of that plan, and the lack of credibility about how that would work, or whether it would actually be followed through on, was, I think, one of the fatal flaws in the approach.

Question: Not to mention the impact on all our various trade treaties and agreements.

Speaker 4: Well, yes. It was certainly debated whether or not that that provision would be

WTO compliant. But there were a number of trade attorneys in different places that seemed to think that yes, indeed, that would pass muster. But it was debated quite a lot. And still is, if anybody is actually talking about it anymore.

Question: I guess if I had to think about the conversation we had this morning, I'd say it was informed by a lot of engineering economics--figure out what things are going to cost, make a projection, discount it to present value, call that reality, go forward. I think a lot of the issues are about figuring out what's the cost of a risk. That's what we're facing with climate change and many of these other pollution impacts. I don't think energy is cheap, and when it risks our future the way it does, we've got to think about that. And we do have some people in society that we pay to take risks. We call them investors.

There are a set of tools--now they're across the river from the Kennedy School at that other school--but there are a set of financial tools that are used to assess risks. Things like asset allocations, capital asset pricing models that give you a beta and assigns a risk value to things. You do a risk assessment, and it leads you to an efficient portfolio. And I guess my question to the panel is, I don't hold out that that stuff's perfect. We have plenty of evidence that it's not. But is there anything in that toolbox that can help us with this problem of risk over the long term?

Speaker 3: I just have come to believe that it's very hard to sell this as climate policy by itself. And it's really important to find a bigger coalition than just climate policy. The risk factor is dependent on what you believe the future looks like 30 or 40 or 50 years from now. And I it's just very hard to sell that to the American public. And the only way to get these policies through is to form a bigger coalition.

Question: May I respond to that? You're required, if you have a mortgage, to have fire insurance. It's a low probability risk of a big catastrophe. I think most people can understand that. I think the American people want a solution to this. They don't want to fight over it anymore. They want a solution to it. And I think the solution lies in diversifying appropriately the generation portfolio. That leads me to financial economics, saying, what is the risk and reward of these choices that we face in microeconomics? And I think there's some tools over there. We ought to take a harder look at that.

Response: That's a very good question, and I think the tools that are used in financial analysis, whether it's at the business school or elsewhere, are not the right focus. Because although they may be thinking about this, it's really more the "black swan" kind of problem, where you have low-probability events that are not so low-probability that you can ignore them, but they're not so high-probability that they fit into the standardized, normal distribution story.

The real challenge here, and something that people who do these models are working on, is trying to find a better way to characterize that problem and understand it, because if you just take the expected values, it's a much easier problem to deal with, and we don't have to worry about it very much. Where it becomes interesting is when you get out to these tails of the probability distribution, but it's very, very hard to analyze that problem. Marty Weitzman at Harvard Bob Pindyk at MIT have has been writing about this a lot. Most of that stuff, I think, is actually going down the wrong path, because it's going too far out on the tails. So their analyses look out into the realm of extremely low probabilities, where the rate of growth of the damage is faster than the rate of decline or the probability, so the expected damage is infinite. It just doesn't pass the laugh test.

But if you go out three standard deviations, where we're not comfortable in working and don't understand exactly what to do, that's where you get serious problems. And there is some work that goes on in that area. But I think that's actually the right question. It's not the expected value that we should think about, but it's these tails, and how do we model those and protect ourselves?

Question: But it's also the discount rate.

Response: That's part of it, yes.

Question: And you know, people have been trying to fool around with the discount rate for 50 years to make long-term events relevant, but it's very hard. And so it's almost as if you have to throw the economics out in some sense.

Response: I'm not recommending that.

Speaker 1: The problem is we don't know the costs on either side of it. I have a hard time with the analogy to the fire and homeowner's policies, because people accept what the ranges are, both of the cost of the fire, if it happens, and we know what insurance costs. We don't know what the insurance costs here. I mean, the insurance policy is the cost of implementing cap and trade, or whatever it is we do.

There's pretty good data that on every major rule that EPA has done over the past 30 years, the economic forecasts of the cost of complying with those regulations have been wildly too high. They're always too high, because they're static, and they don't understand the way the market works. (It's kind of funny, in my mind, because conservative people who believe in the market kind of forget that the market works.) But once the price signal is in place, the market responds, and things end up being a lot cheaper than we think.

On the other side, Speaker 2's point about adaptation I think is a good one. When people start seeing bills for adaptation, that's when it becomes a lot cheaper and a lot more manageable to put a price signal on it, because it's not zero on one side of the balance anymore. Massachusetts just came out with a draft of its adaptation policy, and all sorts of my clients in various sectors are going to just freak out at the things that Massachusetts is going to do to start to adapt.

It comes back to the science. If you don't believe the science, you say, "Well, I don't care about the cost of adaptation. We don't have to adapt, because that's all fiction." So I don't have an answer other than working on both sides. There are reasonable people. You know, there are a lot of utilities, a lot of manufacturers who were prepared to accept a bill, because there were appropriate compromises, there were things to deal with some of the trade issues. But until there is a broader consensus on the science, so that people realize that there are these adaptation costs, so that when we talk about the cost of prevention, you might call it, it's not as compared to zero. It's compared to adaptation. I'd rather not start doing adaptation-- I'm hoping that's a waste, because I'd rather prevent.

Speaker 2: Sorry, too late.

Speaker 1: Well, that's as may be. I don't know what to do about what I see as a just repeated overestimate of the costs of the regulations, because you can look, and it always is the case. But as each individual one comes down the line, all we have are the models that we have, and people see the costs, and that's what they're predicting.

Speaker 2: Well, it's actually better than that. Margaret Taylor did some work evaluating cap and trade as compared to regulation as a technology pull, or a technology driver, and regulation comes out far and away the better spur to technology development. And that's why you can make that observation.

Speaker 1: I'm not sure I understand that. I would say cap and trade *is* regulation.

Speaker 2: Well, I would say "regulation" is saying, you cannot emit more than such and such.

Speaker 1: I see. I'm skeptical about that.

Speaker 2: As opposed to putting in a market mechanism for doing it, and then people find market mechanisms for getting around it. Whereas when you have a regulation that you just can't emit a certain amount, it seems to be a better push for technology development, according to her analysis.

Speaker 4: And once you meet the standard, you're done, and there's no incentive, then, to continually innovate, because you're met the requirement, and you can sit there. With a market standard, there is always that cost line in your financial statement that you're always trying to minimize.

Speaker 2: Not really. You could say, for example, right now you can emit such and such amount of carbon dioxide every year, and by 2050, it's going to be zero, and here's the schedule. Personally, I think that would be the best thing to do. But I'm simple-minded.

Question: I want to go back to the question that we started with, which is, what can we do to focus this debate on the micro costs, because that's where they're going to be felt, but also make a compelling case that this is worth it, and we have to do this. And I found this discussion very fascinating because I don't follow this in my day job. But it is something that as a citizen and as an economist I'm very concerned about. We need to be able to do something.

I don't want to minimize the arguments that Speaker 3 and Speaker 2 have made, that you have to sell this on multiple fronts if you want to get it through politically. But one of the pieces that has occurred to me, since I don't follow this in my day job, that would be very valuable, something like the white paper that the *Economist* put out in the middle of the California energy crisis, like a manifesto saying, this is a crisis. A bunch of economists said, "We rarely agree on everything, and there are lots of things we don't agree on, but these are the principles that we agree on about what you ought to do to come out of this crisis." That paper (even though the Governor didn't listen to it) was very valuable in terms of explaining what happened and why, and helping people calm the hell down, coming out of that.

This goes to the question of how do we sell the public that this is something that we genuinely have to do and why. A paper that summarizes the science and that has some large coalition of scientists and economists who say, "here's why we support this despite the uncertainty," could be important. Because I felt as a citizen that when the news broke about the emails where people were confessing to boogering the analysis, that that was a huge blow to the public belief that the need to do something about climate change was credible. This let people off the hook. "Oh, thank God, they're exaggerating this. I don't have to worry about this. I don't have to be concerned."

The only thing I've seen that kind of fits that category was an article in the *Economist* magazine maybe a year ago on climate change, where they actually spent a fair amount of time talking about what the climate models did and what the differences were and what the debate was all about, and kind of summarized it with, "We don't really know what's going to happen, but the probabilities are large enough that the consequences of not taking certain minimum actions are such that as a magazine, we support this. We support doing actions of this sort."

This is a harder story to tell, because we don't know what's going to happen. But I think that that's kind of a critical missing piece that would be valuable, that we'd have to pull together some disparate disciplines that would actually help with the communication process and starting to change public opinion. And it seems like a natural role for a coalition of people who come to this meeting, a role for Harvard to try to take on.

I have talked to a lot of people that I know personally who have asked me, "What do you think? Do you think this climate change is real?" And they will say no--people who I would think ought to know better. I mean, they'll say they don't think it's a problem, and there isn't a crisp answer to it. I'd like a crisper answer to be able to talk about. I think it would help.

Speaker 4: I think there is an effort to do that. I think part of the issue is, about 40% of the population cares passionately about this issue. Half of those are absolutely sure this is a hoax. The other half of that 40% are absolutely convinced that this is a disaster or train barreling down on us, and we're all going to be creamed. And everybody else in the middle, if I remember right, about 20% of the remaining people are too busy to think about it, and the others are kind of, "Yeah, well it might be real. It seems like it could be, maybe, sort of, perhaps."

So with that sort of profile, it's not possible to get it done right now, and particularly because all you have to do is go online, and any article about climate that allows comments, the comments, unless it's what I would call a lefty site, are almost always dominated by people who are writing in caps, "THIS IS A HOAX." And they're very energized right now. So I think that that's the knot hole. And frankly, with that sort of thing going on, it's very hard to have a conversation. And it also doesn't help when the other side says, "The debate's over." There is absolutely a debate, not necessarily within the body of the scientific community that works on this, but certainly among the general public. So I think that was a fatal error for the proponents to advance this debate is over thing. That just infuriated the other side.

Speaker 1: I would second that. I actually think the emails didn't really say we have to play with the science to make it more persuasive. But that's the way the entire public heard it. What they heard is that people are going to play with the science.

You have raised the question, how do we make this more crisp? Well, that was exactly the problem. They were trying to make it crisp, and they tried a little too hard. I certainly am one who says, the answer is clear, but that doesn't mean that the science isn't complex. And it's easy to paint with a broad brush, but I'm going to do that for shorthand purposes. The scientific proponents on the side of regulating climate were too simplistic. They said that the science is simple, which is not the same as saying that the science is complex, but it's overwhelming, and we're persuaded. And those emails really were a disaster, and they really did matter.

At a broader level, it is a symptom of what a lot of people see as arrogance on that side of the debate, and that hurt the cause. There's no question that they shot themselves in the foot. When emails essentially say, you know, we can't put this stuff out there, because we'll give ammunition to the other side, and that's sort of what they did say. Again, they weren't playing with the science. But they said, you know, oh, all my friends thought, oh, disclosure, and we should put this information out there. But then I showed them the website of the climate cynics, and then they all agreed that these people are nuts, and we can't give them any information. That's not the way things are supposed to work.

Speaker 2: You have to keep in mind that the science is complex, but the social situation is complex, too. It's not just the climate scientists making these comments, but it's also the Koch brothers funding misinformation campaigns, because they have an economic stake in the outcome. And it's the way in which the Tea Party has been funded by these guys, and now the Tea Party is all the deniers.

I think that geo-engineering brings up an important issue. I call it Frankenstein's Academy, because you have to start to think about whether the science and societal capacity building has been done the right way. Scientists basically took off in the '70s and '80s and began to develop climate science, based largely on things like beginning to understand nuclear winter. That was the beginning of climate science. They did it basically in the academy, in the ivory tower, and then felt that their results were so compelling, that if they threw this data over the transom to society, society would respond, because the answer was so compelling that society would be galvanized and do something about it. When that didn't happen, and you got the misinformation campaign, then it was a perfect storm on the scientific side, because one, the scientists were disengaged from society, and two, those that wanted to engage became politicized and overstated some of their cases. So this is really a mess.

You have to start thinking about how you're going to do science with society in an entirely different way than the way we've been doing it. It's very pervasive. We're talking about a lot of different vested interests that have to be dealt with. We have the economic vested interest. We understand about that. But we've developed huge institutional vested interests and intellectual vested interests that all play into this. We have to have better ways for dealing with that. We need to be more mission driven in the science that we're doing, and we need to be more engaged with the public and the way that that science gets done, where the public is beginning to own that science, and beginning to own the research agenda. It isn't just the scientists sitting there in their ivory tower, throwing the results back over to society and saying, here, this is compelling. Go fix it.

So I think that the institutional way in which we handle science, down to "publish or perish," which is about getting results, needs to be looked at. People who have negative results about climate can't get them published, because it's not a positive result. And so that breeds distrust. We have to change this whole way in which we've done science only for competing, and that this is how we evaluate scientists. It has to be much more mission driven and much more engaged. And I think that's the revolution that has to happen, or we're going to be back in the cycle forever.

Question: What did you mean when you said people who have negative results about climate? Meaning that if they show that it's not so much of a problem you can't get published?

Speaker 2: No. I mean, I think there are examples where, for example, it's not just in climate. For example, a guy that I know of has a result showing that third-hand smoke doesn't cause cancer. They have statistical results that third hand smoke doesn't start, and nobody will publish it.

Question: What's third-hand smoke?

Speaker 2: Third-hand smoke is when you expose materials in a room to smoke, so it's not just you're exposed to somebody else's smoke, but somebody else's smoke that's been absorbed by something else.

So I think that the issue is whether scientists are getting, and institutions are getting credit for saying that they're wrong.

Moderator: That's another market at work, is what I would say with this publication issue. .

Question: As a trade association, we work this issue on Capitol Hill for our members. And when push came to shove, and I would agree with you that people were coming together on Capitol Hill, but a couple of things happened. One is, the loss of the jobs, and candidly the NAM analysis did reinforce that, and it had an impact. And Speaker 4, we agree with you on that. Because before, leakage had been talked about. We ourselves had raised that--the leakage of jobs overseas. But the combination of the job loss and then finding out that China was building in five years more coal plants than we've built in 100 years. And the impact of that to a congressman or a senator was, "Oh my God, if I expose my consumers to this, my constituents to this, their rates are going to go up. And we'll switch more jobs overseas." So this leakage risk, I mean, it almost calls into question, whether this country needs an industrial policy. But the whole issue of leakage wasn't mentioned. I was wondering if anybody had comments on that.

Speaker 1: Well, the whole point of the allocation to the energy intensive trade exposed was to prevent that leakage, because it would have blocked any kind of cost increase caused by the policy. They would have been given an equal amount of value for their cost increase, and it would have varied with their production levels. So if their production had gone up, they would have gotten more allowances to compensate for, again, for that increased cost. So that was the intent of that, combined with the threat of the Board of Tax Adjustment then as well.

Speaker 4: The problem was that people saw very quickly and told the congressmen, that sounds good, but you lower, but you give them more allowances, you give us less, and our costs go up.

Speaker 1: Exactly. Well, that was it. I mean, it was not believed.

Question: I had a couple of observations. I think the sense that a lot of people out there don't believe in climate change or it being a risk is overstated. I think it's far more nuanced than that. I think the concern is the whole problem of the commons concern and whether what we're about to do is going to make any difference, and whether the science really supports the statutory thresholds that we were all talking about, and whether that's going to change anything. That was our experience, anyway.

The other thing, and Speaker 2, I think you said something like that you were "simple minded," and your comment at the end there disabused any of us of that notion, if we needed to be disabused of it. But there is a very hard challenge to get good news out, benefits messaging out, whether the economics are sound or not. And I go back to Speaker 1's presentation, and on page 12 you indicated for the transport rule that the science says that it's going to cost $2.8 billion a year for industry to comply. The next line says the projected benefits are $120 billion to $290 billion a year. Yet when we hear about EPA regulations in the news these days, we're hearing about the job losses, and we're hearing very definitely about the $2.8 billion a year and some older coal plants that are going to close down. But the message about societal benefits is just not out there, doesn't resonate. It's just not carrying any weight. It's surprising. And I don't necessarily believe the $120 to $290 billion a year benefits message any more than I really believe the industry message here.

But to me, if you pull all that together, one of the things that I think we really need to explore, and I'm going to get to a very specific question and suggestion here, is whether or not we could rebrand carbon in some way that's more acceptable. And for example, the clean energy standard, and Speaker 4, I'd solicit your views, as well as the other panel members on this, could be expanded, for example, to include RECs for redispatch of coal to gas, which many have believed is one of the most effective and least costly means of creating real carbon reductions in the near term. And in fact, if you look at the McKinsey curve and some of the other work that's been done, including the work that Exelon's done in this area, it's one of the most cost effective mechanisms. So is there a road out there that says, look, you build a windmill, you get a credit. But if you redispatch coal to gas, actually run your coal fleet less, and redispatch with gas, you get a credit, too. And that makes the coal owners somewhat whole, and it allows for a transition to cleaner resources, whether they use that money ultimately for gas development or something else. But there have been a number of economic models out there that suggest that this might be a cost effective mechanism of putting a price on carbon, albeit not as perfect as the carbon price that we saw in the earlier pieces of legislation. But nonetheless, driving us to a better carbon reduction plan than the clean energy standard, the Lugar bill that Speaker 4 described earlier.

Speaker 4: Well, I think that that would be politically seen as almost the same as a CO2 price. The utilities may be indifferent, but the coal producers certainly would not be. We could be moving toward supporting a clean energy standard. We don't think that there's any need to further incentivize natural gas in this country. I talk to the Shell people quite often, and they are all about gas incentives right now, and I'm kind of shaking my head about it--as if you needed them.

So I think if we're in a political environment where we've sort of been handed our head over carbon, and part of the reason for that was the concentrated political interests geographically in support of coal, and not just utilities, but coal producers themselves, that that doesn't necessarily solve that part of the problem.

Speaker 1: I would just say briefly, first to give Exelon the credit that it's due, if you look at the thing that I handed out today, Exelon was the sponsor of a study showing the economic/environmental benefits of the transport rule. I guess I'd say two things. One is, yeah, explicitly I don't think that's going to work. There are still, first, as Speaker 4 said, there are a lot of people who are not just the utilities, but the people that are just about coal, who aren't going to be happy. Second, there's Speaker 2's point, which is, if what you care about is getting to 80%, getting part way there on what is a dead end for getting all the way there--there may not be much point to it.

But then I'd come back to the point I made in my original presentation, which is, de facto, we are doing that. And that may be the best way, because then we're not saying that's really part of the long term solution. But we are going to get some short term reductions, because there's no doubt that these rules are going to drive people towards gas in the near term.

Question: I was going to ask a question about gas. President Obama was saying the country needs a new conversation about natural gas. And I didn't know whether you thought he was getting to energy security or to global warming. And I was looking at natural gas as perhaps hurting this global warming, because it's going to make renewables more expensive, and nuclear costs prohibitive. And it also creates a psychology in the country that we solved it. So I was wondering if you have any reaction to that.

Speaker 2: It's a great transition fuel, but in the long term, you're going to have to use it in a way that sequesters the carbon from natural gas. So maybe you need to couple those two ideas somehow. I don't know what the economic answer is, but if you're going to keep using natural gas, you're going to have to either offset it, or you're going to have to sequester it. So you can use it an electric utility and sequester it directly. Or you can create an offset by burning biomass in electricity, sequestering the carbon, and thus creating a negative emission. And then you can keep using natural gas with impunity, and you sure want to use natural gas with impunity over coal, because you've got twice as many credits that way. So I think that trying to think about that is really important--trying to think about the long term and the short term at the same time would be important.

I wanted to come back to the previous speaker. When I was in Nevada, I ran the energy efficiency and renewable energy task force, and we got a renewable portfolio standard at that time, a and I was really struck by the fact that the environmental community was pushing for an expansion of that to a low carbon standard, and they just couldn't get it through. And they couldn't get it through for the reasons that you're talking about. The people who supported it supported it for three different reasons. They supported it because they were tired of being victims of the California energy crisis, and they wanted to have generation in the state, so they were kind of a security contingent. And then there were people who wanted economic development in the state. So they liked to have the businesses move there. And then there were the climate people who wanted to not emit. And when you changed it to a low carbon standard instead of a renewable standard, you lost two of your three constituents. And so it was really hard to change it. Now, I think, again, it comes back to mores. When the society believes that climate is a problem, then you can move that way.

Question: I think the bottom line that I'm hearing here is that if we're going to address climate change in any reasonable, rational way, we need to put a price on CO2 emissions and equivalent other greenhouse gas emissions. Without that, we're sort of wandering around in the forest. Because I think as Speaker 3 pointed out in his comments, and I think appropriately so, and Speaker 1 alluded to this as well, we're already addressing climate change in a very indirect and oblique fashion. We've got the tailoring rule. We've got the transport rule. We've got HAPS MACT (Hazardous Air Pollutants Maximum Achievable Control Technology). We've got 316B. We're going to have the update of the NAAQS (National Ambient Air Quality Standards) rules coming along down the pike in a couple of years. And so, it really becomes an issue of psychology as I'm listening to the conversation here.

And I'm reminded of Keynes and the issue of money illusion. It almost seems like we as a society are averse to actually seeing transparent prices, even though those transparent prices and policies may be the most cost effective means in which we could actually meet the climate change challenge, if you believe in climate change. Instead, we're doing a lot of these oblique policies, which are extremely non-transparent. People cannot see them. Therefore, they're out of sight, out of mind. Because they're out of sight, out of mind, we believe they don't cost anything. When in fact, they actually cost us much more. It may not be directly in our power bills or gas bills. It may be through taxation. It may be through increases in deficit spending, increases in debt and so forth. And so, given that that's the consensus we've arrived at--to be non-transparent to kind of put our heads in the sand, so to speak, because of this money illusion issue that I mentioned—the question I have is how do we change the psychology?

I think an earlier speaker brought up black swan events. And it reminds me that we're almost talking about changing the objective function here. I'm reminded of being in first year graduate classes. Well, the objective function is to maximize welfare and so forth, but what is welfare? And if we think about trying to avoid black swan events, that social welfare function actually changes. We're actually trying to minimize the worst outcome that we could envision. It's no longer maximizing expected welfare. We're trying to minimize the worst outcome. And so, is that something that we're really trying to do? How do we communicate that? And then the second part of this is, whose responsibility is it to change that psychology? Is it the industry's responsibility? Is it academia's responsibility? Is it the responsibility of Congress and politicians and policymakers? I'd just like to get some comments.

Speaker 1: Well, I mean, it harkens back to the question about insurance. Yeah, this is at some level an insurance issue. And I do think one could imagine people coming to agreement on the need for transparent and explicit climate regulation, without having to agree or disagree on whether it increases GDP or net expected value or something like that, because it decreases the likelihood of a catastrophic event, and the costs are worth it. Some people might say, in fact, it's not only the costs are worth it, but net, it's a benefit. But you could agree to regulate CO2 equivalents, even without agreement on whether it's a net benefit, just because it avoids the catastrophic outcome. I guess I'm leery of the notion of saying it's anybody's responsibility. You're getting into a sort of deep philosophical question that's kind of beyond me, other than to say at some level, it's everybody's responsibility.

Speaker 2: It's really more complicated even than that, because if you get into, I don't know how much you guys are aware of the climate science, but there's several degrees of warming that are being masked by air pollution that comes out of coal-fired plants. So if you start clamping down on the coal-fired plants, and you start eliminating the aerosols that are in the coal, the sulfur dioxide that's being emitted there, then you're going to see a huge ramp up of temperature. How are people going to feel about that? And then how is that going to make them feel about whether or not they should be controlling the coal-fired plants for the purpose of climate, when they close them down, and then things get warm really fast.

So in other words, when you take the coal emissions away, you stop reflecting the sunlight back to space, and things get warm really fast. So somehow you have to have some way to build a really cogent strategy, and we're talking about like the tip of the iceberg of being able to manage this problem in just reducing emissions. It's much bigger than that.

Moderator: It is much more complicated than that. That was a great concluding sentence, and it's fascinating to me to hear how we talk about big ideas, we talk about long term curves, we talk about science, but we do seem to keep coming back to politics. And all politics is local, and we talk about microeconomic effects. That means that there are winners and losers from whatever policies or legislation is adopted, and losers are going to react strongly to the perception that that's what they will be under any regime. So it's difficult.

Question: Ontario could be a really interesting test for this balance of politics and economics and jobs and environment, because they made a huge commitment to get off coal, and a huge commitment to smart meters. They're seeing some backlash on prices. They've just in the last few weeks come out with a big plan, and there is an election going on next October. So I have some more details on that. If someone wants to hear about it, it's an entirely different governance structure and weaker federal government, where you can do things across the province with the swipe of a pen. But I would urge people to watch what's going on there in the next year to 18 months.

Session Two.

Resource Adequacy in the Era of RPS and Carbon Concerns: Reliability Considerations and the Specter of Scarcity Prices?

Widespread adoption of RPS by states assumes that the intermittent resource component of available generation will grow. Coupled with the uncertainty over carbon emitting resources, there are reliability concerns. There is a prospect of very high prices in the wholesale markets reflecting real time reserve availability problems, and negative off peak pricing reflecting the tax needs of wind producers to produce without consideration of market conditions. WECC provides an excellent example of this problem. California, with its 33% RPS goal, represents ½ of WECC. Thus, if California attains its RPS objective, as much as a sixth (depending on how much of the RPS is geothermal or biomass) of WECC resources will be intermittent in nature. How can the grid address such levels of intermittency? If coal plants are shut down by owners concerned about future regulation (state or federal) of carbon emissions, what non-intermittent resources will be called upon to meet demand. If the resources are constrained, how will those constraints be reflected in pricing? What policies are appropriate for grid operators, system planners, and regulators to have in place to deal with these potential and foreseeable problems?

Moderator: We're moving into the resource adequacy and RPS world. In the absence of federal legislation, the laboratories of the states have not been unbusy. They have stepped up and done some things, some of which some of us may think are quite dislocating and creating some distortions in the marketplace. And hopefully our esteemed panel here this afternoon will shed some light on what the implications of these state policies, particularly with regard to RPSes, are for the marketplace.

Speaker 1:

My focus is on resource adequacy issues and their connection with energy and electricity pricing in low carbon energy policies. There are many other aspects of this problem, but I'm particularly going to focus on how resource adequacy relates to both the average prices of the system, and then on some of the issues related to peak pricing and price spikes and what it means that we should be doing going forward in policy terms, under the assumption that we will be operating with something like the collection of RPS policies that are developing in various kinds of states.

The starting point, I would point out, is the connection between resource adequacy and reliability. This is a subject we've talked about before. And an important distinction is the distinction between economic investment in capacity, versus investment in capacity or the pursuit of other kinds of policies in order to meet various kinds of reliability requirements and standards.

And basically, although there are differences in different parts of the country in the mechanics of how this is actually implemented, it all revolves around the one event in ten years criterion. As we know from prior discussions, the reliability standard based on the one event criterion produces high implicit values of lost load. I've extracted some numbers here, which are similar to things that I've talked about before. This particularly comes from a paper by Jim Wilson, which was in *Public Utilities Fortnightly* a couple of months ago or a few months ago. It's essentially the same story that Mike Telson, (many of you know Mike Telson) wrote about in her dissertation, which was published in the *Bell Journal of Economics* in 1975. So this problem's been around with us for a long time. And the basic idea is, taking the formula from Wilson's paper, is that the probability of the expected number of events in a given year, times the duration of the events, times the value of lost load should be equal to the net CONE (cost of new entry) of the appropriate plants, in this case, probably peaking plants.

Basically, what Wilson points out in his paper is that the standards that we're actually using, with the one event in ten years threshold, that standard is a little vague about how long the event lasts, and that's important for doing the economic evaluation. Wilson postulates five hours for the event, which is a long time. But basically what he comes away with is the loss of load expectation, if we did the optimal thing, given the cost of new entry and all the other things that we're concerned about, would be much higher than one event in ten years. So it seems to be that this is a very, very conservative standard. It's out of synch with what we think the value of lost load is.

Another way to look at it is the example that I just took from his equation on the bottom, which is that if you took one event in ten years, and it lasted two hours, which I think is a more interesting and relevant empirical case, and you take the round numbers, the $80,000 net of cost of new entry that he talked about per year, the fixed cost associated with that, then the implied value of lost load per megawatt hour is $400,000 per megawatt hour. So that's what you have to believe in order to match this particular standard.

These are high values compared with the $1,000 bid caps and $50 average energy prices in the system. So there is ample room for improving the determination of prices in order to catch up and try to deal with this reliability problem. I think it's one of these gaps in the system and the structure that is going to be under increasing pressure as we go forward, and there are different ways to think about what that might do. But I wanted to lay those numbers out there to remind you, and also use them as a reference point when we go on to some of the other issues that come along.

The loss of load expectation and expected value analysis that is embedded in that are important for resource adequacy standards, but they're only part of the analysis. There's another part of it that's relevant for renewable energy, and particularly for intermittent or highly variable sources that I just want to raise because I think it's something that gets overlooked in a lot of this discussion, or at least my reading of the literature is that it gets overlooked. The other side of the story is dealing with contingency constraints, which enter the analysis directly for large facilities and indirectly through transmission and other limits. Now, the way this is actually implemented in different parts of the country is different. And people have slightly different rules. But there's a forecast that goes forward. There are contingencies that are identified. We worry about the transmission interaction and those contingencies. We worry about the probability distribution of changes in load and changes in generating facilities in order to see whether or not we meet this standard. Embedded in that is consideration of the unusual contingencies that can actually constrain it, and sometimes, and particularly in transmission constraints, for example, these contingency constraints are deterministic limits to deal with low probability bad outcomes. And both of these elements could have a big impact on variable energy.

I want to illustrate that with the case of wind. Wind, as we know, is a low-cost source--relatively low-cost, compared to all things, but certainly amongst renewables is the lowest cost source of energy, which is why it's such a large part of the penetration in the new renewables that are going forward. The variable nature of wind presents operating challenges for ramping and operating reserves. That's a familiar conversation. We're going to hear more about that I think from Speaker 3 in a few moments. But it's not what I want to focus on here. I'm assuming we could solve that problem--the variability and the ramping problem. We can do better forecasting, we can have sufficient ramping capability, and so on. I think it's definitely a solvable problem. The recent FERC NOPR on intermittent connection standards addresses those issues, and I think that is a good start in dealing with some of those things.

Another point that people make all the time about the effect of the wind is the portfolio effect. Geographical diversification provides a portfolio effect that reduces the aggregate volatility of the wind, which is another advantage. As you go over it, it's sort of obvious--if you look at a particular turbine, it might be highly variable, because of the wind at that turbine, and as you go to different locations, and as you get larger and larger geographic areas, then you get portfolio effects, and it starts to balance out and so on. So that's another feature of the system. It depends in part on the transmission system. It's complicated in terms of analyzing it, but I think the principles are pretty straightforward. And there are things that we can do with those problems and take advantage of those things with wind and other kinds of variable sources.

The other problem that I'm highlighting here, which gets to the resource adequacy and reliability question when we're building capacity in order to make sure that we meet these very high reliability standards, is that reliability under contingency planning presents a different challenge for resource adequacy. Let me try to illustrate that with some numbers. I think the Cal ISO sent me this graphic and another that I'm about to show you. The first is an example of kind of good news. So this graph, for September 1st of this year, shows the load in California, or the Cal ISO, which is the green line, and it shows the California wind, which is the red line on the bottom, which is quite low, relatively low. And it shows the wind in BPA (Bonneville Power Adminstration), which is a big source of exports into California, and also physically far away. So you would think, we've got this diversification story going on for us. And what we see is a good outcome here. Although there was some volatility in BPA, the down period was mostly relatively low load, and then when the demand peaked, when you had high load in California, you had a high wind in BPA, so you could imagine that you could use these two things to compensate for each other and meet the load, and everything would work well. And that's true. So that's good. That's an example of the good kind of news about diversification and portfolio effects.

The bad news is in this next picture, which is the thing I'm trying to raise about this contingency planning and the concern about resource adequacy per se, as opposed to managing the normal operational situations. This shows the graph of the California ISO and BPA wind production over a period of four days, from August 24th to August 28th 2010. What I point out here, and this is not unique, but this is to illustrate the point, is that for the 24th of August through the beginning of the 26th of August, the left hand side of that graph, what you'll see is that there was basically no wind. There was no wind in Cal ISO, and there was no wind in BPA. The geographic diversification problem didn't solve the problem because we had an event which was caused by the fact that you get periods of time when there is no wind over very wide geographic regions. So you don't get the portfolio effect for those by comparison relatively rare events.

Now, the question is, how rare are they? Well, if you start thinking about it in terms of the reliability standard, that expectation of one day in ten years, then they're nowhere near rare enough in order to get around that problem. And I was looking at another study on this subject, which talked about a Stanford report which looked at eight sites across the Midwest and found that bad things like this only happened 2% of the time. Well, 2% of the time is somewhere on the order of, how many days of that? It's probably 15 days a year or something like that. That's not 1/10 of one day a year. I mean, it's a huge number in terms of this reliability standard.

It's not a huge number if you're thinking about, "Well, it doesn't happen very often. We can adjust, and as long as we have enough capacity around in the system to substitute something else, we don't have to use it very often." A good candidate for that would be very aggressive penetration of demand response, which you could use to reduce the demand in order to meet these kinds of things. But if you don't have that, and you're now facing the possibility that you have to have other iron in the ground in order to build it, which is the reliability test that we use for resource adequacy computation, this presents a very serious problem. As soon as you start getting a lot of wind, something on the order of the reserve margins of the system, then you can't add more wind, because it essentially becomes the binding contingency, because you have to put enough capacity in to meet the days like this, where even over a very large geographic region, there is no wind. So I think in terms of the resource adequacy question, this is a challenge that we are going to have to face. How we're going to deal with it is a good question. And I don't know the answers to how we're going to deal with it. At small penetration levels, it's not a problem. I think the operational problems can be dealt with. But at the high penetration levels, the no wind contingency could be the binding constraint, even if we have perfect forecasting and no ramping limits. So I just lay that out there as a challenge for us to think about it.

One of the ways to deal with that, as I've suggested, is to put more iron in the ground, which is very expensive, and that will attack the economics of these renewables. Another way to deal with it is to improve our demand participation and have much more flexible demand, which of course, as you know, would be near and dear to my heart.

If we're going to do that, we have to think about--oh my gosh--incentives, and if we think about--oh my gosh--incentives, we'll get into pricing questions. I want to spend a few minutes briefly just to sort of sketching what I see as the challenge and the problem here.

I've given you a picture here, which you've seen many times before. This is the simplified electric market with a short run supply curve and demand and prices at different cases. We know that we have a problem at the high end of those prices, because of bid caps and other things, which suppress energy prices. This is the missing money problem, which occurs as part of the resource adequacy issue. It has a big impact. The reason we have capacity markets, the reason we have concerns about resource adequacy, is often and chiefly connected to the missing money problem, which is not enough money in order to justify building the capacity. And so we create these other resource adequacy payment mechanisms in order to provide the missing money. And that's something that's in the background here that we have to be thinking about.

I want to just sketch for pedagogical reasons how this might play out in dealing with the electricity market and RPS and other kinds of low carbon policies. First, I'm going to take that simple diagram from before and make it even simpler. This was actually a complicated problem that requires detailed simulation of the system, because it depends on whether you're on the left hand side, which is the off peak hours when demand is low, or you're at the right hand side, where capacity is constrained, and the scarcity pricing is high, or the intermediate hours, which I'm going to finesse here for a moment in the picture. But if we have the nuclear and then the coal and then the gas, that sort of dispatch curve, you can see what the picture looks like. And then we talk about what would happen if we did the first best way of dealing with this, that I would prefer, which is to put in the cost of carbon dioxide, and I made up a stylized example here, where you add it to the cost of coal, and you add it less to the cost of gas, because gas produces less CO2. Nuclear doesn't produce anything. That would produce a change in the relative economics. It may not, depending on the CO2 price, but if you make it high enough, you get this change where gas is better than coal. Eventually you can make both of them terrible, but I'm just looking at this intermediate case. So you get a reordering of the dispatch curve, where you're going to do gas before you do coal. But you won't have a dramatic effect yet if you assume that there's no entry or exist from the system, which this example illustrates.

That's just to set up the problem, so we can then think about what's going to happen. Then we have green entry, and I picked wind, again, as the example. Here I'm assuming that we have a carbon price, and that carbon price is big enough to pay for the cost of the wind that's above the cost in the marketplace that you would have without the carbon price, which is a simplifying assumption. Then you get a shift in the curve, and the first thing that happens as a result of that is that in the short run, if you don't have exit, prices go down at the peak load, and they also go down at the off peak hours. The intermediate hours is a more complicated story. The reason they go down at the highest levels is just because you now have excess capacity in the system, which is why I'm trying to connect it to this resource adequacy story. But what it will do is produce lower margins, because a lot of the money is going to pay for the CO2 credits, and so the gas and coal facilities won't be able to stay in business. The nuclear guys will be delirious as they collect all the additional rents, assuming they can solve the dispatch problem, because they're now going to be forced out of the low end of the dispatch, and they might have to either pay in order to stay online or do something that's a more complicated story. But if you have those lower margins, the traditional units will be forced to retire early, or we'll build fewer of them and invest less. The point I want to emphasize here is that more of the total cost move from the energy market, again, into resource adequacy payments. So we're going to have a situation where the capacity markets and the resource adequacy, the reliability considerations will become more important rather than less important. There may be some increase in energy price volatility, because of this fact that the off peak prices will drop even more in this hypothetical example.

The details of actually how this works require dynamic simulations over uncertain conditions, but if you look at that case, what you find is that it has less impact on some of these issues about resource adequacy payments, but it does tend to drive them down, and it makes it harder to fund the other conventional resources, if they're still going to be there to meet resource adequacy requirements. And eventually you'll get the exit. People will stop building. They'll retire those coal plants. Then prices will of course go up in the peak periods again, and we'll reinforce that situation.

If we go to the next slide, this starts the analysis all over again, but does it the way we're doing it now, which is that we have something like investment tax credits, which make it cheaper for wind to enter, and production tax credits, which make it cheaper for wind to enter. So wind enters. In other words, we don't have a CO2 price in order to justify it. The production tax credits are variable, so that gives them a a negative variable cost, which is what happens on the low end in the off peak hours. You don't get the increases in everything else, but you do have the excess capacities of margins in coal energy and gas go down. How it's all going to equate to the load is a complicated story. But I think it's unambiguous in that it's going to put more pressure on the resource adequacy story. So we're going to have more of this concern about reliability, more money going through capacity markets and resource adequacy payments, and that pressure is actually going to build if we don't do something to fix it.

Eventually that will change. You'll get exit, and then people will leave the market in the high ends of the coal and the gas, but how it's all going to shake out is complicated in terms of its effect on the load. But I think it's unambiguous in the fact that it's going to make the resource adequacy problem more problematic and less handled by the energy market. And more is going to have to be handled through other kinds of means if we don't do something about it.

So efficient carbon pricing handles all or most of the impact to the short run energy market, and it's well integrated with operations. Targeted renewable supports handle the most important payments outside the energy market in decreased net energy prices in the short run. So these are ITC (investment tax credit) and PTC (production tax credit) kinds of payments. And they also tend to socialize the cost. Feed in tariffs, or renewable portfolio standards, lower short run energy prices, and average total load payments may also go down in short run, but up in the long run.

This is the phenomenon that's been observed in Europe, where with the feed in tariff, it's basically a monopsony story, so you pay above-market prices for something. It enters the market. It shifts the supply curve. The supply curve is steep. Prices crash. There's a big transfer from generators to load. So prices to load actually go down as a result of that, even though the cost of the system goes up. But there's a big transfer from generators. Whether or not that's a good thing, we can debate, but it's certainly unambiguous that it's going to result in big resource adequacy problems, because now you're going to have much more incentive to retire plants and do all the other kinds of things.

The direct effects of RPS on energy prices depends on the actual implementation. One of the things you could look at is different ways of imposing the obligations on load or generation to meet RPS standards, and that has an impact on the prices that go through the energy market. So it's a big deal to nuclear, but it may be not such a big deal to load that ultimately will have to pay the average costs.

Low carbon policy could simultaneously decrease peak prices and increase the volatility of prices by inducing more negative off-peak prices. Which gets me back to my final point here, to connect it back to my favorite subject. If we're worried about this resource adequacy problem, and we have this big gap between reliability and normal standards, if we'd like to use the energy market to provide efficient signals, one of the big challenges is to improve dynamic pricing, both to provide the incentives and to make real this alternative of partially addressing the resource adequacy problem by having more dynamic pricing and demand response. And by dynamic pricing, I mean real-time pricing, which is not the same as time-of-use pricing. The upper graphic on the right is something I've prepared before for a conversation about this in Newark, so I picked Newark Bay at the time, and PJM, but this is just in February. It shows the real time prices every hour for 24 hours, for every one of the 28 days in February. And the point here is that real-time pricing is not the same thing as time-of-use pricing. Time-of-use pricing is, "I know when the peak is. I know what hours to increase it. I know when to set it off low, and that's all, and I can set that in advance." And this picture is just to show you that that's not true. Price varies all over the place. You don't know what's going on. There are all kinds of complicated things. The RTO model deals with that, but we need to get those signals out to people into the marketplace. And the missing money problem, which is serious, will likely increase with further renewable entry. That's the conclusion, and improved scarcity pricing would help support operations and send investment signals.

The lower right hand graph, if you look at it, is just this PJM data on comparing the fixed costs versus how much money you actually earn in the energy market. And the point is, the dark bars are always less than the grey bars. The grey bars are what you'd need to make in order to justify the resource adequacy investments, and the dark bars are the money you do make. And what you see is that they're a lot lower.

So this is this missing money problem, and the lack of good scarcity pricing is a very serious and first order issue. Which is an old story, for those of you who are familiar with it, and I continue to work on trying to deal with this, and FERC is working on it. Speaker 3 is working on it.

But real-time pricing would improve scarcity pricing and would support demand response and dealing with variable energy resources, and it has all kinds of other advantages as well, in terms of energy efficiency and such, and it's something we should be doing. It also has a big impact on technologies like batteries, because we've seen ideas about how plug-in hybrids could allow for the use of their batteries to arbitrage across the day with this price volatility. But people who have looked closely at that have concluded, well, there's not enough. There's not enough volatility in those prices, and we need even more if we're going to justify the batteries. So I think it's justified after all, because we're not pricing the scarcity enough, so we don't have enough volatility, even as much as we actually showed. This would bridge some of the gap between the reliability standards with implicit value of lost load at $400,000. The greater volatility of short run prices would have a big impact on renewables. Solar, which is positively correlated with prices, would benefit. For wind, which is negatively correlating, prices would suffer. But better scarcity pricing would mitigate but not eliminate some of the missing money problem and the reliance and resource adequacy payment mechanisms.

Question: I had a quick question about the last part here. You talked about demand response and bridging the gap. Do you have a sense that that was going to be mainly through alleviating the resource adequacy requirements, meaning that demand response would satisfy the resource adequacy requirements as opposed to new resources? Or were you thinking that the major contribution would be really to relax the ad hoc rules of market power and scarcity pricing?

Speaker 1: Well, certainly, better scarcity pricing through things like the operating reserve demand curve will deal with the market power issue. I mean, it doesn't make it go away, but it doesn't create this inherent conflict with better scarcity pricing. I think the resource adequacy part of the story and integrating demand response is an unsolved problem at the moment, the way we actually do it in our reliability testing. It doesn't really incorporate it in a very effective way. And we're leaning very hard in the direction of trying to get more iron in the ground, that kind of thing. But I think having good demand response, real demand response in real time when you really need it, would help a lot. It would also require us to rethink how we do this resource adequacy test and this reliability testing. Because demand response is going to come in a lot cheaper than $400,000 a megawatt hour. And so resolving that gap, I think, is a challenge that is before us.

Question: On that question about that gap, it seems that there's still a problem in terms of the missing money not being subsidized through reliability payments, passing payments across the whole year that's not paid for by the load in that high hour. Why not charge the load for the reliability payments based on the loss of load probability in the hour, so you'd have a capacity auction. You'd have payments to generators, and you don't subsidize it across the year. You have scarcity prices, but then on top of scarcity prices, you put on your payment for reliability capacity.

Speaker 1: Well, there is an issue here about exactly how just mechanically to implement that, but I think the spirit of your question, my answer is, yes. So I would agree with that that's a good idea.

Question: Your prescription for scarcity pricing and demand response--does it change between having a carbon pricing for renewables, as opposed to having these tax credits and other incentives? Or is it the same as long as you have variable resources on the grid?

Speaker 1: I think the conclusion which I came to in preparing these comments is, both through renewable portfolio standards or anything like that, or through carbon pricing, one of the characteristics of that problem is, it's not time sensitive over the day. I mean, it's inherently a long term problem. You can effectively bank these things so that the incremental cost of generating more carbon is the same in the middle of the night as it is during the peak hour. So all it does is raise and lower the average costs.

But it does torque things a little bit, because of how much is variable and how much is fixed. And because a lot of it is fixed with the renewable and is handled through some other way, it tends to leave less money in the energy market for everybody else. So it makes the resource adequacy problem worse. But it's not because it's changing the shape all that much, but it is changing it to some degree. So it's less important for the scarcity problem than I would have thought ex ante, just because of the fact that it doesn't change over time. But the scarcity and missing money problem, and the fact we're not pricing it or charging for it in something like the previous questioner was suggesting, is made more important just because you have less total rents going through the energy market, and a lot of it gets siphoned off into CO2 or renewable energy credit payments or something like that.

Question: That was a scary slide, if there's no wind for three days, and you're expecting a lot, and I recently saw a proposal for demand response that would be unlimited calls on the demand response participants. And what we had looked at was like 9% would be a good number to get if we could really reach a demand response population of 9% of the load. And so what does that portend for how much demand response are you talking about? Is there an order or magnitude? Is it 50% of the load? What's possible?

Speaker 1: Well, the simple answer would be, take the iron in the ground that's dispatchable. You have to derate it to account for the fact that some of it's out of service, or whatever it would be, for the traditional units. And then if you're worried about it from a contingency point of view, you can't rely on the wind for anything if you're doing the contingencies planning, if that's the problem.

So it's not how much wind there is. It's how much load there is relative to the iron in the ground. And then that's what you need in terms of demand response, because you're going to have to curtail it. And you're either going to curtail it involuntarily or voluntarily on these days. Now, these days are relatively rare. And 2% seems to me to be relatively rare, and we might find a better way to deal with that through pricing and using demand response. But if you're using the current logic of resource adequacy and reliability, then they're not rare enough. Right? So you're going to have to either build something or contract with people for the demand response and pay them in advance in order to make sure you have enough to capacity to deal with it. But in some sense, it's not how much wind there is. It's how much everything else there is, plus the total load. Because the wind can go to zero, and it could go to zero for days.

Question: And it's a question of installed reserve margin, how much you really change that to have iron in the ground, and how much you can really have, how much of the 100% of load as demand response is realistically possible?

Speaker 1: Right.

Question: You talk about industrial customers, OK, they can go away. But what about everybody else?

Speaker 1: Right. And how much of it is credible and all these other kinds of things.

Speaker 2:

What I'm going to do is kind of give you a lay of the land of RPS in California, and realizing that this is also a discussion about resource adequacy and linkages, towards the end I will try to give you some update on what we view as the linkages between resource adequacy objectives and meeting the objectives of RPS.

The major policy drivers in the state are several, and they come in over several years. The first one is AB32, which basically calls for reduction of greenhouse gas emissions to 1990 levels by 2020. And then to support that, you start getting into specific renewable portfolio standards, starting with the 20% by 2012 timeframe, and then a 33% renewable portfolio standard by 2020. In addition to this, there are also other supply-side policies that are impacting resource flexibility and the conventional fleet. Specifically, the once-through cooling plants, which will over the next ten years affect 38% of the state's gas-fired generation and some of the nuclear. So some of these will have to be repowered or replaced or dealt with, because of the once-through cooling issue. How these resources are replaced will bear on how we can manage the resource flexibility needs as we get higher penetrations of our renewable generation. More recently, FERC has a recent NOPR that also is addressing the variable energy resources to address the renewable penetration.

My discussion here is mainly about operational integration issues. I'm not here to discuss transmission-related siting issues. Instead, I will focus on integration issues, which I define as basically how do you manage the meeting your load and the flexibility needs of the system. The next graph here provides some insight into how the different technologies that can count for RPS will be growing over the next years, as we approach the 33% level. Just so everybody understands, biomass, biogas, solar, geothermal, small hydro and wind are all the generation sources that count for renewables. In California, large hydro does not count for renewables. I know in other places, that does count. You can see here, though, that the big changes that we see on the horizon is the large increase of solar, and solar itself has some uncertainties about is it going to be large central station, thermal? Will it be PV? Or are the economics driving more towards the distributed PV solution? It seems like things are shifting more towards the distributed PV solution, in which case we have to take that into account, both from a transmission and from a distribution point of view. In addition to that, wind is the next big increase, and again, as Speaker 1 indicated, diversity will have to be considered-- where the wind pockets are, and the benefits of diversity that can come about, but also the potential that they can be in synch in high load periods where they may not both be delivering.

This next graph is just an illustration of the balance effects on the system of higher levels of solar and wind. Traditionally in California, we've been very used to having to ramp up conventional generation as wind drops out during the day during high load periods. In the future, with the higher amount of wind, we'll see the ramp-out of wind be a larger ramp-out towards the morning hours, and then a high fast ramp-in as sun rises of solar generation. The speed of the ramp will depend on the type of solar technology, whether it has gas augmentation and so forth. Then most of the day you're basically dealing with relatively flat in balance effects, except for potentially on those cloudy days where the variability of the solar may be impacted. However, we do recognize that you have a distributed set of solar, and the signal of the variability due to clouds does tend to dampen out as a result of that diversity. And then as you go towards the evening hours, your load is dropping off, but not always dropping off. Often times, especially in portions of the year, as the sun goes down, the lights come up. And actually, the winter peaking pattern is that we peak in the evening, as the sun goes down. So we can get in these situations where the sun is going down, so we lose the solar, and we have this gradual ramp-in of wind generation.

Again, these are all going to be new patterns from what we operate with today, utilizing a potentially more limited fleet than we have today. So therein lies the challenge that we've tried to study in coordination with others.

And really, what we're trying to study and what's illustrated in this graph is how much flexibility we need in the system, both from a fleet capability perspective and also operationally--how do we prepare ourselves and manage the fleet that we do have on a daily and hourly basis? And so we've performed studies that have identified both the regulation and load following requirements.

Regulation, I think, is fairly well understood by people. It's the four second balancing capability of the systems, automatic generation control. The one that's kind of new here is this load following flexibility need. And the way we describe that is really, it's the amount of flexibility needed to meet not the intra five minute capability, but the differences between the average hourly load and I'll call it net load, because it's really net of the intermittent resources, versus what the average five minute net load is on an ongoing basis. So the differences between the average five minute and the average hourly is basically what we call load following. And it's important to understand, because that amount of flexibility needs to be available in the system to be prepared for either the variability or forecast errors that can cause differences in the system. So we are working with both uncertainty and variability.

In August we completed our renewable integration study, which was a very detailed study looking at the fleet capability for meeting 20% RPS. The study was a collaborative effort between GE, Pacific Northwest Labs, Plexos and Cal ISO staff, and I want to recognize specifically Udi Hellman, who some of you know, for their efforts on this intensive study. This study also is the first study in which we also started recognizing and studying the effects of large levels of integration of solar resources. So it's an important transition from previous studies that traditionally looked at the integration of wind resources.

The key findings are that with the increased renewable integration and the location of the wind and solar resources, we will get both benefits and potentially some issues with the diversity of resources. And that does affect the flexibility needs, both in positive and negative directions. We do see from the study that there will be an increased need for regulation resources. However, we also concluded that based on the current fleet, there is sufficient installed regulation capability in the system.

In terms of load following requirements, I want to clarify that today we don't have an explicit load following, let's say ancillary service. Our load following comes about from the flexibility that is committed in day ahead and augmented in real time. But there's no explicit constraint that says we need a certain amount of flexibility committed. So generally speaking, there is sufficient committed flexibility to meet the requirements of the system; however, the study indicates that that amount of flexibility needed will increase. And there are times where it will be a challenge and a management issue for the fleet at 20% RPS levels to maintain and insure that you have the right mix of fleet committed on a given day or a given hour.

We do see the potential for over-generation conditions increasing in the study. However, surprisingly enough, we do not see large amounts of hours of over-generation conditions. This could be in part because of some of the differences the way the study was performed, versus what we're observing in actual practice today. Very little wind or other intermittent resources get scheduled day ahead today. We then end up committing other resources to fill in. And then when you get to real time, we do see in actual practice times where we're in over-generation conditions. The study did not factor in that some of the wind and intermittent resources do not always schedule in the forward markets. And so we were able to reconcile the results we saw in that study with actual practice. We saw that the fleet that does exist, especially the combined cycle resources, have increased number of starts and a general decrease in energy production or capacity factors. And that relates to the fact that we do see the potential for reduced revenue in the energy market coming about at the higher renewable integration levels.

And then lastly, we do observe that market rules and market incentives around self-scheduling and reducing the operator's flexibility in the downward direction will have larger impacts in the future on our ability to manage the higher levels of renewable penetration.

This next slide here is just a comparison of what the expected regulation and load following requirements are in the upward and downward direction as we move from the current levels, the 2006 levels, to 20% and 33%. And so you do see the significant increase in load following in the range of moving from around 1,500 megawatts to potentially over 4,000 megawatts. For regulation, where we're roughly in the 500 megawatt range at 20%, on the outside, we see requirements potentially going up to as much as 2,000 plus in each direction.

I want to say here, too, that the solutions and the problem of upward imbalance needs, and the downward imbalance needs are probably different and probably do need to consider different solutions. For example, in the downward direction, if we have over-generation solutions such as curtailment of intermittent resources or other resources, this is certainly an option and should be considered.

The next slide here is a picture of what the study indicated with respect to the combined cycle resources utilization in terms of starts, energy, and revenue. You can see that what it looks like is the utilization in terms of cycling of the resource will increase while the general energy production and revenue stream will decrease. That does present some concerns. As indicated before, are we facing a situation where the revenue will not be sufficient to maintain the resource fleet flexibility? And what do we do about that going forward?

The next slide here is similar. And this looks like the simple cycle view. And interestingly, the simple cycle resource actually has fewer starts than the reference case. Some of our 33% studies do start to indicate that at the higher 33% levels we start to see the simple cycle combustion turbines actually increase in their number of starts and in capacity factors as well. So there is more utilization in terms of cycling them. But at the same time, we still continue to see the revenue decrease.

So that brings us to the question of what we see as the combination of solutions to address these issues. Resource adequacy is something that we've recently said, "If you don't start now in terms of looking at resource adequacy, in terms of the flexibility of the resource adequacy fleet, then we may be setting up a situation where while we're meeting our planning reserve margin with the resources, we may not have sufficient flexibility in that fleet." And just briefly, in California, the CPUC basically requires load serving entities to have a planning reserve margin of 17%. There are some requirements for local capacity, for local transmission in congested areas. But there is no explicit rule about the ramping characteristics or other characteristics of that resource adequacy fleet. Furthermore, the resource adequacy needs can be satisfied in part by wind and variable resources. They can account for some of the resource adequacy, based on historical contribution to peak load. Now, that does set up a situation where on that bad peak day, where the wind is not blowing, those resource adequacy resources that you may have been relying on may not be there. So that all needs to be considered and factored into this.

In the longer term, looking out ten years, how do we build the fleet, or get the fleet built, to support the renewable integration? In the CPUC, there is a long-term procurement planning process that is underway, and it occurs every two years. And in this cycle, there is a discussion about renewable integration needs and the flexibility of the fleet. So we're encouraged by that discussion.

From a California ISO perspective, our immediate task is to be operationally ready. And so what that means for us is ensuring that we have forecasting capabilities, we have sophisticated grid monitoring capabilities, we know how to manage the intra-hour flexibility, and we have the tools to do that. Part of that is setting up specific operational desks with the responsibility of managing and monitoring the renewable fleet and the flexibility needs. From a market policy perspective, we are undertaking an initiative to evaluate whether there need to be additional new products to support renewable integration. Do there need to be new types of regulation or different types of reserve requirements, including potentially adding either additional contingency reserves, or explicitly putting constraints in around load following reserve? And lastly, we are looking at potential needs for more sophisticated day-ahead and real-time control algorithms to minimize the impact of the variability of the renewable resources.

Speaker 3:

What I'm trying to do here on this panel is to try to draw the linkage back to Speaker 1's presentation, which is specifically addressing the issue of resource adequacy and the introduction of wind with the energy market and capacity markets. And I want to look at the overall resource adequacy issue as we addressed it this morning in the first panel. We started at least mentioning some of the other policies that are out there, whether it's the HAP MACT (Hazardous Air Pollutants Maximum Achievable Control Technology) rule, or the transport rule, and so forth. And so I want to try to bring that together and provide you a sense of the challenges that we may face in PJM.

In compiling some of the data that you have in the presentation, I've tried to make sure that the data that's here comes from publicly available sources, and I'm concerned about revealing commercially sensitive data, so some of the data consequently is going to be a little bit out of date. I'll point to places where it might be out of date, and suggest some adjustments that we might want to make for that.

Here's a matrix including the greenhouse gas tailoring rule, the transport rule, the HAP MACT rule, which is yet to be issued, the 316B cooling water intake structure rule, which is yet to be issued, and so forth. And in thinking about the different categories here, I think the relevant dates are extremely important. We know that the tailoring rule is going to go into effect on January 1st of next year, essentially. (Actually, I think it's technically January 2nd because it's a weekday.) The first phase of the Transport rule is going to go into effect in 2012. But the more stringent caps and the reduced flexibility for trading amongst polluting resources goes into effect in 2014. Then we've got the HAP MACT rule, which there's a general consensus is going to become effective on Jan. 1, 2015. You've got 316B, which will have an effective date somewhere in the 2015 to 2018 range. But there's some flexibility because of the way the permits are issued. So once the rule is issued, you may have resources out there which may have only once through cooling, but which will have several years to make that retrofit based on the timing of their permit renewals. More locally, we have the specter of high electricity demand day rules that are being promulgated by states that are signatories to the ozone transport commission. Currently, we only have one state within the PJM footprint that has that, and that's New Jersey. And they've got some more stringent rules that are going to go into effect in the 2015 to 2018 time range. There are discussions currently going on at the New Jersey DEP as to how close in do we want to see those new regulations go into effect. And of course, renewable portfolio standards, which we've heard quite a bit about already on this panel.

I think it's useful if we think about the standards themselves, and then about the impacts on the effected units, or on the impacted units. So, for example, the tailoring rule. I think it's reasonable. I happen to agree with speaker 1 on this in reading the tailoring rule and the guidance that was issued recently. I think it's much ado about nothing right now for coal units with the emphasis on efficiency, notwithstanding one participant's interpretation and the wink, wink, nudge, nudge that the EPA did put into its guidance about combined cycle gas as possibly being BACT (Best Available Control Technology). It just depends on how the states all react to that, I think. But clearly, the impact on these units is going to be mostly on their fixed costs.

In order to meet some of the requirements of the transport rule, as we'll see later, there are going to have to be quite a few retrofits done, FGDs (flue-gas desulfurization) for sulfur dioxide, SCRs (selective catalytic reduction) for nitrogen oxides. So there's going to be a huge fixed cost component. But because there's still an element of cap and trade, at least within each state's boundaries, you're now going to have a price on emissions at the state level, whereas in the regional cap and trade program under CAIR, you had one region-wide price for SOx and NOx. Now you're going to have each individual state with prices for SOx and NOx for both annual and ozone season. So you want to talk about really complicating things and following the prices and how they're going to be incorporated into dispatch. That's going to be a joy for all of us to try to track.

HAP MACT is either going to be a performance or technology based standard. Even if it's a performance standard, it's probably going to be de facto a technology-based standard. The likely technologies that we're talking about in the industry are wet limestone FGDs. Fortunately we're going to see a lot of those installed with respect to the transport rule. But also the additions of activated carbon injection and/or fabric filter baghouses.

Then there's the Clean Water Act, 316B. Once-through cooling seems to be out as a general consensus. And so the question is going to be, what is the cost of putting in cooling tower structures to reduce water intake from the various bodies*?*

I'm going to skip over the HEDD (High Electric Demand Day) rule here for a moment and get to renewable portfolio standards, because this is where it gets interesting. If you talk about environmental policies, the ones that I've just mentioned are primarily or largely going to affect the fixed cost of existing units and/or new entry units if new coal happens to enter into the mix. Let's not foreclose that just yet. However, the RPS, as Speaker 1 has pointed out so well, and then of course, Speaker 2 has also pointed this out in the California context, it's going to have an effect on the net energy market revenues. So now you've got two things going on that are going to affect the economics of resource adequacy. One's on the cost side, one's on the revenue side and the ability to recover those costs. And I think it's important to note that you're going to get it from both sides here with these different policies that are being put out there. And it's a different way of looking at the world. But it's all going to affect the economics of resource adequacy.

So if we think about just the costs of some of these technologies, these are some very rough ballpark estimates taken from various sources, whether it's from the EPA, or it could be from the Energy Information Administration. I've backed out some numbers from the PJM Independent Market Monitor's 2009 *State of the Market* report. What we end up seeing is that the cost of retrofits for FGD is probably in the ballpark of $500 per KW for a reasonably sized coal unit. For SCRs, I've seen ranges or $150-300. For ACI and baghouse, I've seen estimates as low as $50 a kilowatt, and some as high as $300 a kilowatt. I just put $100-200 range in there just to be safe. And then some of the costs for cooling towers.

Now, compare that to the fixed cost of new entry for combined cycle gas, and for simple cycle CTs (combustion turbines). It's hard to tell just from a fixed-cost basis which is going to be the more efficient or cost effective decision. It depends on where you end up landing. EIA uses an estimate of close to $1,000 a KW for new combined cycle gas. Yet if we back out the numbers from the 2009 *State of the Market* report, it starts looking close to $1,500 a KW. Same is true on the CT. So, low end, you see EIA close to $600 a KW, and I think that was also a number used by NERC in its recently study. And then as much as $1,000 from the *State of the Market* report. So the range of cost of new entry that could possibly replace any of these existing coal units or other units that might be affected by environmental regulations is highly uncertain at this point, until we actually start seeing a lot of steel being put into the ground.

Obviously from a resource adequacy standpoint, not to belabor the point, the whole idea is that resources, whether they're existing resources or new, have to have a reasonable expectation of collecting sufficient revenues to cover their costs, including the cost of environmental retrofits and other going-forward costs into the future, plus a return on investment. So the real question is not, in the context of RPM and PJM, not whether we're going to have a resource adequacy problem, but how much is resource adequacy going to cost us at that point? Because with RPM, we're going to try to maintain that resource adequacy requirement. It's just, what is the price of doing so at this point? And what's going to drive that is what's going to be the new entry, and how many units are actually going to choose to deactivate or retire as opposed to making retrofits?

And so that's the part where I'm going to turn my attention here. And I'm going to focus mostly on coal fired capacity for our purposes. If we look at PJM, and again, this is from January 1, 2009, from PJM's EIA 411 submission, we had 66,000 megawatts, approximately, of coal-fired capacity in the footprint as of January 1st. Since then we've had some announcements of deactivations that will be effective at various dates up through 2014. We've actually had some units retire in the interim. But this is the approximate number. And then I've tried to break this down by age and size, and then by region, because the location is going to matter. If we look at coal units more than forty years old, it's just a little bit more than half. If we look at it by size, maybe a third are less than 400 megawatts. And I'll show you why in a moment I chose the distinction between 40 years and 400 megawatts. It's a pretty stark difference. And then there is the intersection of those two things. And I think as a general rule as we look at this, about 2/3 of that capacity is in the rest of the RTO. A third of the affected capacity, as it's going to turn out later, is going to be in the Mid-Atlantic region. So basically, it's on the eastern side of the West to East transmission constraints that currently exist within PJM.

Size in this case does matter much more so than age. If you look at units by size, if we're talking about that 400 megawatt cutoff, units that are greater than 400 megawatts in size operated in 2009 at an average capacity factor of 70%. For units below 400 megawatts, on average, you were operating about 33%. And, of course, there's a huge difference in thermal efficiencies as well.

This is data that was taken from EPA's Clean Air Markets Division databases that give us gross generation numbers and heat input numbers. So anybody could try to reconstruct that with the EIA 411 data. Age is not as big a factor. So really, it's going to be about the size of generating units as opposed to age that may be a determinate for the economic viability of these units to be able to recover the cost of environmental retrofits going forward. But as I was discussing at lunch a little bit, certainly age and size are pretty highly correlated here. So we're looking at older, smaller units that are most likely to be at risk for early retirement.

Now, what are the pollutants in the short term we might want to pay attention to? If we think about the transport rule, one looks at the proposed rule and looks at the proposed caps by state for sulfur dioxide in 2014 (and I chose 2014 simply because that's where the more stringent caps go into place, and will be fixed from that point on, at least for now). And there's only that intrastate trading. And you'll notice here that given 2009 emissions and where the caps are in 2014, there's a lot of work to be done in terms of getting emissions down at the state level.

And in particular, I want to highlight three states that are almost entirely in the PJM footprint, Ohio, Pennsylvania and Maryland. If you just look, as a percentage of where they need to get to, given the caps in 2014, there's a lot of work to do. One is simply not going to get there by fuel switching, by switching from high sulfur coals or even medium sulfur central app coal to Powder River Basin coal, for example. It's going to require FGD retrofits in order to get there on a lot of units. Other states are not in quite as much trouble, per se. West Virginia's not so bad off. Virginia may not be so bad off. But those three states are pretty worrisome in terms of the caps and the kinds of retrofits that are going to need to be made. Although I can tell you that in Maryland, there are a lot of units that have recently undergone retrofits that have gone into service this year. The same is also true in Ohio. Not as much so in Pennsylvania.

So if we actually look at the configuration of coal units within PJM that do not have either wet limestone FGD or just dry limestone FGD, and/or fluidized bed combustion--a lot of newer units, which are smaller often in cogeneration operations, had chosen circulating fluidized bed or some sort of fluidized bed combustion technology, which is great for reducing sulfur dioxide emissions in the combustion process. A little bit under half of the capacity does not have sufficient controls for sulfur dioxide currently. And if you break that down by size, you're looking at about a quarter that are less than 400 megawatts that fit that criteria. So we've got quite a number of generation facilities in terms of megawatts that are not yet controlled that are going to have to make a decision with the transport rule, and then obviously later with the HAP MACT rule on whether they're going to install limestone FGDs.

NOx, however, is not a really big problem, as least initially. In fact, if we look at 2009 emissions, the 2014 caps are not even binding at this point. So the need for immediate retrofits for SCR to reduce NOx emissions are not as critical. So at least in the short term, if we're thinking about looking at units that are going to have to make these decisions, it's probably going to be on the sulfur dioxide side, as opposed to NOx. Because again, these caps are not really binding at this stage.

For completeness, if we look at the set of units that don't have SCRs and/or limestone FGDs, it's a pretty similar number that don't have limestone FGDs or fluidized bed combustion technology. A little bit smaller in number, but nonetheless, they're out there. The one thing that is looming, however, that I didn't have on my first slide, is the update of the National Ambient Air Quality Standards rules that are coming down the pike in the 2012 timeframe, if I remember one of the presentations from Session 1 correctly. The "train wreck slide." That could have a big effect on nitrogen oxide emissions. So I've put this up here. While it doesn't seem to be an immediate concern, it may be a concern at some future point down the road. Again, we're looking at it by location, getting 2/3 in the rest of RTO, a third in the Mid-Atlantic region.

Now, if we think about other rules, for example the HAP MACT rule for mercury and acid gases, based on conversations that we've had with EPA staff, EPA, when they modeled the transport rule, did not see a whole lot of unit retirements nationwide, let alone in the Midwest or the Mid-Atlantic region. But what they did feel, at least a priori, without any modeling that's been done publicly, is that if there's going to be a rule that's really going to affect coal fired power plants, it's this one. It's the HAP MACT rule. And that's because it's going to be more of a technology-based rule, or a standard that's going to mandate technologies. In addition to limestone FGDs, you're looking at the addition of activated carbon injection and/or fabric filters. And again, the numbers by age and size are very similar to what we've seen before without limestone FGDs or fluidized bed technology. So we're looking at in the ballpark of greater than 10,000 megawatts footprint-wide that may potentially be at risk by age and size of early retirement, just simply because the economics may not be there.

Now, if we turn our attention to once-through cooling and 316B of the Clean Water Act--in order to come up with some of the numbers here, we actually had to dig deep using EIA 860 data from 2008, the discontinued EIA 767 data from 2005 and then 2000 for nuclear units. So these numbers may indeed be out of date. But one of the things that I wanted to point out here is the oil and gas steam numbers. One of the things that NERC had mentioned in its recent study was that oil and gas steam units will probably be the most affected set of units under 316B in their analysis. Now, while we have very few oil and gas steam units relative to the rest of the generation in PJM, which has over 165,000 megawatts of capacity resources and generation, and in that context 4,200 doesn't seem like a lot. But of that 4,200, 3,000 are located specifically in MAAC, and another 1,000 or so in the rest of PJM are actually east of the West to East constraints.

So here it doesn't seem like a large number, but this is where resource adequacy gets a little bit fuzzy. It's not always about the numbers. It's also about the location. And so while the numbers here may not necessarily draw a "Wow, oh, that's a lot," the location does matter, and especially if we start considering that in 2009, those oil and gas steam units on average operate at a capacity factor of 7% or less. They're not really operating in the energy market. They're really going forward on capacity market revenues at this stage. Also of those numbers, just for full disclosure, there have been about 550 megawatts of those units that have already announced their intentions to deactivate by the end of 2011. So we know some of them are already going to be going away.

Now, in terms of RPS, to provide some empirical evidence for what Speaker 1 said and what Speaker 2 said about California, back almost two years ago when PJM did its CO2 white paper study, we ran some scenarios with 15,000 megawatts of wind resources on the system. And what we found is that it reduced load-weighted average LMP by about $5.00 a megawatt hour. So this just reinforces everything that Speaker 1 was saying earlier about the impact of RPS on resource adequacy, on the stream of revenues, and moving those revenues from the energy market into the capacity market going forward.

Now, I don't want to get too much into RPM. I don't want to make this a tutorial about RPM. But let's just keep in mind that as the RTO, we don't have the power to mandate that units enter or exit. It's got to be based on market signals. There has to be revenue sufficiency. The good news is that in RPM, offers into the base residual auction and incremental auctions can include the cost of environmental retrofits. There are specific tariff provisions that allow for project investment recovery, and even special provisions on cost recovery for mandated expenditures, like environmental expenditures. Now, while the offers are capped at the avoidable cost rate, there's actually a great deal of flexibility underneath those caps. And in talking with some of the generation owners within the footprint, they feel like they do have at least some flexibility to make offers that match their expectations about questions like how many years am I going to amortize the investment over? What's my expectation about the internal rate of return that I can handle before I decide that it's just not worth it? What are my expectations about future gas prices, and so forth. So there does seem to be quite a bit of flexibility in RPM to allow affected resources to make offers that are going to reflect environmental retrofit costs and also reflect expectations about future policy, future gas prices, future energy market outcomes. We've already talked about that.

This is just a slide showing basically where RPM prices have been in the Mid-Atlantic and in the rest of RTO as we've seen. Prices have gone up recently in the Mid-Atlantic and in the rest of RTO. They've been quite low. But again, if we're going to see a dynamic where there's new entry, or we see units retire, these are obviously going to change.

Now the question becomes, if we do see unit retirements, or we do see the potential of new entry now that the costs of maintaining existing units go up, where are we going to see that new entry come from? Well, currently (and I pulled this last week), we look at units that have actually satisfied or completed their system impact studies in our interconnection queue. They would be eligible to offer in the next base residual auction.

By the way, that would be for the 2014/2015 delivery year. That coincides hauntingly with the effective dates of a lot of these regulations. So decisions are going to have to be made very quickly with respect to these units going forward, whether they're going to decide to retrofit or not, whether they can clear in the base residual auctions and still be capacity resources. There are 7,500 megawatts of gas, and there's 2,000 megawatts of wind that can also be capacity resources, but with the caveat, as Speaker 1 said--we have a much larger system than in California--but still, the issue remains that if those resources are not there at peak when we absolutely need them, because there are often times that the wind isn't going to be blowing during the peak hours, it does lead to potential issues.

And then, of course, there's demand response. I think it's been well documented. There's no need to beat a dead horse, so to speak, but demand response has been a huge player in the capacity market in recent years in PJM. We don't expect that pattern to change any time soon. Demand response as a capacity resource is still there to help alleviate any capacity, any resource adequacy issues, should we see retirements. It may also have a mitigating impact of the cost of meeting those resource adequacy requirements.

But if we are looking forward, the issue is uncertainty. We're not sure how things are going to shake out. And given that there's enough flexibility within the RPM process to reflect the cost of environmental retrofits in future market expectations, there's going to be a lot that's dependent on owner-specific beliefs about what their true costs are going to be, what rate of return is acceptable on those investments, and how many years they're willing to amortize that investment over. Chances are, if you're going to be making these large investments, you're probably not expecting to recover that cost in three or four years. You're probably looking at at least ten years. So these are going to be long-lived investments, and it means that folks are probably going to stick around for a while to be capacity resources.

But then the other thing that hasn't been talked about much that I keep hearing in discussions with various generation owners, and it came up at lunch in a lunch discussion today, is the specter of future climate change policy. It may not be there, but decisions are being made as if it's going to be there. For example, if you're a coal unit, and you're looking at doing a retrofit, yes, we don't a well-defined climate change policy today, but I have a real option value of waiting to make that investment to see what that looks like, because I could make that investment and then turn around, climate change policy comes in, and it makes that investment look like a bad decision. And so there may be a lot of investments that would be good today that may not end up being made because of individual owner expectations about future climate change policy. I don't know whose magic eight ball is going to be better at predicting that. I know mine is pretty lousy right now.

Speaker 4:

I want to add my welcome to all of you to the West. This is a region that's characterized by having two organized markets, one in California that we've heard about, and one in Alberta. Otherwise, it's a market where you find states that are named after their utilities (Arizona Public Service Company, Montana Power, Idaho Power). And it's a market where utilities and their regulators still matter. I work in the West, so that's my perspective.

It's also the place where half the load exists in California-- you can think about that in political terms or population terms--and where Jerry Brown has just been re-elected governor. So if you think change has been interesting up to this point, keep your eyes on California. It's going to get much more interesting over the next four years.

I'd like to offer you sort of three steps through what I have to say here today. First, I'm going to deconstruct the panel's description a little bit. Some of the language there I think will give me an opportunity to talk about some of the issues that have been raised.

I want to pause at a couple of spots and talk particularly about reliability concerns and operations and market changes. And my thesis here is that from a wind perspective, there's a tremendous amount of good news here. I know that this has been sort of a grim panel, full of warnings of eminent disaster and catastrophe. That's not my perspective. I like it when prices go down. I think that's good for consumers.

Then finally I want to end up on the policy issues, which is where I spend my days, talking a little bit about utilities and business models and their incentives.

One of the propositions in the charge to the panel is that state renewable energy standards are here, and they're having effect. I wanted to add just one thing to that. And that's that they're going to continue to increase. I think more states will adopt this policy. And I think we'll see a continuation of the trends that we've seen in my home state in Colorado to increase the amounts of these standards over time. We started on the ballot in 2004. We put before the people of our state the question of whether they thought a 10% minimum renewable energy standard should be enacted into law. And over very significant utility opposition, we won that election. We increased the standard by doubling it to 20% within three years, because Xcel Energy, our utility in Colorado, and the Public Service Company of Colorado, decided that they would actually try to make it work, and they have done so. And recently, we added another 50% to the standard, bringing it to 30%. So 10, 20, 30. Is there a trend, and can you tell where we're going next? So this isn't going to stop. It's not going to go away. I'm wearing a lapel pin from Vestas. Vestas is putting a billion dollars and 2,500 manufacturing jobs in Colorado as a result of these policies. This is very, very popular politically on a bipartisan basis in our state. So I think it's going to go forward. We're going to see more of this.

The language in the charge to the panel uses the word "intermittency." Intermittency suggests an on and off situation. I think the power engineers that are studying the impact of wind and solar on power systems are talking about some different language, "variable," which suggests the weather changes that drive the output of these facilities, and "uncertainty," which is the inability to precisely predict what's going to happen, which is addressed by forecasting and improved scheduling. And I'll talk about that a little bit more.

This slide is basically the additions of wind energy. The green bar is cumulative, and the smaller bars, the annual additions. The wind industry thinks that this year will be a down year, given the economic situation and the reluctance of utilities to make commitments in a bad economy, and the low gas prices have had an impact. But we think in the long term, the trend line represented by the green bars is probably where we're going. We've come from zero to 2% of the nation's energy supply in a very short amount of time. We think that wind could play 20% or more in the market. And the trip from 2% to 20% is going to be full of the kinds of challenges we've been learning about in this panel. It's going to have an impact. It's going to change things. It's going to be a reason that we can improve the system overall and incorporate variable resources.

The language of the charge to the panel included reliability concerns. There are certainly some. There are always reliability concerns. It's so vital that we have reliable electricity that it's always a concern. But given that, I think we can take some solace from the European experience with wind, where much larger penetration rates in sometimes much more challenging circumstances--I give you Ireland as an example-- shows that you can really do this. I mean, the engineers there have figured it out. So we have some things we can learn from them, albeit their circumstances are somewhat different than ours. Many of the same problems are being confronted and have been successfully addressed there.

Second, we have the utility wind integration group. I'm giving you their website. This is a group of utilities that have wind or are interested in wind. They come together to talk about the same kind of problems we're addressing today on the operational side, and they make tremendous progress. Almost everything we see coming out of this utility enterprise is good news. It's cheaper and easier to do integration of large amounts of renewable energy than we thought, is the way I read these conclusions. But you can take a look at them for yourself.

The IEEE power engineering society is on this. They have a new wind committee, led by Dick Butko, out of Schenectady, and they publish every couple of years their power and energy magazine on wind. Now, I brought a few copies of this. This makes a dandy stocking stuffer for that young person that you know who's decided on an engineering career and really wants to be green at the same time. Or for that liberal arts major who's turned away from engineering, this might really ratify that decision for them. But in either case, the power engineers are on this. They're working at it.

Again, from our perspective in the wind industry, it's a lot of good news. We're able to do this. There's a menu of choices. There's very deep thinking about this, a lot of study work, a lot of budgets being spent here and so on.

I've lifted a couple of studies as examples. The National Renewable Energy Laboratory and the DOE are spending a lot of our hard-earned tax dollars on studies of very significant wind penetrations. The Western Wind and Solar Integration Study is one of these. And the Eastern Wind Integration and Transmission Study, called EWITS in the trade here, is another one of them. And there are very complex studies, along the lines of what was reported earlier, by Cal ISO, about what are the operational impacts of large amounts of variable energy. And also in the West here, we have a variable generation subcommittee of WECC, which has a big agenda a lot of things to handle, and taking a look at the agendas they run and the outputs of their meetings, this is another place to catch up on this stuff, if you're interested in getting deeper into it. I've taken just one of these kind of studies. There was a DOE, AWEA combined study. It's a couple of years old now, but it was a 20% wind study. I'm giving the website for that. The basic conclusion was that 20% wind, is technically feasible but not under business as usual. And I put this study down because of the list of policy and market and operational changes that I found in it, which is very much like what Speaker 2 showed you earlier. This is the menu of changes that we need to talk about.

I'd like to talk about this a little bit, because again, from my perspective, there's a lot of good news here. Most of these things, if changed to accommodate variable renewable energy, will also help the underlying economics and operations and reliability of the system as well. So wind/solar penetration into the market becomes a reason to change some stuff that's needed to be changed for other reasons for, in some cases, a very long time. More flexible generation and load technologies is one such change. There are very interesting developments all the time coming out here. Xcel Energy in Minnesota has put AGC (automatic generation control) on a wind plan. So now the wind is dispatchable up. It's always been dispatchable down. But now it's dispatachable up to the extent that it's been throttled back when the wind is there. So wind can start to carry some of its own upramping requirements. AGC is also a bid requirement in the 200 megawatt bid that Xcel Colorado issued two days ago. So if you're a wind developer, and you want to bid a wind plant, you have to accommodate the controls necessary to have that wind plant be dispatchable.

Improved forecasting tools--this is one of the most exciting areas. I have a fondness for this, because it's just changing so rapidly, and there's so many improvements being made. From a piece of equipment in the aftermarket that you can put on your wind turbine, it's a LIDAR that reads the wind around the wind turbine, and prepares the wind to move and change both direction and the pitch of the blades to meet the wind that's coming in to that particular wind turbine. Now, the claim I saw in the trade press was that installing that LIDAR on your wind turbine might increase its efficiency by 15%. That's pretty striking.

All the way to the other end of the forecasting scale, where the NOAA, the National Oceanic and Atmospheric Administration, whose weather satellites and weather station network around the country tend to generate the information from which the wind forecasters do their business of putting accurate forecasts in front of operators in control rooms, that their science budgets and so on are getting new justification. The Congress is interested in funding that work. And you have to realize that NOAA really never had the task of forecasting the weather for wind or solar, and now they're taking that on.

So imagine the changes you've seen over the last ten or 20 years in the accuracy of the weather forecast, which we all, of course, like to joke about. But imagine that applied to software that then makes a forecast for the incoming wind and is neurally programmed to learn from its mistakes and improve itself. So this is a tremendous area of endeavor and improvement. It's just fascinating.

One of the many places in the wind endeavor where there's rapid change and lots of good news coming in is improved grid codes and wind plant models to model the impact of wind. You need a good model. But wind technology is changing quite rapidly. A lot of electronics being applied inside the turbines and to the wind farms themselves. And modeling abilities for wind is lagging that. So as that catches up, we'll have better results from that enterprise.

Aggregating the wind output over larger areas, we've talked about that. It also helps to aggregate loads over larger areas. So we start to see a justification for changing how the markets are structured in places like the West.

Improving and balancing areas of cooperation and reserve sharing--this is an old chestnut in the business. We've always made efficiencies by sharing these costly elements of the enterprise, and here again, wind/solar provide another reason to be doing something that's good for the system overall, that promotes efficiency and reduces costs.

Real time load response markets--I think that's pretty evident.

In terms of market rules, faster scheduling really matters. I mean, wind has a variability component that the scheduling practices that we have around the country were really not built for, so they need to be rebuilt, not to discriminate against anybody else's scheduling issue, but to accommodate the necessary inclusion of these new technologies under law through those renewable portfolio standards that we talked about. And I know that many of the organized markets are working this issue very hard.

I've talked about eliminating pancake transmission rates. You know, I try to describe to civilians what the energy market is in the West, and I think the best analogy is taking a load of wheat or wine down the Rhine River in the year 900. You stop at every utility castle and pay a toll. And by the time your wind product from Wyoming gets to Los Angeles, there's nothing in your boat. So this is really a very primitive market. We can do much better than this. And we're making very much progress. It's been enormously gratifying to me to see in the discussions with WECC and within the sub regional planning groups that do this kind of stuff, that we've really turned away from an attitude of "We can't do this, it's a problem, oh my God, the sky is falling," to "OK, we're engineers. We're going to roll up our sleeves. How do we make this happen?" So I think this is a time of great promise, myself.

And I'll move on to another piece of the charge to the panel. "If the coal plants are shut down," I think we need to really think about this as "*As* the coal plants are shut down." We're playing with live ammo on this in Colorado in a docket that's before the Commission today. Yesterday they were split one to one to one about what to do to replace the aging coal plants that are going to be retired. This is not unusual if you've done this kind of work, as I have, to be groping towards a consensus among three different points of view. But they're working on it. This will be about 40% of Xcel's Colorado coal shut down. They're moving quickly on this, the regulators, and really, state legislation, again on a bipartisan basis, really asks the question for ozone non-compliance with NOx as the precursor. Do you set up these old coal plants to be retrofitted, or do you shut them down and move on? It's interesting that the most that any of the retirements in this package are accelerated is eight years. So these are really coal facilities at the end of their useful lives, and you don't want to put retrofits on them. You want to move on. So there are a lot of issues there. I think we'll learn a lot from that docket. Hopefully it will be of use to someone else as well.

The last piece of this that I want to deconstruct is sort of "what policies." Well, in my view, regulators need to talk about least-cost integration. We have to talk about maximum use of existing grid. The grid is very inefficiently used, particularly in the unorganized markets. We have to talk about sharing costs to achieve joint benefits. This is underlying the Texas build out of the transmission system, which helps to solve all these problems. There are some pretty favorable economics of replacing gas with wind. It really does pay. But we need to focus those costs and benefit issues. We talk about a transition to clean energy--this is how we deal with the risks that we're facing from the climate, and so on. I think we ought to talk about performance, shared savings and shared benefits incentives, and I will talk about that a little bit later. And then I think we need to talk about rules of prospective application rather than trying to adjudicate these issues.

Operators--you know, this is traditional. Reliability, accuracy, forecasting, scheduling, access to balancing services and markets. I think from an operator perspective, keep talking the way you've talked. Keep using the tools that you've used. Try to use them in a fair and balanced way, and move the system to accommodate the new resources.

System planners--again, I think they basically do a good job looking out. Diversity, risks, I think, become more of an issue going forward. We need to talk more about portfolios that manage risk. And of course, costs are always important.

I put down "officers" here, because I think the officers of utility companies need to be thinking quite a bit about new business models. We're asking them to do a different job than they've done. The smart integrator, the energy services utility, and the portfolio allocation manager. If you pay a fee-only financial planner only 1%, what they do for you essentially is to keep your asset allocations in balance. And I think that's what we're asking utility executives to do for us now. And we should pay them to do that job.

So I'm going to talk a little bit about performance models and business models here, just to close this up. The current incentive and rate-based rate of return regulation is to invest in equity and return on that equity and spin the meter. The more you spin the meter, the more money you make. So you end up running 40 year old coal plants. You can keep that model, in deference to the Wall Street types who probably need the accounting basis to make sense out of what they're doing, but think about some different incentives. The first thing that happens when you say incentives, the consumer representatives jump out of their tree saying, those bastards ought to be taking care of this stuff for what we give them already. They don't need more money. Forget it. But the proposition I have in mind is that there might be a consumer benefit if we could get utilities' incentives right to make a faster transition to cleaner energy. Key considerations in this are some new utility business models. I've stolen this shamelessly from Peter Fox-Penner's book, *Smart Power*. He makes the interesting suggestion that to do this, we'll have to have regulators be certified. And I got a laugh out of that. I've been a regulator, so I think certifying regulators for the loony bin is probably a pretty good idea, but certainly raising the level of play on the regulatory side is going to be very important. Now, Wall Street provides some accountability for utility managers. So they need to understand the risks that are inherent in any change.

The proposal I'm going to make to you today is in aid of some of the scenarios we're doing in regional transmission expansion planning in the West. We're going to try to include these as elements of those scenarios, so maybe you'll be reading about it again if we're able to get these into those scenarios. The proposal here is to add some performance standards to the underlying incentives to invest in the business. That's not a wrong incentive. But by itself it's not going to speed the transition that we need. And I've been looking through the literature on this. There's not a whole lot there. But the place where the literature is pretty full is on the DSM incentives, which I think are going to be discussed here tomorrow. But I would propose adding a second performance review. So this could overlay the existing incentive. With that incentive in place, you would put some incentives around the transition functions that are critical for moving forward in this area. And those would be scalable up and down, depending on the local circumstances, as is suggested here.

So I've come up with five performance categories to think about. One would be essentially diversity. We want to diversify to manage risks. Our portfolio standards do this, and typically they incorporate a penalty, but no upside. So let's put together a performance incentive that has an upside for utilities that meet or exceed the minimum standards.

Second issue here is make or buy If we have the rate-based rate of return incentive in place, then we need to think about how to provide some incentive for that choice between your own resources on which you make a return, and a power purchase agreement from a supplier on which you make nothing. In fact, Wall Street will ding you for having these things that look like debt on your books. So we need to think about that. There is a docket in Oregon, which we think will come with a decision on this pretty quickly. It's called UM 1276. I'll cite it for you later. Which I think will cut some new ground on this issue. We definitely want to reduce pollution. We want to handle our carbon issue. We want to reduce exposure to all the future regulations that we've been talking about. So let's set some performance standards around those goals. Meet them early, do more, you make more money. Meet them late, don't meet your goals, you get a penalty. It's pretty clear where to go.

DSM, we know a lot about these incentives. We'll talk about them tomorrow. Let's keep those in the package.

And I put down transmission as a fifth area. We have some pretty significant transmission planning efforts going. That's going to target some routes and put some dates out. Maybe we could construct a performance incentive around meeting some of those goals. I've got a question here, because I'm still thinking about this. And I can't find the answer in the literature. Maybe some of you can help me with that. But can we add some market and operational changes? We've seen the operational agenda of reform that we need. Is there a way to put some incentives around that piece? I'm done.

So these last slides simply go through each one of those, and talks about them a little bit. And concludes with some of the regulatory dockets that give you some analogies to this stuff. If we don't start talking about these, it's not going to happen, and you know, the utility executive's a little bit shy. They've just filed their rate case. They don't want to look greedy. So they're not going to talk about it. So the rest of us have to, I think, bring this up, and see if we can't construct some different incentives that move us along faster.

General Discussion

Question: As you know, we announced the retirement of three coal units in Eastern PJM, as well as a natural gas unit in eastern PJM. These are older units that are 40 plus years old and meet some of the criteria that you described. But quite frankly, the EPA regulations were not the driver for us on those retirements. And I think the back story that a lot of people are ignoring with the EPA regulations is that natural gas and the decline in merchant markets of natural gas has just crushed the economics of a lot of these older coal units. And you indicated as much in terms of the dispatch of the units. And you were seeing some of that coal to gas switching occur as well.

I think at one point in your presentation, you talked about ten gigawatts at risk. And if I recall correctly, the market monitor for PJM maybe last year in one of his reports indicated that there were about 11 gigawatts at risk, I think again, unrelated to upcoming EPA regulations, but 11 gigawatts that already were not making enough money. Can you comment on how those numbers might compare? And how big an issue here in terms of these potential retirements is natural gas, the abundance of it and the cheap supply of it that's available in the market right now?

Speaker 3: The numbers I put up earlier included the units that you said had filed for deactivation, the Epsilon units, and that's why I mentioned that those numbers are not up to date. Again, I wanted to make sure that I was using data that was publicly available, so that somebody could actually go get it, manipulate it themselves and come up with the same numbers. So if you take those units out, yes, the numbers are a little bit smaller, but the same trends are still there.

In terms of the natural gas issue, I think you've hit on a really important point. Some of the studies that have been done recently by Brattle and ICF in particular have really pinpointed that the EPA regs in and of themselves may not be enough to push older, smaller coal units over the edge into retirement, but that along with the gas market dynamics that people see going forward, especially with shale gas--the Rockies Express Pipeline in the West bringing bottled Rockies gas east, levelizing the prices across the United States--all of that is going to have an impact on the economics of those units going forward. So it's not going to be entirely the EPA regulations. But by the same token, if the gas market dynamics were the same, and we didn't have these environmental rules, would a lot of these older coal units stick around? The answer is probably yes. They'll still be able to continue going forward. So it is a combination of things.

With respect to what the market monitor pointed out, for those of you who might not be aware, in the 2009 State of the Market report, the independent market monitor for PJM pinpointed approximately 11,000 megawatts of coal-fired capacity that in 2009 was not able to cover its going-forward costs. In large measure, those were tariff-defined going-forward costs. I won't get into any specifics, but I can tell you that the intersection of those units and some of the units that we've identified without FGEs and so on, it's not a very large intersection. And I wish I could get into more detail, but I can't. But there is an intersection, but it's not as large as you might think.

And I think a lot of the points from the State of the Market report relate directly to gas prices, because we saw gas prices at loads that we hadn't seen. The load-weighted average LMP over the entire year was under $40 a megawatt hour. So we saw some very different dynamics. And of course with demand being down for a second year in a row, you'd have all of that to conspire against a lot of base load units having a difficult time covering their going forward costs.

Question: One point for Speaker 2. On page seven of your deck, you indicate that about a 60% increase in the RPS standard more than doubles the regulation requirements--that it's not a linear relationship. Is that something that you see that holds for all increases in RPS standards? Or is that just that block is an elliptical relationship between those two things?

Speaker 2: Are you saying it's a linear relationship? No, it's not. It depends on the technologies that are coming in and filling in the RPS. And you've got to remember, 20% in 2012, it's largely being built out by wind with a little bit more solar. When you get to the 33%, you're really talking about a combination of wind and solar building out. So it's technology-based, as far as what's causing it, and where the variability is. The other thing to keep in mind is, regulation is largely driven more by intra-hour variability, whereas the load following is more driven by things like forecast error-- uncertainty. So that's what's really driving the regulation. The other thing to keep in mind is that you get down to .20, there may be the algorithmic things you can do in the AGC algorithms so that, if you can get ahead of the needs, you may be able to reduce some of the requirements for the regulation service.

Speaker 1: Speaker 4, on your chart number seven, when you went through the DOE 20% wind study policy market and operational changes, so we had that whole list of more flexible generation and improved forecasting tools and so forth--all those seem to be as good ideas and things we ought to be doing. None of them, as near as I understand them, address this question I raised about the contingency problem, and the connection with the way we do resource adequacy, as opposed to the way we should do resource adequacy. And I wondered what your view was on that. One possibility is you don't think that's a problem. Another is that we can change the rules. Another is that we apply the rules, and then that has implications. What do you think is going to happen there?

Speaker 4: Well I guess my reaction to that is that if you take reliability problems from the way the capacity markets incent people to either put money into capacity or not, and lay them at the feet of wind, I think you make a fundamental mistake. It's not a capacity resource, by and large. It has these second-order impacts, which I think are due to the way the markets work, the way the incentives are set up, and other things. You know, in a sense, I have a sort of secret glee. I may have gotten this across to you a little bit. But here come a new technology. It's disruptive. It drives prices down. Old plants are driven out of the market. People get cleaner resources at a fixed cost over 20 years. There's something to like about that. It is troublesome. Yes, it's a problem. Operators probably have some times when they just want to scream. But you know, we're resourceful people. We can rise to these challenges. We can solve many of these problems. So my sense is that it's your work in analyzing this problem, and the work of others in responding to it that will provide some solutions for this. I don't see it as a long-term sort of fundamental problem that we can't work out. We need to get the signals right. But it seems to me fundamentally that bringing in low cost energy is a good thing, and we ought to do as much of it as we can, and handle the problems and challenges that it brings with it.

Speaker 2: What I heard then, which is a solution which I think is consistent with the current system, is that you don't treat wind as a capacity resource, so it doesn't get paid through the capacity market.

Speaker 4: I think that's at least one way to look at it. It's more productive than crucifying wind on the cross of capacity. It doesn't provide that. It provides low-cost energy. And in our experience here in the West, at least, is that wind stores gas in the ground until you need to burn the gas, and it does that very, very effectively. So all the storage stuff, the demand response, has to wait, and it's going to wait for two things. One is, there's a whole new generation of gas equipment that's going to again provide another bump in the technology that we've got to look at. And the gas system itself is pretty clugy. The way I think about this is that the electric system has always had a dance with weather. Loads are driven by weather. The algorithm generators are generated by weather. The hydro system is driven by weather to some extent, and the dance that it does is a lot like clogging. OK? It's a pretty basic dance. And we need a modern dance. We need to dance more effectively with weather in the electric system. So there's a ton of ways that that can happen. Right now I don't think we can treat wind as a capacity resource and get good results out of that.

Now, I guess that part of my reaction to what you said, is that yes, but there's also the second order impact that you're describing, which is it drives prices. Our markets aren't set up to respond to that and so on. Well, those are problems we can work in the market setting and the way we operate and so on. So I guess that's my response.

Question: I had some thoughts I'd be interested on hearing your comments on. I don't actually spend much time in America anymore. I do more work in China these days, and I just thought I'd share with you a couple of things that the Chinese are doing with respect to both environmental needs and renewables. One is that at the municipal level, the rewards in terms of moving up both in the government and of course in the party itself, are now getting related to local air quality. So clean up the cities, clean up the air, and off you go, higher in. I don't know that we have the equivalent for that here, except to reward utility executives for producing cleaner product.

In China, they've also got output efficiency incentives for 22 industries, including the power sector. And if you don't meet those requirements as an end user, you actually pay higher rates, not only larger bills, but higher rates. Your rates go up farther above the efficiency requirements for the more you fail to meet those efficiency requirements. An idea that I'd love to see tried here in the States. I wonder if it would raise issues of undo discrimination, but it would be interesting.

For the generators themselves, they actually just shut down all their smaller resources. Speaker 2, you had a point about the smaller generating units having the higher heat rates. In China, they just shut them down. It's about 70 gigawatts of generating units over the last 3 ½ years that have been shut down. Something that they're talking seriously about in Shanghai and Beijing now, is actually setting municipality-wide energy caps, just a cap on the total energy use. The question, of course, will be how you trade equivalents of electricity with other sources of energy. But they are seriously thinking about that now.

And lastly, they are concerned about the environmental effects of the power sector, which counts for 50% of their coal use, and in six provinces (it will be nationwide when they get it straight) they have gone to something that they call efficiency dispatch, but which looks an awful lot like environmental dispatch. And all the non-emitting units (and in this case, it's SO2 that they're talking about) go first. And when there's a tie between the thermal units, the less emitting one gets the nod. That's one way that they deal with the FGD incremental cost penalty. But they also just cover that through governmental transfers. But it's an interesting approach, and I'm wondering if any of these ideas would satisfy Speaker 4's call for performance incentives.

Speaker 4: I don't know. I'll want to think through that with you, and see if we can put that on the menu. I think we need a broad menu of incentives. I think there's a lot of thinking that needs to be done. These are good ideas. There's a very intense literature on demand side that talks about shared savings and I think there are some analogies we might draw over to the supply side from that literature. But again, it's something that we've just started thinking about. We want to put a broad menu out for discussion through the scenario planning that WECC started up in Salt Lake on Tuesday. They're going to meet again next week in San Diego and go on with it. So it's just the beginning of the discussion, and I really appreciate your suggestion, and I want to follow up with you to get more about it. Anybody else has ideas, I'm collecting them. So let me know what you think.

Speaker 2: Well, I'd be interested in what the impact of behind-the-meter generation would be with caps.

Question: Yeah, there would have to be some way of accounting for it. The Chinese are only just beginning to think of this.

Speaker 2: Right.

Speaker 1: Well, I think the other thing the Chinese do is, they don't require you to be financially viable. And that's a big help. And I think the idea of environmental dispatch in the context of a system where the money flows actually matter, and people are responding to the money flows, is going to create all kinds of problems, because the dispatch won't be consistent with the economic dispatch, and then people will want to do things to deviate from the dispatch, and you get all these other things. So it will kind of unravel. So unless you have another way of handling where you get the money from, where you have the central government providing the money, I don't think it works.

Question: Well, we'll see. One of the things that the Chinese are struggling with, and one of the reasons why this is taking longer to implement than hoped, is that problem. It's that the units that are now being dispatched less than they had contractual entitlements to be dispatched (the contracts in China work on hours per year) have to be paid off, essentially. So they've developed a fairly complicated scheme of generation trading rights. We'll see if it works. I think there are other solutions. Two-part pricing might be one way to start. But we'll see.

Question: Speaker 1, I want to come back to where you started in the discussion, and I think Speaker 3 touched on it, just to see if I'm understanding the point you were making. And this has to do with the impact of reducing energy prices, leading to a situation where more revenues may need to be recovered through a capacity market. And I long lost a bet about closing coal plants as a result of restructuring. What has happened is that with reduced energy prices, and not even sufficient revenues in capacity markets, we have RMR units, including older coal plants, that have to run for reliability. Now, you came back around, I think, to scarcity pricing as part of the solution. I can't resist coming back around to building transmission as part of this solution. But what I'm really interested in is mostly your thoughts on, are there some perverse or unintended consequences here? Or how do we address the fact, if I'm getting your point correctly, that this low cost energy resource is coming into the market? Other units need to rely on more money coming through the capacity market, and some odd things then happen in terms of which units stay online, or get those additional capacity revenues, because I think, as Speaker 4 acknowledged, it's not the wind units getting the capacity revenues.

Speaker 1: Right. I mean, you could just imagine the extreme case where we contracted for 100% of our requirements with wind with a zero variable energy cost. Then we'd have the energy price, and the energy market would be always zero. And nobody would get any revenue through the energy market, and everything would be handled through these long-term contracts that would have to be going forward. So that just conceptually is the problem. And so it could be that you don't have people responding to the incentives in the energy market. You have them responding to the RFPs and to the contracts. And that was the problem, remember, we were trying to solve with the electricity restructuring. We were trying to get away from doing that, because of all the problems that created. I could go through the litany of all the problems that it creates, but that's the fundamental issue here.

And despite the fact that Speaker 4 likes it, I don't think it actually works in the long run. In the short run, you can exploit the existing capacity that's there, and you lower the prices, and the cost of doing that for a little while is going to lower the total cost to the load payments--not the total cost of the system, but the payments. But it's just a transfer game that's going on. In the long run, it doesn't work. It becomes more expensive. But the problem is now, more and more decisions are being made through capacity markets, through RMR contracts, through other kinds of special deals, when often you're recreating the problem that you were trying to get away from. And it's partly driven by the fact that we haven't completely solved the pricing problem in the energy market. And we can't completely solve that 100% and get rid of all these other difficulties, but we can reduce the impact of a lot of those things a lot by getting this scarcity pricing story straight. So I think it's a critical part of the package. And it's not instead of transmission. I think it's a complement to it. They interact with each other.

Question: Yes. So that's coming back around to idea that the solution is to get the pricing better.

Speaker 1: Right. The point I was trying to make is, as we go to this lower-carbon world, for a variety of reasons, it's more important to do it, and a lot of the policies that we're adopting for the lower carbon world also were exacerbating that problem. So it's more important that we fix it, and we're making it worse, with the policies by themselves. We're making the scarcity pricing problem worse, because we're taking more and more money out of the place where it would occur, which is in the energy market. It's the old stranded cost problem, which is going to come back to haunt us. And we've been there, done that, don't want to do that again. Right?

Speaker 3: Just to add very quickly to what Speaker 1 has said on that, I think you could even get more precise. I think part of the problem in scarcity pricing is the willingness just to let demand set the price. If take Econ 101, and we drop the supply and demand diagram, and we simply run out of supply resources, it's going to be the marginal value that demand puts on consuming energy that sets the price. And today we just don't do that very well in energy markets. And so I think allowing that to happen on a locational basis, where LMP exists, such as in New England or PJM, you'll be able to handle a lot more of these localized problems. You'll see higher prices, which should help give resources enough revenue to continue going forward, but also sends the right price signals to demand to reduce their consumption at the time when you need to reduce that localized reliability problem. So it all goes hand in hand. But a lot of that goes back to some of the details of how we implement scarcity pricing as well. And that's the particular issue that I see with that.

Question: Can I just follow up on that? I hear what you're saying about the benefits of the implementing scarcity pricing and sending those price signals. But there's an interesting dynamic that's going on in the debate about why one should support long term contracts for renewables, because there are all these studies out there about the price suppression effect on energy prices, and that these are then savings to customers because energy prices have been reduced. So there's a real tension here. And I guess as an ex-regulator, there's only so far I think regulators can go politically, this not being China, in terms of allowing customers to see actual price impacts. And so there's a tension I'm seeing here, and I'm not sure whether you are offering a possible resolution, or it's just a matter of trying to move in the right direction and find that balance.

Moderator: Yes, I think it is about putting the price down. It's not just setting the price on the wholesale market. It's bringing it through to the retail customer. I think that's the step that we're all missing. And that's the dance that we're not all doing.

Speaker 4: I have a comment, and I think with renewables here, even if you go to scarcity pricing and have high prices or not, you're talking about probably short-lived volatile high prices, not sustained high prices. So that's good in one way, because it will encourage and incent the most flexible resources that can respond to those prices to come into the market and respond. However, I'm not sure it will be sustained enough to fully fill out the revenue gap. And I think you're still in the position of having to look at other revenue streams--resource adequacy, capacity markets--I think are still going to be necessary. The other thing is getting other products in place. We talked about load following. There's another revenue stream, if you can define it right, for the resources that are needed to support the integration.

Moderator: I recall the other issue. The other issue is state RPS requirements, for example, that are requiring capacity to be built and to market, with reserve markets out the wazoo. What are the effects of that in terms of energy prices? And for example, the production tax credit, there was some discussion that as the price goes negative, they're still receiving compensation. So if you look at that as a sort of capacity market compensation corollary, it's providing that perverse incentive into the market. So it does complicate things.

Speaker 3: But I think what you've pointed out was what I was talking about towards the end of the last session. That is this issue about transparency of prices, because ultimately, if there is a so-called price suppression effect in the wholesale market, those costs have to go somewhere, and they're going to end up, as the moderator said, on the retail build, but in a nontransparent fashion. And so it's almost as if certain parties in the legislative process have this incentive to say, "Look, we did something. We got wholesale prices lower. Look at us." But in the meantime, they're actually just transferring those costs, and even higher costs, to the retail bill that no one can see. So I think we have to be real careful. Again, this is where the price transparency is so important to getting the right decisions made.

Moderator: Yes, and I think the other thing is that really what you want to attack here is the load share and flatten this thing out to the degree that you can. And that has implications as well.

Question: I found during the course of this panel and listening to the discussion that I'm completely confused about what the real economics are with respect to renewable technology. It seems like we're starting, and I understand why, from the presumption that wind is going to be built, whether it's economic or not, because a renewable portfolio standard has been set. And for the most part, as far as I know, all of those projects that are going in today are receiving some form or subsidy from somewhere. I know how the New York system works.

So my first question is, is that true? Is my understanding true? So that's the first place I stubbed my toe. If you have to subsidize it, so we can build it…And then secondly, if we say, OK, once you give them enough money to build it, and you're going to tax it to subsidize it, it has a zero marginal cost. So I think that's where your low-cost energy comes from, because I don't get "low cost" when I think that it needs a subsidy to operate. It gets deeper and deeper into the system, and it requires more and more operating differences in ancillary services and more and more flexible capacity to manage that on the system. Shouldn't the cost of that additional regulation that you need to maintain reliability be properly assigned to that resource when we think about what are the economic consequences of these various strategies? I'm getting lost in this--how do you follow the money? How do you follow the money through the system to figure out what you're doing and what it's really costing so that we can sort it all out and come back and say, OK, this is a reasonable basis to make policy decisions?

Speaker 4: Yeah, the answers are no and yes. No, the subsidy isn't out of line. We have an energy system that doesn't have anything that's not subsidized. My favorite example is, about half the cost of your low-cost coal is the transportation. Where does the transportation come from? It comes from right of ways that were granted, gratis, to the railroads a long time ago. If they had to pay today's marginal cost for the new cost of a right of way for a railroad, forget it. We have the air as a convenient dumping ground for the products of combustion--free. It's a freebie, for the most part, for people who do combustion technologies. So we have a system that is riddled with subsidies. If we got rid of it all, what would it look like? I don't know. It depends on how far you want to take the analysis.

Question: Maybe I should ask the question another way, since the S word seems to be a bit of a hot button here. Can wind technologies, wind farms, finance themselves purely with the proposition that they're going to bid into the market, or just take the market price, bid zero, get the market price, and be standalone financeable? Is that what's happening? Or are there payments? The only one I'm really familiar with is in the New York market. They bid for renewables to meet their standard, and they get paid. When they bid for the subsidy they need, then factor into their bid what they think they're going to get out of the energy market, and bid the residual. That seems like a pretty reasonable way to do it, if you start from the assumption that we have this target that we have to meet no matter what. But it isn't the way to think about it if you're just trying to figure out what this particular strategy is really costing us. So does that help?

Speaker 4: Well again, I don't live in ERCOT, I don't live in PJM. I mean, I live in a world where there's a contest to provide the marginal new generator to a utility that's integrated. And what we found is that when the gas price goes up, or if you assume a high gas price, then these wind projects save customers money. That's within the context of the very limited economics that we use in the utilities sector. We don't think about the environment. We don't think about healthcare costs. We don't think about technology. We don't think about a whole bunch of things. But even within that, these projects pay off. Now, from a public policy perspective, what do I want to assume about the gas price?

Question: OK, I'll try one more time, and then I'll give up. The question is, suppose gas is setting the price, and wind gets paid the kilowatt hours, and you displace the gas, so they save that. But you get paid the gas price, plus another payment. Is that not how it works?

Speaker 4: You get paid a PPA price. There's a negotiated price for PPA, a number of dollars per megawatt hour produced. You produce it, and you get paid.

Moderator: If I can, I think there was a question in there sort of implicit in the panel discussion, and that's the load-following issues in the ramp. For example, if Illinois imposes an RPS in MISO and PJM, some fixed level of renewable has to go in. And this is regardless of what the economic conditions are, or the reserve margins or anything else. You just force this into the market by fiat. Then the issue becomes, does this destabilize the reliability? And do you need additional ancillary services, frequency regulation, ramp, load following resources, to meet that? And as far as I know right now, those are being uplifted to the entire footprint. So the question becomes, are we going to continue along these lines and have policies dictated on a state level impact the rates, or states that may not share those philosophies? And the implications are that the externalities that we're all talking about here just seem to multiply and disperse without a broader national model.

Speaker 4: When the nukes came in, they became the N1 contingency. Everything else was impacted. Did you put an integration cost on that piece of behavior? No. But when wind comes in, boy, if there's a cost that can be assigned, it gets defined and filed at FERC, and away we go. Now, Xcel Energy did this. They said, you know, we've got one of these studies, like the Cal ISO study that you heard about. And some day we're going to have 20% wind penetration in the Xcel system in Colorado. And we want a payment for cycling our coal plants. Well, we responded to that, and we said, look. There's no law in our state passed by the people that requires coal on your system, but there is a law that requires renewables on your system, for good and sufficient reasons. I mean, these are reasons that are outside of the kind of market issues that this panel's about, but they're good reasons, and the people voted for it, so there it is. One. Two, you're not facing any coal cycling costs. Those are prospective in nature only. And three, we think that those are costs of the obsolescence of the old system, and if you keep loading those costs on the new stuff, you won't have a transition to the new stuff, which is required by law, again, for good and sufficient reasons. So we resisted that trend. The utility withdrew their petition at that point.

And to some extent, there are a lot of different factors to try to keep in mind here, but I think Lincoln said it, if you go along the direction that the people want, you won't go wrong, and the people want to see this transition happen. You know, in December of 2005, one out of five Xcel customers couldn't pay their bill on time. By March it was one out of four. That was when gas prices in Colorado, which is a gas producing state, went to about $12. That's a utility in breakdown failure mode. When lots of people can't pay their bill, we're not doing the job. We have to diversify away from that. There are going to problems. We're going to face things. There's going to be debates about what's a legitimate cost of integrating the new stuff, versus the obsolescence cost of the old stuff. But it's a debate we're having right now. Our position is, hey, this stuff is going to drive stuff out of the market. It's going to cause problems. Primarily, I think these are good problems to have. We're diversifying the system. We're insuring our children and grandchildren against some contingent risks that are not very nice to contemplate. And so these are problems that we have, but we've got to face them.

Question: Well, I wanted to pursue a slightly different angle. Speaker 1, you mentioned demand response being able to potentially address some core issues of how the markets are not functioning properly. But there was a gap to that, and potentially addressing the process for resource reliability assessment. And so I was wondering whether there was a way to talk about that a bit more. In particular, you mentioned dynamic pricing or real-time pricing. But given the fact that we do need to have load following and load shaping, (as Speaker 2 pointed out, you need to balance the wind and the solar, especially if we have the very high wind and solar scenario), with our current market structure and our current set of market prices or market for subsidies, as you might point out, it doesn't work. So we need to have something to function to resolve that and bring in either the right resource or compensate entities adequately to address the load following and load shaping. But is there a way, essentially, that load can actually provide those resources directly? So could you actually envision a scenario where you just have wind/solar and load, but under the right set of market and technologies?

Speaker 1: Well, I mean, I think the answer is yes--decidedly so. I mean, right now, we're building power plants to sit around and not run so that we can avoid paying $400,000 a megawatt hour for hypothetical load reductions. But we're unwilling to pay $1,000 for real load reductions. And so I think we have a lot of room to maneuver. And we don't have to get it precisely right. But I think if the price were $20,000 a megawatt hour, most of the load on the system would disappear. And so this would be a non-problem. So there's enormous potential there. Now, we don't want to do that overnight, and we want to make sure we deal with the people who can respond to it most effectively, which would be mostly the people who are already responding to it effectively--the commercial and industrial folks--but set up the rate structure so that they can do it. They're already metered, most of them. And then get the signals into the energy prices that are passed through in real-time pricing, so that they can actually do this. And for the households, they'll hardly notice. I mean, the less they're paying attention, the better in some sense, because they won't notice that the price went up and went down and went up and went down. But their average cost will actually go down, if it's working properly, because we won't have to pay for all those $400,000 power plants that aren't really worth it. So I think that there's enormous potential there. I don't know how far it will go. I think it's an empirical question. But I think we could make a lot of mistakes between here and there and not do too badly, given the gap that we're dealing with here.

Question: I'd like to direct this at Speaker 4. A couple of people have talked about transparent prices. I'd like to talk about transparency of cost. We've been working very closely with DOE on the issues related to EWITS (Eastern Wind Integration and Transmission Study) and WWSIS (Western Wind and Solar Integration Study). And I'm sure you're familiar with both studies. And we think that was a good start--not necessarily sufficient to answer all the questions, but a good start. But in both of those studies, there was an enormous cost of integrating large amounts of wind. And those costs have to do with the transmission needed. So when we talk about cost impacts with regard to the energy market going down, don't we also have to talk about the cost impacts of the $150 plus billion that we need in transmission for the wind? I'd like --

Speaker 4: Yeah, absolutely. We argue the CREZ model. They're going to put five billion in to get about 18,000 megawatts of [wind] in, and what I understand from the study that ERCOT did, they'll pay that back in less than three years. So if those kind of economics reveal themselves, I think it's an investment well made, the benefits should flow.

Again, I want to go back to the question, what do you think the gas price is going to be? Well, you don't know. You can hedge to a certain extent, but you don't know, over the timeframes that we're going to invest in. And from a public policy point of view, it matters whether you're wrong too high or wrong too low. Think about it. Make a gas price projection. Say you're too high, price comes in lower. You've got more efficiency and more renewables in the system than you needed. You've erected the hedge against the next spike. But say you project too low, which we've done pretty consistently in the past, and the price comes in higher. Then people get to be homeless, because it's a heating fuel for people.

Question: But shouldn't somebody recognize --

Speaker 4: So if we keep our expectations of gas at the high end of some reasonable range, I think we do better on these problems than otherwise. It's always a tradeoff comparison.

Question: I agree completely, and with $13 gas, I want to build as much wind and invest in as much wind as I can. But my point was more related to the transmission needed specifically for wind and where that $150 billion comes from, and who should pay it?

Speaker 4: Well, if you want to finance it at the wind industry's expense, you'll raise the cost of wind to people for this off-set to gas. If you want to do it at less expense, the utilities can do it at their cost of capital. That's a lot more reasonable. Or if you really want to do it at the lowest cost of capital, you get entities like our federal power marketing administrations that do it with tax free capital, essentially. So how do you want to do it? Do you want to do it expensive? Do you want to do it cheap? Do you want to do it in between? Probably we'll end up doing it, some of all three of those. How do we do it when the hydros came on? Pretty clearly, the federal government sat up and did the job.

Question: The problem I'm seeing is, I'm seeing zero price in the energy market, and a whole bunch of dollars that somebody else is having to pay. And that's what I'm trying to get an answer for. Who's going to pay the 150? If we're to transfer it over here to consumers, and then say, "Look what a great deal we have over here for the wind," that's a little bit of a bait and switch, isn't it?

Speaker 4: No, I don't think so at all. I mean, you really don't build transmission for no reason. You build transmission for good and sufficient reasons. And one of them is to get to low cost generators. Again, the Texas CREZ model I think is the model for the country. You don't do it on the basis of no return. You do it on the basis of investment for return. And the return is to insulate yourself from those contingent risks on the fuel side. So you've got to make an estimate of those. I think we should keep our estimates of what fuel costs are going to be down the road high, because then it protects people.

Question: I would agree with you, but I think everyone needs to know all the costs and not hide it.

Question: This might just be a short question. It's actually somewhat related, and I just wonder a little bit about that dialog and how both Speaker 4 and maybe Speaker 3 think about how estimates of future gas prices and reliability relate both to long-term planning for integration of wind, and also the sort of short-term questions on the PJM, but also elsewhere with regard to the impending clean air rules that are coming up. I think on the one hand, you might want to say, "Look, gas prices look really low right now. Let's build a bunch of new gas plants to meet the requirements of this clean air rule." But that same estimate maybe runs counter to Speaker 4's point, and I just wonder if you guys have different or similar thoughts on that issue.

Speaker 3: I will answer it this way. The warning we heard in the morning session about forecasts and their accuracy rings very true. Now, while forecasts may not have been off five times, if you look at what EIA publishes, they actually go back and look at realized gas prices after they've done their AEO outlooks. It's buried deep on the website, but you can find it. They're off by, you know, 50 to 100% three years out, four years out, five years out. Usually the gas price forecast has been far too low, and gas prices have been much higher. It will be interesting to see with shale gas whether that trend reverses-- whether they actually forecast prices too high, and they actually end up coming in lower. But I think our history, empirically, of forecasting natural gas prices, has been just awful.

And so, if you're looking out much more than a year or so--and even then, do so at your own peril. It's hard to do. But this is where expectations come in, because whether we like it or not, we all think about these things heuristically. If we're making that investment decision, we have in our minds, yes, the gas price forecasts, but there's also a heuristic that goes into it, sort of a gut feeling, I think, and those expectations could be based on things other than the forecast. Maybe on other trends that forecasts do not see coming. But right now the industry's talking about low gas prices for the foreseeable future. Whether that's going to actually happen, I have no idea. Like, I said, my magic eight ball isn't very good on that one. But certainly, everybody's perception of where they're going to be is going to have an effect on the investment decisions.

Speaker 4: I guess I'd say, look at the depletion rates on the Barnett shale. It's been drilled and fracked the most. Take a look at the unconventional gas plays in the Rocky Mountains. A lot of it on coal bed methane. Again, depletion rates drop right straight off a cliff. So you can frack it again. You can rework those wells. That costs something. Maybe the technology gets better faster than the cost of reworking those wells. But again, I think there's enough experience being wrong about gas price forecasts. We don't have to make that mistake anymore. I think we ought to go forward assuming gas prices are going to be going up. That's the safe side of the assumption. The side where we risk harm to people is when we get it too low.

Session Three.

Utility Demand Side Management Programs: With and Without De-Coupling. Measuring Their Impact on Utility Profitability

Utilities are under increasing regulatory, legal, and political pressures to increase their efforts in demand side and load management. Incentives in place to align profitability with demand side programs vary widely. Revenue caps de-couple sales and profits in order to better align policy goals and incentives. De-coupling, however, has many variations in both theory and application. What are the approaches that have been taken and how much variation is there across jurisdictions? Estimates of end-use efficiency gains versus loss of sales for other reasons (e.g. weather or macro-economic conditions) are not uniform from state to state. How have different states approached measuring efficiency gains? To what degree has de-coupling led to the general socialization of risks? Many utilities are being asked to undertake programs that will reduce their sales, and, therefore, perhaps reduce their profitability. To what extent has this posed a serious burden on affected companies? What measures have been taken to reflect the misalignment of utility incentives and the public policy objectives of energy efficiency?

Moderator: An issue that people have been struggling with for some time is whether retail rates, the traditional rate setting mechanisms, are a strong disincentive to utilities to engage in demand side management and energy conservation efforts in general, because profits are linked to sales, and obviously if you conserve, you're going to reduce sales. So the public interest in energy efficiency is not properly aligned, so the argument goes, with the incentives to the utilities.

And so there's been a lot of debate and discussion about how we should structure retail rates in order to reflect the public policy of encouraging energy efficiency. What incentives do utilities actually need to encourage their customers to engage in economic efficiency activities and to develop programs to encourage it? And then, of course, that leads you to the question of decoupling profits and sales. And if you look at decoupling profits and sales, there's a million different ways to do it. You could do the simplest thing, which is just straight fixed variable, and leave it at that. Another way is to simply decouple the rates and not worry about whether you're getting efficiency benefits. Just assume that's the way to do it. And another is to say, well, we'll only make adjustments to the amount of recovery we will allow you to do if you the utility can demonstrate that you've accomplished something in terms of energy efficiency. And so even among the states which have decoupled, there's no uniformity as to what the practice is. So we're fortunate to have a panel with folks with different sort of views and perspectives or experiences, in particular, on this.

Speaker 1:

My presentation assumes that you all have a basic understanding of decoupling, so I left out much of the mathematics. I'd simply say that if you're interested in sort of digging deeper into some of these issues, there are some papers on the Regulatory Assistance Project website, www.raponline.org, that you can look at.

I'll just start with the premise that utility financial structures really do enhance the power of incentives. Let me start with the bottom bullet. What I'm talking about here is the non-production cost side of the utility business, the wire side. And decoupling in the electric industry so far has been limited to the distribution and the wire side of the business only. Few non-production costs vary with sales in the short run. That's just simply the case. So increased sales go to the bottom line, just as decreased sales come directly out of the bottom line. Customers in the utility are exposed 100% to any deviation from the rate case level of assumed sales. The companies' risk and rewards are mitigated to some degree by income taxes, but nevertheless, the effect is directly on the bottom line. High leverage means that the utilities' profits represent a relatively small share of the total cost of capital, and so small changes in sales, small changes in revenue show up as fairly large changes in that income. The effect can be very powerful.

The numbers in this table come from a small eastern utility from several years ago, and I can give you the underlying assumptions behind the numbers, if you're interested. It's that second column from the right that I would point you to. Here's a utility whose ROE after taxes in the rate case is $9.9 million. That's the amount of money that the rate case assumes will be returned to stock and shareholders. For a 1% change in sales in either direction, the effect on the bottom line is over 10%. And it's fairly linear, as you see, in both directions. So significant effects upon net profits, net income come from very small changes in sales. To me, that's a show stopper. It makes it very obvious that traditional rate-making, which is a price setting exercise, gives utilities great incentives to maintain their sales levels, to increase their sales levels, certainly to manage their costs, and that's a good thing. But it naturally makes them quite uninterested in energy efficiency, or any customer side activity that will affect sales.

Decoupling is simply a mechanism for breaking the link between sales and revenues, and I'm going to tweak our moderator here about the idea that decoupling is breaking the link between sales and profits. Now, it does have that effect, but it's important to think about it fundamentally as a break between revenues and sales. We want the utility to retain its cost minimizing incentives. And to do that, we want to break the link between sales and revenues, so that any savings in costs accrue to the bottom line of the utility. We want the utility managers to be ever thinking about operational, managerial efficiency. So the objective simply is to make the revenue levels immune to changes in sales volumes, and this is a revenue issue, as I say, not a pricing issue.

I would argue that we want to maintain volumetric and other pricing mechanisms that send customers the appropriate economic signals. We'll have a debate, I'm sure, about straight fixed variable pricing, which you'll soon learn I don't think much of. Decoupling in my view is not intended to decouple the customers' bills from their individual consumption, merely the utilities' total revenues from their sales in the short run. In effect, what decoupling does is that it puts the utility on a budget in the same way that I'm on a budget each year with my salary. I know how much I'm going to make. At the end of the year, if I've got money to go on my three week vacation, it's because I saved some money. I reduced other costs. The same idea is behind decoupling. You put the utility in effect on a budget, and in effect, you link its revenues to its short term cost drivers. And this is what we'll hear about from Speaker 2 later on today, how there are different approaches to decoupling, and they generally reflect the different ideas that regulators and the utilities themselves have about what their short term cost drivers are.

One of the things that we've been talking about for a number of years is revenue per customer decoupling, which is to link the total revenues that the utility receives in a year to the total number of customers it serves. Because in the short run, it's the number of customers that has a more profound effect on its costs than other drivers, and certainly not sales.

To answer one of the questions that is asked in the abstract on the panel, does decoupling create an incentive for energy efficiency? By itself, the answer is no. It simply removes a barrier, a disincentive. Making the company indifferent to its sales levels does not make the company necessarily a big supporter of energy efficiency. Just under decoupling, energy efficiency is neither profitable nor unprofitable. Now, I'll add as well, aside from California and a couple of other states, Oregon as an example, decoupling is a relatively new phenomenon in the electric sector here in the US. In the gas world we've seen a good deal more of it. The Christianson report on Northwest natural gas is I think the only independent study on decoupling done for regulators. It's the only one that I've seen. It's a few years old. I encourage you all to take a look at it. So given that decoupling is relatively new in the electric sector, it's still a little early to make final judgments about the effects of decoupling on utility behavior, but that said, I'll make some judgments anyhow.

Decoupling reduces or eliminates the effect of changes in sales on revenues, on finances. If you want to do energy efficiency, if that is your objective, I think decoupling is an essential part of it, and I think that if you're going to decouple your utilities, regulators must extract an explicit commitment to support energy efficiency--whether it's utility-delivered or third-party delivered, doesn't matter to me. But there must be a commitment to energy efficiency, if that's what you want. Consequently, it may very well make sense to put in place performance incentives for energy efficiency, using the same logic that was talked about yesterday for renewables.

So the question to ask is, what is the business model for utility-delivered energy efficiency? If that's the route you're going to go down, I would argue that decoupling makes sense. It's a matter of economic efficiency, even if you weren't interested in energy efficiency. And the reason for this is that, again, under traditional rate-making, where the incentives are very, very strong to maintain or increase throughput for the utility, it's because for the most part, incremental sales revenues greatly exceed incremental costs, certainly on the non-production side, as we said, as those numbers show before. So consequently, utilities have a natural incentive to encourage sales, even if they are wasteful, and not to discourage sales, even when having your customers be more efficient is more economically efficient overall. So decoupling, which again puts the utility on a budget, and focuses its attention on its managerial and operational efficiency, makes sense as a matter of overall economic efficiency. And I would recommend it, even if you weren't doing energy efficiency. But as a practical matter, I think that a great deal more investment in energy efficiency is warranted, and I think decoupling is a natural part of that.

Pacific Corp's experience with decoupling was ended in 2002 after the staff argued that decoupling had not resulted in increased investment in energy efficiency by the utility. I think this was wrong, because I don't that's what decoupling is ever intended to do. In this decade, Northwest Natural Gas made decoupling an explicit condition of its agreement to provide funds for energy efficiency investment by the Energy Trust of Oregon. It was simply quid pro quo. They were very clear about it. Without decoupling, they would not support energy efficiency investment.

Green Mountain Power, Vermont's second investor-owned utility, is decoupled, as is Central Vermont Public Service now. These are still fully vertically integrated utilities. The costs on the generation side are separated through a fuel adjustment clause. There are some caps and collars on changes in costs, and so there's a sharing mechanism for bearing changes in power costs, which actually gives the company some incentive to manage its costs well. But on the non-production side, they're fully decoupled. The public service board reduced their allowed ROE by 50 basis points in recognition of the increased stability of their revenues. Energy efficiency in Vermont is provided by a third party called Efficiency Vermont. Green Mountain Power, once it became decoupled, became quite enthusiastic about Efficiency Vermont, and in fact has put more money towards investment in energy efficiency in its service territory, because being vertically integrated, and having power contracts with Hydro Quebec and Vermont Yankee, Green Mountain Power discovered that it could make a good deal of money by selling its excess power down to Massachusetts and Connecticut while market prices were higher than the prices they were paying under the contract. So they were quite happy to see savings in their own service territory. In speaking with executives of Green Mountain Power, they were very clear about the effect that decoupling had on their managerial focus. They felt that it relieved them of their revenue anxiety, and that they were able to now focus more on customer service in ways that they hadn't before. And they are thrilled. They are absolutely thrilled with it.

In Washington, the Utilities and Transportation Commission concluded that since about only half of the efficiency savings in Avista's service territory were related to its efficiency programs, the decoupling mechanism would recover only about 45% of the revenue shortfalls. There were no cost of capital or capital structure adjustments to reflect the reduced risk for this reason.

In Wisconsin, a 2009 settlement between Wisconsin Public Service and the Citizen's Utility Board, CUB, called for decoupling, (again, on the non-production side), increased investment in energy efficiency from 2-3.5% of revenues over three years, and reduced customer charges. One of the things that they agreed to, of course, is more recovery of their short-term fixed costs through volumetric charges, because they knew that the decoupling mechanism would resolve any revenue shortfalls associated with reductions in sales. The consumer advocate was interested in seeing customer charges reduced for equity reasons. There was no return on equity or capital structure adjustment made, but instead, there was a flat per year $2.1 million reduction to the cost of service just right off the bottom. You could see it as a cut in the return on equity, or you could see it as a productivity adjustment.

Turning to some of the questions that decoupling raises, one has to do with risk reduction. Full decoupling covers everything. If you're given an annual budget of $500 million a year to cover your non-production costs, that's the amount of money you're going to be allowed to keep at the end of the year, no matter what happens in the economy, with the weather, or with energy efficiency in your customer's premises. In that sense, in my view, all weather, economic and sales risks are eliminated for both the utility and the customer. We know how much money is going to be extracted from customers' pockets for the provision of the delivery service for that year. Anything that reintroduces some measure of sales risk we will refer to as partial decoupling. Caps and collars, any adjustments as a consequence of changes in sales that for whatever reason were deemed to be something that should be borne by the utility, naturally introduces a sales related risk.

So in talking about decoupling, in my view, if it's not full decoupling, it's not decoupling. It's something else. It's a lost-revenue adjustment mechanism. It's some other thing, because it doesn't eliminate entirely that connection between revenues and sales.

How do you recognize the reduction in risk? There are a variety of ways, obviously, an ROE adjustment is one. Another one that I think folks ought to think about is capital structure adjustments, retaining returns on equity at current levels, but increasing the leverage in the capital structure, which has the effect of reducing the total amount of return on investment, but maintains the higher returns on equity. Some utilities and some rating agencies may see that as a better approach.

A question I think that Speaker 4 is going to talk to us about is regulatory lag. Certainly with decoupling, depending on how the revenue true ups are made, regulatory lag--that span of time between when rates go into effect and when they are changed--is reduced or eliminated. And it depends, of course, on the means by which those revenue reconciliations are done. Baltimore Gas and Electric is fully decoupled for its non-production costs, and its adjustments are made in each month. In effect what happens is, that the price that's paid is varied every month. Decoupling, again, if you're on a budget, $500 million a year, whatever the number is, of course, we can divide that by 12, and we know how much the utility should recover each month. Of course, given seasonal variations in consumption, we'll adjust the target revenues according to the season. So in July, Baltimore Gas and Electric will get a lot more revenue than it will in May. What it does, in effect, is it knows how much revenue its decoupling mechanism should give it in each month, and when its billing determinates come in, it divides those billing determinates into its allowed revenues for the month to determine the prices that will be charged. And there is no lag whatsoever. It recovers exactly the amount of money in that month that it was supposed to, without any lag in the recovery time. So we refer to that as current true-up decoupling.

A question, of course, is with the elimination of regulatory lag is who benefits and who loses? In the case of Baltimore Gas and Electric, prices don't always go up. They sometimes go down, and the adjustments have been very, very small. They got the numbers right at the beginning when the designed the mechanism, and the adjustments have been fractions of a percent from month to month, small enough that customers really haven't noticed it.

There are some rate design issues. As the moderator points out, straight fixed variable pricing is an alternative to decoupling. If you recover all your non-production costs in a flat monthly recurring charge, you have in effect decoupled. For a variety of reasons, I don't think that's a good idea. We'll hear why it may be. And I'll just stick my chin out now. The first reason is equity. I don't think that it's a good idea, because low-volume users will end up paying more, depending, again, on how you design the rates. Low volume users will pay more of the non-varying short term costs than will large volume consumers. Number two is, I actually don't think you'll ever get it right, and there will always be some element of short-term fixed cost recovery in the variable portion of the prices, and thus the utility will retain a measure of throughput incentive. And thirdly, and this is the one I know I'm going to get spanked on, I don't think straight fixed-variable pricing is economically sensible from the long-run perspective.

There's also lastly the question, give that you've got to pay for the so-called fixed cost, how do you want to do so? And again, it's done different ways in different places. In Ohio, all the gas utilities are under some form of straight fixed variable pricing, and they're talking seriously about doing it on the electric side.

With respect to the Averch-Johnson effect, if we believe that operates, and I think it does to some measure, decoupling does not remove that incentive to invest in rate base, because you will have periodic soup to nuts rate cases to determine what the underlying revenue requirement ought to be, and that effect will still operate there. So good planning is still a critical need.

If you want your utilities to invest in energy efficiency, and you want to give them positive incentives for doing so, there are a variety of ways of going about it. Here are three or four approached that have been used. I just note that the approach that's been taken with Avista is one example I can give of a decoupling mechanism that does create an incentive to meet your energy efficiency targets, so long as you can establish that that's what you did. And then matters of evaluation monitoring and verification come up. I'll just pass over those and go right to the key quitting thoughts. They can come up in discussion if we'd like.

And this is the Moskowitz voice coming through from 20 years ago. Rate making policy should align utilities' profit motives with public policy goals. All regulation is incentive regulation. It's just a question of knowing what the incentives are and what it is you're doing. Thus the design of a decoupling mechanism matters. Decoupling by itself doesn't address all the concerns that regulators and utilities and consumer advocates have. It's not intended to. There are other approaches that need to be layered on as well.

Speaker 2:

I'm going to start with a little context that follows on from yesterday's discussion, which dealt a lot with questions like what are we going to do about climate change and carbon reductions, and who's going to be taking these actions? And I would put forward that I think in many states across the country, policymakers are looking to utilities to be taking the actions to help address climate change. So we're being asked increasingly to manage the rising and volatile cost of energy in the current environment. I think someone said yesterday that no one would take a bet on any given year these days. Prices go up. They go down. We'll never see $2.00 gas again….We'll never see $10 gas again…OK, we'll just wait and see.

We're also being asked to reduce greenhouse gas emissions. For generating companies, obviously, that was a lot of the focus yesterday. There are environmental regulations asking them, requiring them, actually, to reduce their emissions. But more and more, at least in our states, we are being asked to address greenhouse gas emissions and to help our customers reduce their carbon footprint by expanding our energy efficiency programs, by facilitating renewable energy in a variety of ways. We have RPS requirements. We have long-term contracting requirements. We have the opportunity to invest in utility-owned solar in order to move that market forward. All of which in one way or another may be reducing the throughput.

So I'll link this back to decoupling. We're also being asked to deploy "advanced technologies. This is sort of the code here for smart grid. So we're being asked as a utility company to really deliver on the public policy objectives that have been set out there. So we're committed to doing this. As a company, we have an internal commitment to reduce our greenhouse gas emissions 80% by 2050. That means decisions we're making about the equipment we're investing in are based on whether this transformer or that transformer is more efficient or less efficient, leading to greater or lesser greenhouse gas emissions. We're committed to facilitating renewables. We see that as sort of a necessary component if we're ever going to achieve our climate goals. And as you'll see, we're committed to increasing our energy efficiency and demand side programs, and we are doing this in a big way in really all of our states.

At the same time, though, we've got a continuing obligation to provide safe, reliable and efficient service. And in the Northeast, what that means is, we're investing a lot in the existing infrastructure. It's old. We have 100 year old assets in New York. We serve Buffalo, which is, I think, one of the first places in the country with electricity. Now, some of these assets that are really old are still doing just fine. But we can't expect they're going to last another ten, 20, 30 years, maybe even another five. So you hear the $2-3 trillion a year investment that's taking place in the industry broadly, we've got our fair share of that to do, at the same time that we are delivering on this variety of public policy objectives.

The regulatory environment is obviously critical. We're not going to be able to do this unless we have support of regulation. And there's an increasing recognition of this, that the traditional regulatory framework isn't working. It is not working for customers, and it's not working for the utilities. There's a disincentive built in to pursue the things like energy efficiency, demand side renewables, customer generation. The framework is not adequate, actually, to support the increasing investment. Now, this may vary by utility. It may be that utilities with newer infrastructure aren't sitting at the beginning of what looks like a ten year increasing investment. We're on that sort of increasing part of the marginal cost curve. And the traditional framework, as it's structured, given everything we're trying to do, is having a really important negative financial impact on utilities, which makes it harder for us to raise the capital we need to make these investments.

So I am going to talk about changes like decoupling and positive incentives for energy efficiency. And then I'm going to talk about capital adjustment mechanisms, productivity incentives, and an adequate return. I think you can't divorce one aspect of the regulatory framework from the others.

So very quickly, because I think we already covered this, revenue decoupling breaks the link between sales and revenues, and I would emphasize it's *revenues*. It's not profit. The utility is still on the hook for managing its costs, and it's that combination of revenues and costs that lead to profit or earnings. Basically, rates are adjusted periodically, so that the utility is only collecting the target revenue level. It removes disincentives for aggressive implementation. It facilitates other demand-side resources.

For National Grid, for example, they have made commitments in both Massachusetts and Rhode Island. Massachusetts to reduce sales by 2.4% by 2012. In Rhode Island it's, I think, 2.4% by 2014. This means they are increasing their energy efficiency budgets in Rhode Island from 40 million for 2010, to 60 million for 2011. In Massachusetts, they're going from $170 million budget in 2009, to 320 million in 2011. These are significant increases, and there are corresponding increases in the savings associated with that. And those budget numbers are electric and gas. So they are ramping up significantly. Right now in New York, they are in the middle of a three year plan to achieve the first of what will have to be two three year plans, I think, to get 15% reductions by 2015.

So one of the things that Speaker 1 touched on, but I'll emphasize, is, there has to be a commitment on the part of the utility to achieve a certain target savings. That's a threshold or a foundational issue. And then on top of that, you start talking about decoupling energy efficiency incentives. So I want to make it very clear. We're not talking about the utility making no commitment here to do something, but we're talking about utilities that have made significant commitments to reduce sales. In our states, we are looking at generally full revenue decoupling. And what that means is, we're not trying to parse whether the reduction in sales was due to our energy efficiency programs, whether it was due to weather, or whether it was due to economic activity.

You sometimes hear that, well, utilities should have a reduction in ROE because they're shifting risk to the customer. Actually, they're not. We're basically mitigating risk for both customers and the company. In New England this summer, we had the hottest summer like ever. It was 46% hotter than average. For Massachusetts, where our decoupling was in effect, we're giving money back to customers. For Rhode Island, we'll go into it next year, had it been in effect, we would have been giving money back to customers. So what this says is basically, you understand what amount of money the company needs to recover its costs, and you set the rates based on that. And you don't sort of bet on the weather to help or hurt either customers or the company in any given year.

Speaker 1 touched on the fact that you need the incentives on top of the decoupling. On the revenue per customer side, that is generally used more on the gas side, because there is some association of number of customers relating to revenues. But generally on the electric side, you're looking at total revenues.

Here's the math side. It's in the pack if you want to look at it. But basically the point I'd make here is, sometimes revenue decoupling is being cast as something that is a real departure from traditional cost of service rate making, and it isn't. You still do the traditional cost of service calculation. You set the revenue requirements. All you're doing with decoupling is instead of fixing the rate, you're fixing the revenue. And then the other part of the equation varies. So what are some of the implications of decoupling? One, it definitely removes the disincentive for utilities to pursue energy efficiency aggressively. It does not provide an incentive to do so. You need additional positive incentives, so that you have management focus on doing energy efficiency, because again, there are many competing things. Our energy efficiency team regularly has to argue that it's worth devoting the resources here, and there needs to be some reward to the company for that. But under traditional rate making, back in the day, when you actually saw increases of 2-3% a year in sales, you might use that increase between rate cases to fund your capital investment. For us in the Northeast, we haven't seen increases in sales on the electric side like that in a long, long time. So as we move into an investment cycle where we have to make increasing investments, even if we weren't doing energy efficiency, between rate cases we're spending a lot of money. And what that means is, we're filing a lot of rate cases. If you layer on the energy efficiency programs, and decoupling, where we're now going to give back under full decoupling any increases in sales that we experience due to weather, then we've got a problem. Because what we're going to have to do is file a rate case every year.

Here you just see some of the little graphs showing the CPI as the bottom line, and the Handy-Whitman index for distribution companies at the top. Then you layer on the fact that in addition to having to make the investment for business as usual, we're making a number of investments to advance public policies.

Then if you look at this graph, the lower blue line is sort of the historic transmission and distribution investment. As you look at the red line, this is the total T&D investment that's being projected out of various studies. And if you look at that sort of blue hatch line above the red line, that is an estimate of what additional spending would be required by utilities if they are going to be making some of the investments in smart grid or smart advanced technologies.

So if you look at what is the path that we're on for investment in T&D, and you're saying, "OK, we're decoupling. We're actually working to reduce sales," then clearly the current regulatory environment isn't working.

And here's another illustration of that. This is assuming a future test year, which we have in only one of our states in New York. So when you go in for the rate case, you're forecasting the rate year sales, and you're doing your revenue requirement calculation. You're dividing it over those forecasted sales. And if you're lucky, and you got it right, that one year you will touch the blue line, which is your revue requirement. The green line on the bottom is sort of the cumulative deficiency between actual cost, actual revenues and the revenue requirement. If you're in historic test year, that red and blue line never touch. You are behind the eight ball from the first time, from the day those rates go into effect. I don't want to get into too much detail about that, but the bottom line is, there's a real constraint here. So we need something in addition to decoupling.

And actually, somebody from RAC has used the phrase that I've now adopted called "advanced decoupling," which expresses the idea that you can't do decoupling in isolation. And in our states in Massachusetts, we have a version of advanced decoupling. It advances the energy efficiency, but it doesn't deal with the issue of how you're going to recover your increasing capital costs in the interim years. So a start for that is future test years and multiyear rate plans.

What I want to talk most about here is reconciling cost adjustment mechanisms for capital expenditures between rate cases. These capital adjustment mechanisms, they adjust revenues, given actual capital expenditures that are still approved by the Commission. This is not a blank check to utility companies. There is still a review process. It adjusts the timing of the recovery, not the amounts approved for recovery. What it says is, you create a mechanism that allows you to flow these costs into rates. They are still reviewed by the regulator under traditional rate making. These capital expenditures would roll into rate base with the next rate case. What you're doing here is saying, we don't need to keep filing a rate case year on year on year addressing all of the other issues that you touch on a rate case. Rate cases are expensive for companies and for customers and for the advocates and all the other interveners, but in fact you have a mechanism that lets you flow these costs into rates between rate cases. You also want to have an incentive here to be efficient, as we're making these capital investments. You obviously want us to be doing a good job at it. So you adjust revenues for inflation and a level of utility productivity, essentially incorporating a PBR (performance-based rate) component.

This is a stylized picture of what we're doing in Massachusetts, where have just filed our first capital adjustment filing. They did approve capital adjustments for us. They capped them at $170 million a year based on some of our historic spending. So we're now in the review period, where they're looking at what we spent actually in 2009 and 2010, because this is a historic test year state, so there are sort of a two year lag there. And that gets rolled in as a component of the decoupling mechanism. One of the things we did is, in Massachusetts, we filed this together. It was very confusing. A lot of trying to sort it out. So when we went in and did our Rhode Island rate case, we actually split it out separately. Likewise in New York. So I think there's some differences in states, and we just did a Massachusetts gas case where again we split it into a sort of separate discussion. But originally it was rolled together, because we do see them as integrally linked.

This slide is just a menu of some capital cost adjustment mechanisms, future test years, and multiyear plans of work. You can have the capital cost adjustment with a cap on expenditures, which is what's been approved for us in Massachusetts for both electric and gas. You could do a partial capital cost adjustment, meaning you only get, say, 70 or 80% of whatever you've actually spent. You can incorporate performance incentives into the capital cost adjustment. And you can have a targeted infrastructure capital cost adjustment. You see this a lot on the gas side, at least in the Northeast, where we have a lot of cast iron and bare steel, old assets that need to be replaced. But we have this on the electric side as well for reliability enhancement projects. So if there's a certain segment of projects, you can split those out. And there are features in all these plans that provide for efficient investment.

So here's just some of the math on the adjustment mechanism with a cap on expenditures. If you're in the middle there, and you hit it on target, you get all of it. But in fact, if you exceed your forecast by more and more, you get less and less a percent of what you've actually spent--not that you're giving this up. You're just waiting for your next rate case to pick it up.

In advanced decoupling, as you look at incentives for efficient operations, you can index straight PBR--the O&M costs for inflation, less a productivity offset. In all of our jurisdictions, we have reliability, service quality, customer satisfaction indices that we have to meet to insure that we're not cutting costs in order to increase profits at the expense of customers. And we have an increasing number or a varying number of reconciling adjustments for highly variable costs, things that are beyond our control, pensions and OPEBS (other post-employment benefits) is one. We have some newer programs on vegetation management. They have a separate tracker. Again, this is where we demonstrated to commissions that we want to be taking an aggressive approach to meet customer needs, that there's value to customers, but that what that means is, we're going to be seeing increasing O&M costs between rate cases, and we need a mechanism to recover it.

Here's a really detailed slide of what we proposed in Massachusetts for our electric case in 2009. The blue box is the productivity incentive. This was not approved, actually, by the Mass DPU. So this is something we have been proposing, but we have not gotten this approved yet in any of our cases.

Another key element is the adequate return on investment. Speaker 1 touched on this. You hear a lot of discussion of it, along the lines of "Well, with decoupling, you're reducing risk for the company. So you should automatically reduce the ROE. That's a little bit like giving with the right hand and taking back with the left hand. If you're trying to make the utility indifferent to decreasing sales, and then you're saying to them, "OK, if you're going to reduce sales, and we give you this mechanism to make you indifferent, we're going to ding you on your ROE. Well, it doesn't give us a huge incentive to want to be aggressive about energy efficiency or even facilitate things like customer distributed generation. Our argument is, you have to look at this on a case by case basis. The ROE is going to be a function of the financial markets, the context in which you're operating, what kinds of trackers or adjustment mechanisms you have, capital structure, and not something you can come up with as sort of rule of thumb that says, let's reduce the ROE by a certain amount, because you have decoupling.

Here's my common misconception slide. It's that, one, revenue decoupling shifts risk from the utility to customers. I think Speaker 1 showed this, and I hope I emphasize that it doesn't. It allows the customers and the utility to share risk associated with weather, and it actually mitigates the weather risk for both of them. As I said, it was a very unusual year this year for us in New England. Without decoupling, we would have kept a lot more money in Massachusetts. We are keeping a lot of money in Rhode Island, because while we had proposed decoupling last year, it was not approved in our rate case. The legislature has subsequently passed a law, so we will have decoupling going forward, but the revenues that we got for 2010 are revenues that we can keep as a company. If you're in a region where there is a lot of upside potential, where you're seeing opportunities for increasing sales, maybe you'll have utilities reluctant to pursue this. But in the end, as regulators think about it, it really is about just insurance against this risk that can go either way. There's no guarantee.

I think we already talked about misconception two, that revenue decoupling guaranteed the utility's earnings. It does not. It sets a target revenue level. The utility still has to manage all of its costs in order to increase earnings. And I would just note that while allowed ROEs may be set at 11, 10, 9%, certainly in our experience, it takes a lot of work to achieve those allowed ROEs. In historic test year states, it's virtually impossible to achieve them. And in future test year states, it's still a considerable challenge.

One of the other misconceptions or concerns out there is that revenue decoupling will lead to large swings in rates. This graph, shows the results of a national survey. It shows that most of the adjustments are within 1%, and almost all of the adjustments are less than 3%. And what I've done is graph onto here that little white star, which is the impact of our first revenue decoupling filing in Massachusetts, and you can see it is a small reduction, a refund to customers that's in the less than 1% range.

One of the concerns you often hear from customers is, "Well, if you have revenue decoupling, and I save energy, and I do all this energy efficiency, you're just going to take back the value of those savings by charging me for the difference. Now, this is something that for T&D utilities is clearly not the case. We did some analysis here of our rates in Rhode Island. Had we had decoupling in place, you would have seen that slight uptick in the distribution rate more than offset by reduction in what a customer would spend for commodity. So if a customer does energy efficiency, participates in a program, installs DG, they may see a slight uptick in their distribution rate, but that's going to be more than offset by reductions on the commodity side. It's a little more complicated, obviously, for a vertically-integrated utility.

So to conclude, we use this phrase, "utility of the future. Everybody's talking about that. But if we're going to achieve objectives such as the ones we talked about yesterday on the climate front, then we're going to have to align, as Speaker 1 said, customer, policy and utility interests. And the regulatory framework is going to have to encourage utility action, because we are the institution out there that is touching customers every day in a lot of different ways, and we're being looked to to be delivering on some of these policy objectives that are not only important for our individual state policymakers, but clearly being debated at the national level as well.

Question: I had a clarifying question in regard to the capacity payment that demand response receives in the market. If I understood what you were discussing correctly, this is sort of rate-based demand response. But what happens to the capacity payment that the demand response receives in the capacity market? Who gets to keep that revenue?

Speaker 2: I actually didn't touch on that at all here, but I think I can answer the question at least for our companies, and this is being debated. For some of our customers who participate in load response programs, that capacity credit or payment comes through the company and is reinvested in energy efficiency programs for customers. That's historically been the case. FERC is actually looking at some rules about whether you pay the load response, the capacity payment, plus their avoided savings, or whether you deduct the capacity payment from the avoided savings because the generators are actually concerned that it overpays for load response. This is aside from the decoupling, and not something that we are taking a real position on. It seems to be an argument that the generators are having with the policy.

Question: With the advanced RDM (revenue decoupling mechanism), would it be up to the utility when to file a rate case? Or is the framework that there's an advanced RDM mechanism in effect, and then there would be a preset time when you would have to file a general rate case?

Speaker 2: We started out without having any preset time to file the general rate case when we proposed this in Massachusetts. In our briefs in that case, because of the concern that somehow that this would become a cash cow for the utility, despite the analysis we had presented, we said fine, we would commit to coming back in three years and filing another rate case if not sooner. So it could go either way. We didn't make an initial commitment, but then the Attorney General in Massachusetts was concerned, and so we said, sure, we'll come back.

Question: One other clarifying question. You have incentives in your presentation. But what about the role of performance incentives in terms of reliability? Because the utility doesn't have that much stake anymore in the meter spinning, does that increase the need for reliability of system performance mechanisms in your opinion?

Speaker 2: I wouldn't say the utility doesn't have as much stake in it, but we, in all of our jurisdictions, we do have performance incentives for reliability, and we assume that those are things that would continue. I'll speak from having been a regulator and starting to do PBR (performance-based rates), it was just insurance that we wanted to have as regulators to say that, "OK, if the utility is going to be working to cut its costs, we don't want that to be showing up in decreased reliability."

Speaker 3:

Yes. Good morning, everybody. The first two speakers have given you a tremendous overview of the issues involved, so what I'm really going to focus on is just a case study from a place where the differences in the regulatory framework from what Speaker 2 described as what's needed for the utility of the future are probably the most stark in the country, or close to it, looking at the experience of a utility that serves parts of the Midwest, including parts of Illinois and Missouri. The company sits in an area that has not done a lot of energy efficiency and has a lot of potential for it, but has a regulatory framework that is utterly broken in terms of going after it and aligning incentives.

The setup for the panel talked about utilities being encouraged or forced to look at energy efficiency. There's been a real change at our company, and I think a lot of the companies in the Midwest, regarding energy efficiency over the last few years, especially as it's become, we talked a little bit about climate yesterday, and maybe climate is a little on the wane right now in terms of an issue that's right in front of policymakers' minds. But we're convinced that something is going to happen there at some point. We actually internalize some costs of carbon into the cost effectiveness evaluations that we use to design and implement our programs. So we're convinced that something's going to happen there, and so especially with a utility that gets about 80-85% of its energy from coal, energy efficiency is a major hedge against our carbon exposure.

Even more important than that, we can see in the customer satisfaction work that we do that there is a linkage between the customer satisfaction scores we receive and customers believing that we have provided them with information and with programs that help them manage their bills. It's a distinct improvement that we see, and that's important to us.

And then really, we've got the long-term incentive of maybe avoiding or deferring power plants, but in our situation, right now, that's not a big deal. We don't need new generating capacity probably for at least the next ten years. So we're not in a place where that really serves as a tremendous benefit. Now, that can change. We talked a little bit about yesterday about the environmental issues that are coming down the pike. Some people call it the train wreck. We're trying to get away from that, maybe tsunami or something like that. But if that comes about, we have a 900 megawatt coal plant that will most likely be retired, and that can change how fast we need to ramp in to especially demand response. So we're a utility that really wants to invest in energy efficiency.

We haven't done a lot, because the framework that we're operating under right now is pretty much the framework we've had for a long time. And so the disincentives for energy efficiency investment have been in place for a long time. And so nothing much has really happened in Missouri, especially.

We've got low rates, too. Our approximate rate for residential customers is around 8 ½ cents at this point, and we've got one large industrial customer that pays about 3.6. So we don't have a lot of the price incentive that others in the country might have. And as the previous speakers have already said, aligning these incentives is really critical, especially in a state that is still vertically integrated, that uses a historic test year, that takes 11 months to a rate case, and has no ability to do riders. That's where we are today.

So the challenges to figuring out how to do this are pretty stark in Missouri, and the financial disincentives are particularly high.

A couple of years ago, we went and did our first comprehensive potential study of demand-side management for our service territory. And we went out and did primary data collection. We did it for all customer classes. It was survey based, and a lot of end-use metering went on. We did the best job we could of really getting a baseline of not just what energy customers were using, but how. We did some psychographic and market research to figure out how our customers might be different from customers in other parts of the country in terms of their energy decision making.

The results are what's shown here. The green line is what we're expecting in our baseline forecast--not huge growth. It's between 2010 and 2030 there. I think you'd probably see energy growth there a little bit less than 1%. And we define a couple of things. One is "realistically achievable potential," which is, potential for energy efficiency given a pretty aggressive approach to incentivizing energy efficiency, but not doing things like, for example, paying the entire incremental cost of a measure, but having it be sort of economically based, having customers having some skin in the game as well. That's where the realistically achievable line comes in. And that cuts out about ¾ of the growth that we would otherwise see in electricity usage in the Missouri side of our operations. So it cuts out about ¾ of the growth that you would see.

If you're willing to ratchet the level of actual utility investment up, going from the light blue line and the triangles to the dark blue squares, that's probably a factor of two in terms of resources invested in energy efficiency. So probably going from something like $100 million a year to about $200 million a year. But you do get some additional incremental diminishing returns here. But what you do in the maximum achievable potential case is that you eliminate growth over that 20 year period. So that's the potential we see in terms of energy efficiency and our service territory.

However, we've got a problem, and it's a pretty big one. In this figure you see the orange box and the red box (and this represents a vertically integrated utility). That's the relative sizes of our variable costs and our fixed costs. One of the reasons that the variable cost is as small as it is there is connected to what it says in parentheses: "net fuel." One of the things that we do in Missouri, we're one of the more active wholesale traders in the country. We sit in the middle of the country. We have an ability to transact a lot of different ways. We make somewhere between $300 and 400 million a year in off system sales. That all flows back to our customers through our fuel adjustment clause to lower rates. So what you see there, the orange is the net of about $900 million in terms of fuel costs, net of that off-system sales flowing back to customers. So what that means is, on a relative basis, there's a huge piece of fixed cost there that in our rate structure is getting recovered in the volumetric piece of our rates.

What that means, then, is that as we ramp in to big energy efficiency investments, we see a big hit to the bottom line. So this is really getting back to what Speaker 1 showed you for a distribution utility. This is an example of what it looks like for a vertically-integrated utility. And how it plays out is like this. This is some analysis we've done for our upcoming integrated resource plan that we'll be filing with our PSC in February. And what you see here is, if you have a rate case every year, that's the green line on the bottom. And then if you have a rate case every two years, that's the red line in the middle. And then if you have one every four years, that's the blue line on the top. So even if we have a rate case every year, as we're ramping into the level--we spend about $25 million a year right now on energy efficiency. When I started our newly invigorated energy efficiency efforts about three years ago, I was convinced that if we demonstrated that we had an increased level of commitment to energy efficiency, that we'd get a regulatory framework that would incent us to do it long term. That has yet to happen in Missouri, so 2011's a really pivotal year for us in terms of whether we can even stay at the level we're at, or whether we're going to need to dial back significantly. And this is why. If we file a rate case every year as we're ramping into that realistically achievable potential (RAP), we're still losing $20-30 million a year, a significant hit to earnings. I'm going to say that's 20-30 cents a share. If you try to stay out of doing a rate case every year, which we would really like to do, and you go to two, you get that first saw tooth, and now you're losing probably $50-100 million a year. And then if you go to trying to stay out for four years, you're up at over 100, somewhere between $100-150 million a year that you're losing. And that's the problem.

As I said, revenue collection through riders isn't really allowed in Missouri, so without a legislative fix, it's probably not going to work. We're looking at the possibility of doing a tracker for lost revenues, for lost fixed cost recovery. I think our concern there is, I'm hearing from my accountants that that may not pass muster in terms of recognition for earnings purposes, especially as the international accounting standards come in, and balancing accounts like this might not be used. So we've got a problem even in this current rate case figuring out what we can do to give us some support for the lost fixed cost recovery that's recognizable in earnings in between rate cases.

On the subject of decoupling, we've spent a lot of time on this. I, too, am not a fan of straight fixed variable on the electricity side, for some of the reasons that Speaker 1 talked about. I do think that some sort of RPC (revenue per customer) model needs to happen, but Speaker 2 did a really good job talking about what the impact in between rate cases is, especially for utilities. It's historical. It takes 11 months. No riders. We rely on some of that upside. That's really what's built into traditional regulation, to fund incremental capital investments in between rate cases, and this eliminates that. So you've got that issue that you need to deal with. And it could increase the negative impacts of regulatory lag. Speaker 2 already talked about that very eloquently. So we do believe that there's benefits to customers of utilities being involved in energy efficiency. We're not the only answer. Codes and standards are important. The market's important. But we think we can be a really effective catalyst in terms of getting energy efficiency adopted into the marketplace at a reasonable cost. But in order to do that, you've got to deal with the problem that I hope my little case study has identified. And with that, I'll close.

Question: Just to clarify, in Illinois, we have done straight fixed variable parameter on the gas side.

Speaker 3: Yes.

Question: And if I'm not mistaken, made some movement. I think on the gas side, we're 80% fixed cost recovery on the customer charge.

Speaker 3: That's right, yes.

Question: And on the electric side, we've made some movement in that in the last rate case as well. So we're taking transitional steps to get that fixed cost recovery established.

Speaker 3: That's absolutely right. You make a really good point. The difference between Missouri and Illinois is pretty dramatic here right now. So that the numbers that you saw up there are really Missouri numbers. The impact is much less in Illinois, because it's a restructured state. So we're really only talking about the poles and wires business and the fact that the rate design has moved towards partial decoupling. So that's a good point.

Question: Could you go back to slide five, your brontosaurus? [LAUGHTER]

Speaker 3: Yeah, sure, here you go.

Question: We're mixing multiple things here, and I'm wondering, have you simulated this to separate the effect of just the historic year versus going out with four years of inflation from the efficiency piece?

Speaker 3: Yes.

Question: Because the bigger issue, frankly, for me, if I worked for your company, would be this historic test year, especially if you're in rising cost environment, to be able to do a lot of things to replace your infrastructure.

Speaker 3: This slide is the incremental impact of just the lost fixed cost recovery associated with our programs. So it's not everything else.

Question: This is just the energy efficiency?

Speaker 3: That's right, this is just energy efficiency.

Question: If you go to the energy efficiency potential estimate slide, I was actually pretty surprised to see that if that were a ten year forecast, you'd have really significant downward movement in either estimate. Is there some reason that in 2020 you see projections starting to turn around?

Speaker 3: Going up? Yes. The reason for that is that we see long-term diminishing returns from energy efficiency. And we try to build in some technology change, where we're trying to forecast technology changing happening. So there's things embedded in here that haven't actually been invented yet in terms of what's happening in the end uses. But our point of view is that as you move forward, you're going to have diminishing returns from energy efficiency, kind of like moving from incandescent bulbs to compact fluorescents to LEDs, or from reciprocating compressors to scroll compressors. There's going to be some diminishing returns that happen in energy efficiency, and that's why it turns red.

Speaker 4:

I was struck as I was listening, and especially listening to Speaker 2, by what's really going on here. And if you stop and think about this, if we were all in business school, and we were all working on our masters projects or PhD projects, and the challenge was to define the perfect business model from a business school standpoint, what would you do*?* Well, one, you would probably draw a circle around your customers and not let anybody else sell to them. I mean, that's probably pretty good. Two, when you're selling a product, probably you would not want to have any responsibility for volatile costs that are not in your control. So you would figure out a mechanism that immediate got that out of your side of the equation and straight down to your customers immediately. Next, you probably want something capital intensive, because really, it's about earning returns on capital for shareholders. That's what we want to do, and well, what a great deal this industry is. It's very capital intensive, and really, you don't want to probably have to worry about historic capital expenditures. I mean, really, wouldn't you rather get paid on what you're going to spend, not really what you have spent*?*

So let's design a model where I get paid for what I'm going to spend. And then really, let's put it in a situation where there's very little oversight, and let's be realistic about sort of the regulatory world today. Most of our budgets have been cut. None of our staffs have been increased. I haven't had a raise in four years, and I've got two attorneys and one economist. Oversight is minimal. OK*?* Oversight is minimal. I would say on balance, the utility industry is getting an A- in this class if not getting real close to an A. And that's what's going on. It's not a bad business to be in. The way that it sets up, it's pretty advantageous, and it's not difficult, let's say. There are some challenging questions, but if you really look at the overall business environment you live in, wow, it's not that darned challenging from a regulatory standpoint.

So anyway, I want to make some comments. I guess my job here is sort of to put the other spin on decoupling and some of economics of this adventure, and so I'm going to try and do that. But I have to issue a caveat one or two things. One is, my views are influenced by the fact that I live in a vertically integrated state. We're old school. And you know, if I lived on the East Coast and bought 100% of my power at market, I'd probably have a different economic view of the world, and probably some different priorities and some different views on things. And I think that's to be understood. I live in a world where I've got a lot of sunk costs, such that even if we cut usage in half, I've got to double the rates. That affects my economic viewpoint. And carbon is going to have a big impact. And I don't know what that impact is on any economic view, regardless of market. And so I'm not really trying to address the carbon issue. But we all know that if at some point there's a carbon price, however formed, dropped down to consumers, that really changes a lot of the economics of energy efficiency, and probably a lot of our views on what the proper business model moving forward might be. But I'm not going to really try and address too much of that. That's really a whole other ballgame.

The other thing that I'm always fascinated with, and I think Speaker 1 actually hit this, is that decoupling is really only about revenues. It has absolutely nothing to do with energy efficiency. Now, we all know that from an academic standpoint, but it's amazing, I think, when you go out and speak at these types of things, and you talk to people in general, it is so linked that they sort of get lost in what's really going on. And so decoupling is only revenues, and yes, it may change your views on energy efficiency, but it's part of the problem. It's not the answer to the problem. And I think actually, that's fairly consistent with what *Speaker 1* said. It's just a mechanism that may lead to other possibilities. And it really is going to depend on the utility's commitment to energy efficiency and a lot of other things that go into this.

Now, I have to say that a lot of this presumes that a utility should even be in the energy efficiency business. And I'll be honest with you.

I don't think you should be. And that's a great policy debate. Utilities are really good at building power plants, stringing lines, delivering kilowatt hours. They've been doing it for 100 years, and you really are good at it. I don't necessarily think you should be doing something else. I think if people don't want to buy your product, we should enable people to not do so. If people don't care about the way you price your product and want to buy, I think we should enable that. I mean, that's the market. We let consumers choose what they want.

And I'll put an asterisk on that. I'm not going to get on a high horse and say we necessarily have pricing in the regulatory framework correct. I mean, that's probably a legitimate complaint. We've maybe not done the best we could do historically in terms of pricing, which doesn't mean I really want hourly marginal cost rates dropped to consumers with smart meters, either. But I think there's some legitimacy to prices and efficiency. But I think we get into these struggles when we start mixing and matching. We want a utility not only to build power plants and provide kilowatt hours and supply reliability. We want you to help people not use it. I mean, it's just fundamentally a conflict. And while from a policy perspective, and a political perspective, I think, there's some hesitancy for the utility industry to stand up and say, "You know, that's not our job, to help people not use our product," I think in some respects, you should.

Now, I also think--and there's a lot of studies that talk about this--that the vast majority of energy efficiency and consumer savings that are going to happen in this economy are not because of utilities. They really are the market-driven building codes, tax credits, efficiency standards for appliances, and things like that. Those are things that naturally and organically happen, I guess it's not organic if it's a standard, but I mean, that happen within our economy. And that's really where the vast majority of savings and efficiency improvements have occurred historically and are going to occur going forward. Can utilities add to that around the edge? Yes, probably, but I think that it's not the be all and end all to have utilities in this game.

Secretary Chu gave a speech not long after he was appointed, and he made the point that we have saved more in this country, kilowatt hour wise, from improving refrigerator efficiency in 30 years than the sum total of all renewable energy that we've put on the system. So how much do you want to spend on renewable energy if you can do that with simple appliance efficiency upgrades? So how deeply should we dive into utilities? How complicated do we need to make the utility and regulatory model look to make energy efficiency palatable? I mean, I certainly respect and understand Speaker 2's presentation. But did you see all of the trackers and riders and decoupling and forward looking…and, you know, maybe you sort of kill it when you make it that darned complicated. It's not very useful, I think, in some respects.

I think that Vermont has shown that third-party providers can be very useful. Utilities produce a product. Let's create another entity that serves consumers that don't want to use the product, or want to use it more efficiently, or want to use it differently. And there's no absence of ability. I mean, if you've gone to Google and typed in energy efficiency or any like term, I mean, there's billions of pages. You can go to Home Depot. There's a wall of potential savings. You can open any newspaper, and there's an HVAC company running ads. It's happening out there.

So what exactly does a utility add to that incrementally? Maybe some, but maybe not much. Versus what sort of crazy regulatory gyrations do we need to go through to make this a palatable business model for utilities? And I just don't see those two balancing. That's just my view. Take it for what it is.

Obviously other states, other advocates, other utilities have a different view. But I think that sometimes we lose a little bit of perspective in our vast rush to have utilities be our social policy arm in this country. And I think that we sometimes do consumers a disservice by mixing and matching those. The other thing about decoupling, it's just not that darned interesting. [LAUGHTER]

I'm stalling here, because we've got like three hours to kill on decoupling. It's just not that darned interesting. The funny thing is, so Ralph Cavanagh from the NRDC, and I know you all know Ralph. He's great. I love Ralph. He wrote his first article on this in 1988. He sent me not long ago an article that was published in 1991 with him and John Anderson debating each other on decoupling, 1991. In October, two months ago, there was a conference, the FRI Conference, he was there, in Columbia, Missouri, and once again, there sits Ralph Cavanagh and John Anderson. John Anderson's at ELCON (the Electricity Consumers Resource Council), if you don't know him, they represent large industrial users. And there they sat 20 years later debating decoupling almost word for word from the article 20 years ago.

It hasn't changed. It's not rocket science. It's not even interesting. It really isn't. In a simple sense, it's rate design. It's rate design of a different flavor, and this is where we were going to have our little disagreement. You know, you can accomplish decoupling with straight fixed variable rate design. We skip all the gyrations and go with straight fixed variable rate design, which I would argue makes more economic sense than volumetric rates, because what you're doing is recovering the sunk fixed costs of the system that are not volumetrically based.

So if you want to get on an economics high horse, straight fixed variable rate design and flat customer charges per month probably makes more economic sense. In fact, if you move down this path, on January 1st of each year, we could just simply send customers a bill for their ratable share for the year. I mean, we know. We've got your revenue requirement. We'll allocate it into the classes. We divide that by the number of customers, and we send them the bill on January 1st. Or we could break the bill into 12 equal monthly payments, or 365. I mean, it really doesn't matter. We're going to get to the same place. It's just rate design.

Now, the economics is kind of fun, because what you will hear from RAP and NRDC and any of these other guys is, well, we want to have really low customer charge and really high volumetric breaks. And why? Well, because that artificially increases the cost of volumetric use. It's a completely artificial construct which may economically result in more than economic energy efficiency being purchased in the market. Now that inefficiency doesn't seem to concern them a whole lot, because it really matches up with their belief about the world. And their belief about the world, I maintain, is that they want less. Less. We must produce and use less.

Now, less isn't really an economic concept. Less is more of a religious concept. It's a faith-based sort of thing, because we could have less cars. We could have less televisions, less airplanes, less Ritz-Carltons. We could just have less of a lot of things. Which really isn't connected to economics or efficiency or markets or anything like that. It's really much more of a faith-based sort of a venture. But in that economic world, yes, of course, you want to give the utility decoupling, so that they'll play along with energy efficiency, but we want to charge consumers high volumetric rates, because we want to over-incent energy efficiency. I don't know that there's really a great economic underpinning in that whole concept. So I mean, I struggle with that. But again, I don't think it's that interesting. It's simply rate design. We design rates any way we want to. We've been doing it for 100 years. We could change it tomorrow.

The subtlety, though, is that the historic utility compact is that we periodically review your rates, we determine a revenue requirement that is necessary and adequate for the service that you're providing. We construct a set of rates that under normal circumstances should allow you the opportunity to earn a reasonable profit, and then we turn you loose until the next time you come in to see us, and we do it again. That's the way it's worked for 100 years, and utility managers have had to manage around that. That was their job. Good utility managers did it well and made money.

Once you get to decoupling, you've sort of taken half of that equation out. So I do agree, it doesn't guarantee profits. And I think that anybody that says it guarantees profits is wrong. It does guarantee revenues, and profits are going to be a function of how well you manage your business. But it does take one huge variable out of the equation, and that's the variability of the revenue flow that you're going to get. And that's not minor. And I would, I guess, disagree that it's a misperception that that shifts risk to consumers, because when a utility needs capital, when somebody's investing in a utility or any business, what you're looking at is the risk of revenue, revenue growth, revenue operation--what is the certainty? And there's obviously a very clear risk/return relationship, because if you don't want the risk of a stock, you can buy a bond for a lower return. This is very MBA 101 type of stuff. It's not different. If you eliminate or reduce revenue volatility, that's good for the utility. It's good in the market. And it should allow any investor to look at your new revenue stream, as opposed to your old, somewhat volatile revenue stream, and judge you less risky and allow you to get capital in the market. That's all it is.

A lot of the argument seems to center on return on equity reductions and whether that's fair. And the consumer side of the equation, and that's us, and my counterparts across the country almost unanimously agree on that, that the return on equity reduction, because of the reduced revenue volatility and the reduced level of risk, is an important consumer component of decoupling or any other new regulatory mechanism that we're going to design. That matters. So I may be willing to trade you decoupling for a lower return on equity, because that lower return on equity is dollar savings for every consumer. That matters. Now, you can be pragmatic. Some people wouldn't trade that, but that's a really fundamental piece. And as much as you make the argument that it's not, it is a really fundamental piece of decoupling.

So yes, decoupling solves a temporary revenue problem. It solves a throughput issue. If you're guaranteed a level of revenues, regardless of what you sell in any year, then you don't care what you sell in any given year. So yes, that solves one piece of the problem of the incentive for utilities to grow sales over time. The thing that I think is the much stronger incentive in the utility industry is not throughput. It is the incentive and the necessity of growing rate base so that you can grow your revenues, so that you can grow your earnings, so that you can grow your dividends. Period.

I think sometimes the measure of utility hubris is to look at what they say in a forum like this, and then go to their website under the investor presentations, and read what they say in those. And it's an entirely different story. Why are we excited about environmental programs? Because it's billions of dollars of capital that we have to spend, our hands are tied. We're just going to have to build that rate base. And our growth model is to build rate base, build revenues, build earnings and build dividends. And decoupling doesn't deal with that at all.

So even if you have decoupling in this perfect world of energy efficiency and everything that you want, you still fundamentally have a business model that says, we have to build things. We have to put them in rate base. If you can't make that go away, then really, all the energy efficiency does is reduces your volumetric piece of how much you divide the revenue requirements over. Rates for everybody are going to go up. We're just going to have lower kilowatt hour sales, but we're still going to have larger and larger revenue needs over time. And every utility, whether you are market or nonmarket, has the same thing. If I was living in the East Coast, and I only had a wires business, I'd be looking to figure out a way to rebuild my entire distribution system, technology, whatever it took, because it's a huge capital build. I mean, what else are you going to spend your money on? What's your earnings model if you can't do that? That's the incentive. And decoupling doesn't address that at all. And so I think that decoupling is a small and not very glamorous patch on what the real issue is overall, and I don't think that we've come close to solving the real issue. So my customers are going to still pay more money.

Now, I love that we kept talking about Moskowitz. I got into this industry in 1992, which was not that long ago, and I was reading the same articles, it was always the Moskowitz versus Joscow debate. But I'll be honest with you, I had to fall in the Paul Joskow side of the debate. It was great fun. But in that world when we started, it was very simple, at least in Kansas, and maybe I think a lot of other places. They came in. They had a rate case. We set a revenue requirement. We allocated revenues. We did rate design. We said, you've got a $6.00 customer charge. You got a seven cent rate, get out of here. Go away. So you had one fixed rate. It was just very simple.

Now, the beauty of that is that when you need to align interests, if at any point your marginal costs got above your marginal revenue under that model, because your marginal revenue is seven cents, I can tell you to the penny how much you should spend and when you should spend it on demand response to increase your profits. And that's a very simple economic incentive. It's aligned. Marginal costs are above marginal revenue. If you can reduce them, your profit goes up. It's that simple. As long as you spend less than the delta. And conversely, in those areas where you marginal revenue is greater than your marginal costs—for example, the middle of winter, since we developed an average rate, probably a good part of the winter--you've got higher marginal revenues than marginal costs. You have a huge incentive to increase your sales, and your profit goes up. Now, I don't know of a more simple or more elegant economic alignment of interests than that. That's where we were. That's not where we are anymore. But that's where this all started. And so sometimes I kind of giggle when people bring out the ARRA (American Reinvestment and Recovery Act), and we've got to align this, and we've got to align that, and I think, wow, we had it. It was aligned. It was beautiful. We had it. Now we don't. Now we've got a lot of other models that we've got to create.

Now equity becomes an interesting question. And economists are not really good at equity. They don't really teach that in economics school. They teach efficiency in models, and they don't teach equity. And you know, I live in a world, especially in what I do, that deals with a lot of equity challenges. And so do regulators and utilities, but at least you have a very laser-like focus on what your fiduciary responsibilities are. There's there's clarity around what you're trying to do. But let me ask a question. And please be honest about this. In the last 12 months, how many of you have gone out with either your local utility, or your local service agency, and done weatherization on low income housing? I mean, actually gone out, put a caulking gun in your hand, and done weatherization? How many of you have done that?

Comment: I built a Habitat house. I don't know if that counts.

Speaker 4: Hey, good job. OK, so here's the thing. We are by definition the most educated and highly paid people in this country. We are. We're sitting at Ritz-Carlton in Tucson, which is beautiful and lovely. I love it down here. Thank you Harvard, because it's a lot better than Kansas at the moment. We are fundamentally disconnected from what's going on out there in the world. We don't really have, I think, the appropriate view of what the housing stock is out there, what the average economic circumstances are, because we are not average. We are way out on the tail ends of the distribution curve here.

And I'm not playing high horse here, but I find it very rewarding, but also very enlightening to get out there and put a caulking gun in your hand and go see what's out there, because it really does put, I think, a lot of context into the academic discussions that we're having here, and it matters. And I think the fact that not a single hand went up is sad. We really need to do that, because it's a very difficult economic environment out there for people. And we come to these types of things, and you can talk about any one of these forums--carbon, environmental, decoupling, energy efficiency, transmission, renewables. Everything has its conference. But when you add them up in a macroeconomic sense, you're talking about a very large economic burden on consumers, very, very large, at a time when they can't afford it. There's very little discussion of priority. There's very little discussion of what do we really need? How do we parse what we really need? And so you get into these equity issues, and they're difficult.

I say this because energy efficiency offered by utilities creates haves and have-nots. If you're the lucky person that gets the energy efficiency product, you win. Your sales or your usage goes down. Hopefully your bill goes down. You win. If you are the vast majority of utility customers that don't get energy efficiency, your bill is going up, unless you do something actively to change your usage without it. You're going to pay. People that say, "Look, all the bills are going to go down,"--that's just simply a lie. People that say that don't understand rate-making. You cannot increase costs, reduce kilowatt hours and have everyone's bill go down. You can't. It may in theory go up slightly less than it would have otherwise. But there are people on the system that may have bought their own highly efficient air conditioner, insulated their house, put in compact fluorescent light bulbs, and are now going to pay for their neighbor to do it. And that's a tough equity issue from a regulatory standpoint. I mean, that's one of the things that regulators, I think, struggle with. How do you justify these types of things?

In Kansas, Kansas City Power and Light just built a big giant coal plant, and it's probably one of the last companies that's going to do that. They did it, oddly enough, with the blessing of the Sierra Club. Figure that one out. That was a minor coup on Michael Chester's part. But they just built this thing, and in a totally unexpected turn of events, it came in vastly over budget. I would have never guessed. And we just had a huge rate case. We've actually had four rate cases in the last five years. We just finished the fourth. This was the one where we argued about the prudence of their actions in building the plant. And lo and behold, the Commission found that we did not meet our burden of showing that the utility was imprudent in spending an extra billion dollars. And we could probably have a fun legal discussion about that whole mess.

But here's what happens. Kansas City Power & Light also filed an application to do energy efficiency programs. They want to spend $43 million in the next five years on direct programs, and they've got a shared savings mechanism where they want to forecast for 20 years what the savings are, apply avoided energy and avoided capacity rates, discount that all back to today, and lo and behold, they want $50 million over the next seven years. So not only are customers paying for a plant that you just built, but now in the same breath, you're going to ask them to pay more not to use it. And I'll tell you, people in Kansas are struggling with this notion. Why would we pay another $90 million to not use the thing we just got a huge bill to build?

Now again, carbon issues aside, etc., people struggle with some of these things. And again, it's at that equity level of, it just viscerally doesn't feel right to consumers. It doesn't make sense to pay on both sides. And so I think people understand, especially about decoupling, that it's a revenue guarantee. It is. And that is fundamentally divorced from what most average consumers understand about the way the world works, because there's just no such thing as revenue guarantees. There just isn't in this world, I guess, unless you're a utility. And so, again, it's not the economic efficiency modeling. It's what's happening with real people out there, and how do you get down to their level? And it's certainly difficult. So those are some of the issues that I struggle with.

Now I'm going to tell you just briefly, I handed out a resolution that NASUCA passed. Now, NASUCA is the National Association of State Utility Consumer Advocates. NASUCA, is sort of the small consumer side of NERUT. If you ever go to the NERUT conventions, NASUCA is somewhere down a hall in the basement in one small room. But it's there every November. So if you're ever at NERUT, you can come to the NASUCA stuff, too. It's good stuff, with good people that come, and it's all open to you, too. But NASUCA did pass a resolution a couple of years ago on decoupling. And you can get this on, we passed it out, but you can get this on the NASUCA website. It's nasuca.org. It's very hard to remember. It has all of NASUCA's resolutions. There's actually a fairly new one on transmission that I think is pretty good. But on decoupling, here's what the national policy stance is. I throw this out there for you to read.

And sort of cycling back around to what's going on with decoupling, it's not a black and white thing. And there are members of NASUCA who are dogmatically opposed to decoupling. I mean, just almost irrationally, dogmatically opposed. And there are other members that have bought in hook, line and sinker--it's the answer to all the questions.

And I'll tell you this. I think they're all wrong for exactly the same reasons. The people that are dogmatically opposed probably really aren't looking at it correctly. The people that think it's the panacea and the be-all and end-all I think are going to wake up one day sorely disappointed. Because I think in some respects, it does come down to the details. Decoupling is a simple mechanism. But it's not terribly difficult. The issue is, what else is going on?

As far as what this resolution lays out, there is disagreement within NASUCA about what it says. Some think it's absolutely opposed to decoupling. It says, we oppose. And then there are others, who believe that it says that we oppose decoupling without certain things. And it begs the question, if you gave us all of these things, would we then maybe be in favor of it? And it's a question the resolution doesn't answer. But at least it gives you a little picture of the types of things we want. Is there a commitment? Is the utility that you're working with good and trustworthy? And I will tell you that some aren't. Some utilities aren't that good and aren't that trustworthy. They just aren't. Some are better than others. Some utilities have a history of programs and doing things, alternative rate making mechanisms, where they have not performed well.

But again, I think in my world, it still comes down to what's the mechanism? I'm willing to maybe trade decoupling for lower ROE targets with symmetric penalties and maybe even incentives. A lot of these are often asymmetric, and that's not good. What's the mechanism around it? And I think that has to happen on a utility by utility and state by state level. And I'll finish by saying this in favor or decoupling. There are a lot worse ideas out there than decoupling. [LAUGHTER] Capitalization is an awful idea, debunked in I think every state that's tried it, except Nevada, and they're working on throwing that one out.

Comment: Missouri.

Speaker 4: Oh, Missouri? You got it?

Comment: Oh, yes. It's the hide bound tradition.

Speaker 4: Oh, that's awful. So that's worse. And the lost revenue mechanisms are certainly worse than decoupling could ever be. You know, there are some shared savings proposals, like the KC P&L proposal that really, even though shared savings in and of itself can be a useful mechanism, the application and proposal is so off the charts, it's ridiculous. So there are worse worlds than decoupling. Again, I think the key issue is, what's happening with decoupling? What are you gaining? What are you trading? Because you can't have everything. And how do you regulators balance the public interest between the consumers that are going to pay and be impacted by this, and the utility that has legitimate financial needs and issues of its own? And so what the right balance for that is is different in every state. Thank you.

General Discussion

Speaker 2: I have a couple of points I wanted to make in response to Speaker 4, and I'm sure you're not surprised. And I think really you have raised a couple of fundamental questions, which are, what is the role of the utility in delivering energy efficiency? And should there be someone else out there delivering it, or should customers be on their own to take advantage of all the information--the websites, Home Depot, Lowe's sales and marketing materials?

At a threshold level, I wanted to invite you to come to our jurisdiction as a consumer advocate to support straight fixed variable rate design, because in our experience, our consumer advocates have not seen the merits of high customer charges and low volumetric charges. And you're right, there are other ways to skin this cat, and you can do rate design. But bottom line, I wonder if there's anywhere in the country where you've really been able to address the issues that decoupling addresses through straight fixed variable rate design.

The other thing I want to put out there, is that I don't think utilities should apologize for wanting to make money for their shareholders, because if we didn't make money for our shareholders, we wouldn't have any shareholders, and we wouldn't have any investment, and we wouldn't have the capital we need to invest in the T&D system. And it needs that investment. We're regulated. We compete with other utilities. I know my company competes with other utilities in this room to attract investment. And I'm going back to my regulatory days--companies that were focused on whether they were running their businesses efficiently and earning their allowed returns, or approaching earning their allowed returns for their shareholders, tended to be better-run than companies who sort of didn't keep an eye on the bottom line.

That said, in our view, and I don't want to speak for Speaker 3, but he touched on this, energy efficiency is something that helps in terms of customer satisfaction. Delivering products that the customers want is our first best way to deliver earnings for shareholders. But in order to deliver those products, we need to make investments. We need to earn a return.

Decoupling does guarantee revenues. I will say that here. However, what it does is it guarantees a level of revenues agreed to and approved by the regulator so that in a hot summer or a cold winter, we don't get any more revenues than we're allowed, and that's something significant to give up for us. In fact, the number I showed you with Massachusetts' first decoupling filing ending in a rate reduction for customers--that includes the impact of $174 million of capital expenditures that have been more than offset by the increased revenues. So the net impact on customers is going to be a reduction. So that guarantee is a two-way guarantee, and it doesn't go just one way.

Two more short points, actually, if I may. One, we've been successfully delivering energy efficiency programs for over 20 years. We think we're also really good at building pipes and wires. So energy efficiency is something that utilities can be good at. I think the central model similar to the one they have in Vermont can work in some places. In New York, they moved to a central model for about ten years or so. Didn't work so well. The utilities are back in the business of delivering energy efficiency.

And so again, some particular circumstances there, and you need to be careful about whether utilities are good or bad at this. If policymakers want to say to us, "We don't need you to do this, we're going to have someone else do it," they're still going to need the utility to be supportive. They will want utility support for improving codes and standards. That's a political activity. It doesn't happen all by itself. And without decoupling, it becomes problematic for utilities to be strong supporters there.

When you were talking about how much of the savings have happened naturally, we have a great example. Over a period of time, in Massachusetts, we had utility-run efficiency programs, and in New York, we did not. Now, due to improvements in gas appliances, you basically can't go out and buy a less efficient gas appliance. They're all more efficient than they used to be. We saw a decline in use per customer in New York of a couple of percentage points. In Massachusetts, however, where we also had utility efficiency programs, we saw twice that decline in use per customer. So the utility programs do make a difference on top of the naturally improving efficiencies. And the old New England Electric system was part of the Golden Carrot program that actually delivered those improved refrigerators that Steven Chu was talking about.

So I think there are some threshold issues. Do you want the utility in? Do you not want the utility in? It's something worth debating. Even if you don't want the utility delivering efficiency programs, you're going to need the utility support for improvements in efficiency, or you're going to see lots of rate cases, and utilities dragging their feet.

Then lastly, I just can't resist. I began my career working at a community action agency doing low-income weatherization. So I haven't done it this year, but I've done it, and as a company, I was just reviewing our Rhode Island plan, where we are significantly ramping up the low income energy efficiency programs, because that's a state I think with the second highest unemployment rate in the country. And these are no-cost programs to low income customers. So we're out there on behalf of all of our customers.

Speaker 4: Great. Look, in a lot of respects I don't disagree. Let's be clear, I was brought here to be the skunk, and so if I just came here and agreed with everything, where's the fun of that? OK? [LAUGHTER] But where I got to at the end of my statement was, if you're going to go down this path, decoupling is not the worst thing that's out there. There are things that are worse. And decoupling is not just what decoupling is. It's what's the package is, and what activities and expectations and standards and shared risks are part of that package. And so I don't really disagree with what you say. It's really a question of, how are you going to skin the cat? And you're right, there are fundamental threshold questions. Should they be in, or should they be out? I don't know. My personal opinion is, they shouldn't be involved. But you know, that's reality. There's different things all over. And I love the fact that you started out with a low income community action agency. But your hand didn't go up.

SPEAKER 2: It didn't go up this year…Well, here. I'll throw in something else. My husband actually works for Youth Build Boston, which trains delinquent youth to work in the construction industry. So I use him as my contribution.

SPEAKER 4: I'm not playing high horse here. I just think it's one of those fundamental things that, given that we are so far out on the tail end of the distribution, it's just something that I think we should all commit to going and doing every year, just because it's the right thing, and just because it helps with perspective. We just should, period. I'd just encourage you to do so.

Speaker 2: It's an important perspective to maintain.

Question: I have two questions. One is, although we talked about it, I'm not sure where the opinions came down, but who are the people pushing the idea of putting your revenues and your profits at the mercy of the weather? It seems like going to Vegas to run your profit organization. I mean, that just doesn't seem to be the right incentive to me, but it seems that there's some entity, somebody who persists in wanting that to be the case.

And the second thing is, I thought I understood decoupling, and I thought it was very similar to straight fixed variable. But at least a couple of you were in favor of decoupling and adamantly against straight fixed variable. So I think I don't understand either what your version of straight fixed variable is or your version of decoupling is. So if somebody could explain.

Speaker 1: Let me start with your first question, which is why put utility revenues and profits at the mercy of the weather--which in full decoupling, of course, you don't do. I know the point you're making. And I actually agree with that. But I suppose I'm enough of an economist, and that's, of course, barely, to say that I could make the argument the other way. And the question that you asked in response to that is, who has the comparative advantage for managing that risk? I think that decoupling handles the problem and just deals with it. So I think the way you've asked the question, it answers itself.

As for the difference between decoupling and straight fixed variable rate design, if we had straight fixed variable rate design, we would not need decoupling. Straight fixed variable rate design <u>is</u> decoupling. I agree with that point. I prefer decoupling to straight fixed variable for three reasons, and I alluded to them earlier. There are equity issues. There's another reason, I can't remember. But the reason I do want to emphasize, it's the one I only alluded to earlier, is in response to Speaker 4's point that this is merely a rate design issue. I suppose that's correct. Decoupling is merely a rate design issue. But in my view, and this is just simply where I've come out after 20 years in regulation, prices should be set to recover the long-run marginal costs of production, of providing the service, not merely the short-run. And I'll make all the arguments about how in competition we don't pay access charges. I don't pay a toll to go into the supermarket. If I pay a Sam's Club annual fee, it's my choice. I don't have to do it, because there are competitive alternatives. I just don't see access fees as being a part of competitive pricing.

Question: But you don't have an alternative to the volumetric rate, either.

Speaker 1: I do. My alternative is efficiency and using less. That's my alternative. If everything is an all-you-can-eat banquet, then I can't avoid that cost even by being more efficient. That's my point. In the long run, I'll just remind us all, all costs are variable. And that means, including the line drop to my house. And at some point or another, I can make a decision to go off the grid. I know that's not realistic. But at some point, technology may change, and I may have my cellar-based fuel cell, and things change. This brings up the faith-based thing that was mentioned earlier. I can't resist responding to that. I hope, being the dedicated and devout atheist that I am, that this is not a faith-based thing. I simply think, after all these years, that that's the way to price. If we price at long-run marginal cost, we're better off. It doesn't mean that we don't do short-run pricing things.

Question: My question was, what's the difference between decoupling and straight fixed variable. What does decoupling do that straight fixed variable doesn't do?

Speaker 1: Well, from the point of view of the utility, there is no difference. From the point of view of the consumer, there's a great big difference.

Speaker 2: And I would say there's a political difference in that straight fixed variable means that you're charging the little old lady in her 200 or 800 square foot apartment $55 a month, and you're charging the nouveau riche and whatever millionaire in his 5,000 square foot house the same thing. Now, you could step it up like cell service.

Question: So you're saying that the straight fixed variable that you talk about is a per customer charge that doesn't vary per customer.

Speaker 2: You could step it up, but--and I would say this from 20 years on the regulatory side, as well as my six years on the utility side, and it's why I would invite Speaker 4 to come to one of our jurisdictions as a consumer advocate and speak in favor of straight fixed variable—there are political realities out there. Theoretically, it could be the same thing. In reality, you ain't going to get there.

Question: At FERC, straight fixed variable denominator is your contract demand, which is –

Speaker 2: By customer.

Question: No, you divide the fixed cost by your contract demand, which is the entitlement that you have. You don't divide by customers.

Speaker 1: Right. So it's a demand charge, and it can vary according to a ratchet or a non-ratchet, over time.

Question: Well, I'm not sure it's a ratchet.

Speaker 3: You know, if I could provide a little perspective, too, as I'm listening to us talking--where does our weather sensitivity come from? It comes from our customers' response to weather. So it seems to me like the one major thing that I'd disagree and challenge Speaker 4 on--I think he gave us some really good challenges, too--is whether decoupling is interesting or not. I mean, it's profoundly interesting to me. And the reason why it's interesting…

Speaker 1: People in Missouri are easily amused. It's a Missouri thing.

Speaker 3: …And the reason that it's interesting is, from a policy perspective, what do you want to fix? Do you want to fix rates, or do you want to fix revenues? And if you fix revenues, then what happens is that the price changes that happen with regard to weather get flowed back, and the customer sees those. OK? And has an opportunity to respond to them. Now, do you take some systematic risk out of the utility? Yes. OK? Is that a systematic positive benefit, the way weather's going these days? It is. So I mean, it's something that the utility benefits from. And so we're giving something up by taking that out. But you are taking risk out. So I really like Speaker 1's idea of thinking about recapitalizing the utility to basically reflect in its leverage that it is a less risky entity. I don't think that the right thing to do is take it out of shareholders' hides. I think that the right thing to do is to adjust the cap structure. That all makes sense to me.

Question: I see that we've brought different presumptions to what straight fixed variable is to this discussion, so we can go off line on that. But yes.

Speaker 4: Can I make two quick comments? One is that the utilities have always been exposed to weather risk. What we're doing now is changing it. So I mean, 100 years of a model is now being changed.

So two quick points. I'm fascinated by the impassioned plea for decoupling, because of all of these harsh circumstances that these pour unfortunate utilities are faced with in this policy environment, and in the same breath, they will say, "But, but, but the decoupling adjustment is like 1%. It's only really 1%. It's so small, you shouldn't even worry about it. I mean, you heard it out of both these guys. It's 1%. So if it's really only 1%. If that's your decoupling adjustment, do you really need it? I mean, how hard is that to deal with?

Speaker 1: That is not what I said at all.

Speaker 4: No, you didn't. Speaker 3 said it.

Speaker 3: I made that point about Baltimore Gas and Electric.

Speaker 4: Yeah, and well, that's on your slide, 1%.

Speaker 2: It's 1% in the rate per customer. From our perspective, it's tens and hundreds of millions of dollars. And it does matter. We have a large number of customers.

Speaker 4: It's 1%. And I agree with the leverage thing. Now, I don't know if giving a utility a 15% return on equity and then only giving them a 25% equity piece in their capital structure really solves the problem. I can't imagine that would.

Speaker 2: It would not be attractive to us.

Speaker 4: But on balance, and I've made this point and made this point. It's off decoupling. But we are in the lowest capital cost environment in history. Debt is cheap, cheap, cheap. We have enormous builds that have to be done, whether for environmental or transmission or renewables. Why are we forcing 50/50 equity structures? I beg you regulators, why are we supporting a 50/50 capital structure? Why not 60% debt, 40% equity, to take advantage of what's available right now to accomplish some of the things that we have to do in a manner that is lower cost for consumers? Why wouldn't we do that just as a flat proposition, period?

Question: Well, yes, just in response, equity does track debt to some extent. But I wanted to talk about the risk of revenue decoupling and the cost of capital. In New York City, when we face high-load summer periods, we declare a corporate emergency to keep the electric lights on, because the transformers are overloaded.

And I'm sitting there saying, where is the alignment here that we're putting people 24 hours a day on keeping the electric meters going and we have revenue decoupling? So there's a little bit of a disconnect there.

There's also a disconnect in terms of economic development. There is such a thing as efficient growth, and [with decoupling] the air is taken out of the utility, not that we don't have a long-term interest in the economic vitality of the city.

Also, in terms of things like electric vehicles, that's a big issue for utilities and the country in general, and we're looking at programs to encourage that usage, and that sort of would increase costs and leave the revenues flat--you do get adjustments.

But I really wanted to talk about the risk that was discussed. You know, I say regulatory risk is the biggest risk in the business. And what revenue decoupling does is require utilities to go back every year, essentially, to reset their revenue targets. So it takes away that regulatory lag aspect of the business, which to me is an advantage to utility companies, and now we're constantly before the regulators, and I would argue it increases regulatory risk.

Also, again, efficiency increases the per unit charges of utilities, because, all else equal, your sales are going down, and your unit costs are going up, and that is not great from the utility customer point of view. So I would say the risk of the business goes up with revenue decoupling, but the end of this little point that I want to make is that after you adopt revenue decoupling, and you have it for a period of time, isn't cost of equity a market-determined fact? And you don't need to make ex post adjustments to anything and say it should be up or down? So what are we talking about?

Speaker 3: Can I start? With your final point, that would be right. When the market recognizes the risk reducing value of decoupling, you'll see it in the market. I don't know that we've seen it yet. With respect to your point about unit charges going up because sales are going down, that is the whole point of lost revenue adjustment mechanisms, decoupling, anything else you do to compensate the utility for the intra-rate case reduction in revenues to cover the fixed costs and thus the bottom line. Anything you do is dedicated to solving that problem. If you're only thinking about energy efficiency, the argument is that if the energy efficiency is cost effective, the increase in rates will be less than the reduction in bills, and customers are better off. And then it's just a question of covering the utilities' net lost revenues. Your first point I've already forgotten entirely.

Speaker 4: I'm going to take a quick crack at that. First of all, ROEs are not set in the market. They're in fact set at regulatory commissions and regulatory proceedings made by regulatory commissioners that may be appointed or elected. That's what your rates are based on. And if you've ever done a rate case, you know that the ROE witnesses can have 200-300 basis points of difference in what they think the proper return on equity is, and that's because the basic DCF model relies on a level of forecasted revenue, forecasted dividends, whatever the flavor is. And so you can pick your forecast from whoever. I'm obviously probably going to pick a lower forecast, and the utility obviously picks a higher forecast. We end up with 300 basis points of difference. And at the end of the day, the regulatory commissioner goes, "it's about there." That's where the ROE comes from.

So there's an argument in the relation to ROE and decoupling that you can't, from an evidentiary standpoint, look at the market data and pick out what the impact of the ROE is. And I say, well, yeah, that's because there's 300 basis points of play in there, and you're right, it's not granular enough data that you could. But at the end of the day, the ROE that goes along with decoupling and is to be collected in your rates is set by a commissioner. And they may be generous, or they may be mad at you that day. Or they may have given to you in one place and decided to take from you somewhere else. I mean, we all know how the regulatory process is sort of a cobbled together suit. So ROEs aren't set in the market, per se.

The other issue is is the rate question. And I agree completely. And the problem isn't that overall, rates may be lower than they would have otherwise been, it's the distribution of rates now that you've got to concern yourself with. And just to give you a quick example. We have a small utility in Kansas, and they wanted to do an irrigation rider, because they are irrigating on peak in Kansas, which inherently makes no sense. I mean, it's a very expensive thing to do. They want to incent the irrigators to turn off. It's cheaper to pay the irrigators to turn off during peak than to go buy new capacity. So you could make a very simple argument that for the system overall, it's cheaper to pay than to acquire new capacity. We should all be happy about that. The problem is, is the residential customers, if you get down to the class and look at the distribution, the residential customers not only have to pay for whatever their peak growth is, which is fine, we also have to foot the bill to pay the irrigators. And so, we get double billed, and over time, our allocated portion of overall costs grows, because you're artificially depressing the irrigators. And so what happens is the residential class overall gets more cost allocated to it and gets higher rates.

And so from a simple standpoint, from a residential-only look, it's better to not pay the irrigators, force the system to buy the extra capacity because we have lower costs allocated, and we end up with lower rates. So the simple question is, it's cheaper overall. The distribution questions are where you get down into equity and difficulties. And I'm not saying that we shouldn't do that. I'm just saying, get in the weeds and look at some of this, and you get some kind of odd results that I don't think can be just summarily brushed away or ignored. Again, it's not that maybe we shouldn't do it. It's that there are issues in the weeds that matter.

Question: Right. What about the idea of efficient growth and the utility role and encouraging efficient growth? That is both with respect to economic development and innovations like, important innovations like electric vehicles and their relation to revenue decoupling?

Speaker 1: If the utilities decoupled, I think, if I'm inferring from your question correctly, the utility will not necessarily be interested in growth at all, in the short run in any case. But to the extent that Speaker 4's point is correct about the desire to invest in capital assets and overall increase the underlying rate base, I would think that incentive is still there and can be directed toward outcomes that I would say we as a society prefer. And that goes to the planning question. Do we want electric vehicles? Do we want particular types of industries and uses and so on? Obviously the market drives a lot of that. I'm struggling in part with the question of "efficient growth" and what we mean by that, what that really constitutes, and how we make those decisions, or do we at all. But in a decoupling scenario, the utility is itself not, it seems to me, not all that interested one way or the other. And again, that's where the planning and public policy interventions may have a role.

Speaker 3: Yeah, if I could provide a little perspective, too. I'm not that excited about that, to tell you the truth. I mean, electric vehicles, we've looked at it. There's a little bit of a bump in terms of revenue and growth, but not really that much in our case. What's really important to us is how quickly we get back the investments we make day to day in the business. And closing the gap that Speaker 2 talked about between what our authorized return is and what we actually make. That's another 300 basis point gap, Speaker 4, right now, that's a real issue in terms of being able to fund infrastructure needs today. Are we getting the revenue support for infrastructure investments we need to make today based on rates that were set in the past? And the answer is, we aren't. So if we can fix some of that, and there is infrastructure benefit that we get from building out to new customers on the T&D side. It's just not a generation side benefit. And where we are in terms of capacity, it's so far in the future that that's a secondary issue, at least, for my company, to fixing some of the fundamental regulatory issues that we're talking about.

Speaker 2: If I may, on the electric side, the efficient growth isn't a big factor. I'd say on the gas side for us--where we have, depending on what part of our gas system we're talking about, only 40-60% penetration of gas for heating, and the alternative in the Northeast is oil, and then we have industrial customers who might want to change from oil to gas for their industrial processes—on the gas side, the revenue-per-customer way of doing decoupling provides the incentive for us to go after those customers, and also to use the revenues we achieve from those customers to pay for the infrastructure investments to connect those customers. So I don't know if that gets bid at the efficient growth. And the idea is, these are customers who would be efficient to add to the system, because they're going to help to cover the overall fixed costs.

Question: We had had revenue per customer for the electric business, too, but there was a concern about gaming. So we went to the more generic one. The purpose was that to retain a growth incentive.

Question: Yeah, thanks. I live in sunny Portland [LAUGHTER] which really rivals Tucson for solar. There's a movement in Portland called Solarize Portland, and there have been neighborhood projects to put out bids to various solar providers, and quite a bit has been done. But as to Speaker 4's point that utilities may not be the best mechanism for delivering services, I agree that that may be so. But there were transactional problems with the rollout of these neighborhood solar projects. (By the way, Portland's a place where we choose to invest in bike paths rather than sewer infrastructure.) And the problems were that there were several contracts that had to be signed and the party ultimately responsible for the maintenance of the solar system, Rooftop Solar, was a company that had not been in business that long. And the individuals who were interested had to go out and raise their own capital. Now, we have two utilities in Portland, which have close and steady relationships with customers. They have access to capital. It seems to me that Pacific Power and Portland General could have made this easier. It could have been an easier rollout. So I'd say let 1,000 flowers bloom. Where Vermont has a system that they have a company that can do energy efficiency, effectively and more effectively than utilities that want to do it, and have access to capital so that consumers don't have to go out and borrow, which is, it's a hassle. That's a good thing.

And as far as utility growth, I'm sure you all know that utility growth is approaching around 1 1/2% per year now. So one of the areas of rate base growth for utilities is the rollout of the smart grid, and of course replacement of aging facilities.

If I may be permitted, I've got one other related subject. And that is, we haven't talked a lot about how to incent utilities or other companies to do energy efficiency. Decoupling is neutral on the subject. And I keep looking at these numbers in the McKinsey and Company study…they project 23% cost effective savings in our gas and electric energy use by the year 2020. It seems to be a careful piece of work. I'm not competent to parse it. It's the equivalent of taking off the road all of the passenger vehicles and light trucks in the country. What an enormous pot of gold that would be environmentally and otherwise. So I'm really interested in the question of, how do we incent utilities or others to go after energy efficiency and make it more attractive than other things.

Speaker 3: Let me start on that, at least from the standpoint of somebody who is looking at a lot of untapped potential, even in our service territory. The first thing you do, is for prudently incurred costs, give it back to us quickly, preferably in a way that is timed with when we're making the expenditures, so that the effect on cash flow is not that great. Second, remove the dramatic disincentive of the fixed cost recovery that we've talked about. So simply removing that disincentive in my mind, for my company, doing those two things gets you about 80-90% of the way there. And then, if you want to add the opportunity--and it can even be symmetric, I'm OK with upside and downside here--of us being able to have a few cents of earnings on top if we perform excellently, I think you've got it. But really, the big issue for us right now is removing the disincentive. Because as I said in my presentation, there are natural incentives for us to pursue energy efficiency, just not at the cost of $100 million of earnings every year. So that's the big deal from my perspective.

Speaker 2: And I would agree with what Speaker 3 says, and for us, because we get the cost recovery, and we have decoupling, or we're getting decoupling, the incentives are very important. And symmetrical is what we're dealing with in New York, and we can live with symmetrical. And again, it's incentives for excellent performance. That's what gets us to take that 1 1/2% growth that we're seeing and eliminate it.

Question: When you say symmetrical, are you talking about sharing of the benefits between the customer and the utility?

Speaker 2: I was thinking in terms of an incentive that if you didn't hit a threshold level of savings, then you might pay a penalty. If you hit a target level of savings or above, you earned an incentive on top. And it's a whole other session to talk about the various ways to structure incentives.

Speaker 3: Let me add real quickly, though. It's almost like a fundamental question here also is, how do you know we don't have the right level of energy efficiency out there right now? How do you know?

Question: Because people smarter than I, analysts, look at the opportunities to do this. They do supply curves of measures that have not been carried out.

Speaker 4: Yeah, except that we live in an economy where people take their money, and they buy stuff. And people have bought energy efficiency, at least theoretically, to the point where it makes sense. Now, I live in Kansas. I have a 30 year old refrigerator in my house. And I'm scared to think how much energy it sucks down on any given day. But I'm paying 8 ½ cents a kilowatt hour, and I've got three kids and a car and a dishwasher that just blew up, and you know what? It would make perfect sense from an economic standpoint to replace that refrigerator, except from my economic standpoint, it doesn't make sense, because I have other economic priorities. And so you presume that I'm not purchasing the right amount of energy efficiency, and I presume that I'm allocating my resources to the place that it makes the most value to myself. I'm maximizing my welfare. So are we necessarily getting the wrong amount? Again, I asterisked very early on, I don't know that we necessarily get the pricing of utility services correct, so obviously prices matter. But if you take the assumption that we have the right price, how do you necessarily assume that we don't have the right result in terms of resources? And I follow that up by saying that anybody that thinks putting solar panels up in Portland is a good idea probably should not be making good economic choices for other people, because that's just nuts.

Speaker 1: You can't have it both ways. [LAUGHTER] I wasn't going to say anything, but you can't have it both ways. You can't say that people are making rational decisions.

Speaker 4: No, no, no.

Speaker 1: Let me just finish. You can't say that they're making rational decisions, such as you and your refrigerator in Kansas while saying that someone who--and I'm not talking about subsidizing--I'm not talking about subsidizing PV in Portland, but if I want to put up a PV unit in Vermont --

Speaker 4: Oh, I absolutely agree. I guess let me caveat that --anybody can, you want to, you know, put solar panels on your house, and it's your money, go wild. You can do anything you want with your money. But when you're talking about utility money, utility capital and money that's going to be parsed back out over other rate payers, that's crazy.

Speaker 3: Let me give you one example, if I could, and we're talking about residential applications. But really, when you're talking about resource acquisition and energy efficiency, it's really more the business to business market that really matters. And so what I see when I go out to businesses is an unwillingness to invest in energy efficiency unless it gives a 12 month payback. Now, I would argue that that is not economically efficient from a societal point of view. So what the --

Speaker 4: Or from a business point of view.

Speaker 3: But the point is, you asked whether we had enough energy efficiency. And let's just say that what we inject into the conversation for a business that's trying to think about its investments, is a longer term view of what the impact of their decision is going to be, in terms of fuel we're going to burn, power plants we're going to build, carbon that goes into the atmosphere. So we give them a price signal that they can choose to react to that incorporates those things. OK? And so they are willing, then, to take a longer payback period and invest based on having that incentive. And to me, that makes perfect sense. I mean, the idea that you would make an HVAC investment, or a lighting equipment investment in your plant on a 12 month payback, all that says is that energy efficiency is a low priority for you. You're right. But should it be a low priority? And I would say, no, it shouldn't be.

Speaker 2: And I would just add that if the utility company came to you and handed you the refrigerator and said, "We're just going to keep charging you as if we didn't give you a new refrigerator," that might be a very attractive proposition for them, because you're imposing costs on others by continuing to use your 30 year old refrigerator. That is certainly your choice, but I almost want to say that's the classic market failure of people not understanding.

Speaker 1: That's the tragedy of the commons.

Speaker 4: Do you want my address? I'll give you my address for that refrigerator.

Question: There seems to be a consensus on the panel that straight fixed variable would address many of the problems in theory, but you can't do it in practice, because it creates all these equity problems. This is a little bit of a puzzle for me, because if we thought of *flexible* fixed variable, where we charged a variable cost, and then we had money that we had to collect somehow, and it has to be collected as fixed charges for individual customers, but not the same fixed charge for individual customers, there's enormous room for negotiation in allocating across customers to have all kinds of different equity impacts. I would submit that there's a huge range.

My experience in this is that the problem is not the inherent characteristic of that kind of system. But it is the enormous status quo bias of people, especially rate payer advocates, who feel that they have negotiated laboriously over many years to craft an acceptable deal, and they don't want to open up the box. And that's what it boils down to. And it has nothing to do with the inherent equity of the rate structure of flexible fixed variable. It has to do with revealing the cross subsidies that are already going on and having them exposed to challenge.

Speaker 2: Politics.

Speaker 4: True.

Question: Is that what we mean?

Speaker 2: Yes.

Speaker 4: I think that's unanimous agreement.

Speaker 2: Well said.

Speaker 1: Well, I don't know.

Speaker 4: See, there's always one.

Speaker 1: For the reasons I stated before, you see my own interest in volumetric rates. There's no question that cost allocation--revenue burden allocation, I think is the better way of putting it, rather than cost allocation--customer class revenue burden allocation is clearly an issue, and these things have to be dealt with by rolling up your sleeves, regulators and utilities and advocates and everyone, to resolve those questions in some suitable way. I absolutely agree.

To the extent that you can do some innovative and clever things with rate design, I'm all for it. I just would say, whatever you do, you want to make sure you understand how it affects customer and utility incentives and behavior.

One thing we haven't talked about, though, in all this rate design stuff, when we talked about marginal cost and so on and so forth, is that we're not recognizing--at least I don't think we're recognizing in this discussion--the external marginal costs and how they should affect, if at all, rate design, and I would just sort of toss that into the mix as something to think about.

And I do want to follow on one other point that Speaker 4 made and Speaker 2 just alluded to, and it had to do with the use of the inefficient refrigerator and the costs it imposes on the system. You were talking about efficiency earlier, and what seemed to be a disagreeable position of many consumers in that they're paying for someone else's efficiency, and that has cost allocation implications. I agree. I'll just go back to what I said a moment ago. You have to work out all these things really by rolling up your sleeves. I would only say, though, that these are the consequences of being a member of a network. When you've got a network industry, we have these shared revenue burdens and implications of costs of our behavior on the network as a whole. And whether you're doing efficiency or anything, there are going to be these issues, and they need to be addressed in some way or another. And with that in mind, the final comment would be, if I'm not a member of this network, I'm producing my own electricity at a much higher total cost for me than I would be as a member of the network. So I'm willing to bear some of those supposed inequities for being a member of the network.

Question: At the risk of piling on, I'm going to ask something else about straight fixed variable. I agree with everything that has been said up to this point about how equity issues can be addressed in straight fixed variable. But it seems to me that we're confusing here issues related to revenue decoupling, rate design, and the form of regulation. Speaker 1 had on one of his slides, that there's still an incentive to over invest with the Averch-Johnson Effect. That's not a product of revenue decoupling. That's a product of rate of return regulation, and you can solve that problem by going to price cap or revenue cap regulation, which is something that Speaker 2 hinted at in her presentation, although it didn't explicitly say anything about this. After all, National Grid has decades of experience now in the UK with such regulatory mechanisms. And then, of course, there's the cross-subsidy issue and so forth. Why are we making this way more complicated than it needs to be? I think Speaker 4 hit on it perfectly. Straight fixed variable works. As the previous questioner said, if you're worried about the equity issues, we can allocate those fixed costs in a whole bunch of different ways. In fact, in working overseas in developing countries, they're looking at that, because they want to get more efficient pricing structures, and looking at putting more of the fixed costs on the customers who can afford it, and then reducing the fixed charges for customers that can't afford it. So why can't we do that here?

Speaker 1: I see that I'm not going to win the straight fixed variable argument today. But I will respond to your first point about the incentive to invest in more rate base. Strictly speaking, I agree with you. Decoupling itself isn't the issue. But to the extent that politics and regulation requires you to take a look either every year, or perhaps every three years or five years, at the underlying costs of the utility and recalibrate the program it operates under--that's when the rate base becomes an issue. So it's still there under our underlying regulatory methods.

Moderator: Let me add a little bit about what you and I talked about last night, because there's a couple of problems, I think, with just using a straight fixed variable rate. I mean, it's true. You can go from a straight fixed variable to a flexible fixed, but I'm not sure that makes anything simpler. What does flexible mean? And you've got a zillion questions that come up, and we could argue about that ad nauseam.

Comment: More for you, and less for me.

Speaker 2: Exactly.

Moderator: That doesn't make it simple. It just changes what we're fighting about. But the other point, and Speaker 1 alluded to it, and we haven't really discussed it a lot, is the externalities issues. I'll use the example I talked to you about last night, and this is a case we actually had in Ohio, about how do you allocate the cost of a scrubber? I mean, is it a fixed cost? Once it's sunk, it's sunk, so in theory it would be a fixed cost. But on the other hand, if what you want to say is, the only reason we're investing in a scrubber is because consumers are making demands that cause utilities to pollute, then let's send the price signal to reduce pollution by putting it in the variable. And I don't know how you address that with the straight fixed variable cost, I mean, unless you throw that into a flexibility schedule, which is fine, you can do that. The problem with doing that is it that doesn't simplify anything. You changed the nature of the debate somewhat, but you're still fighting over similar issues.

Speaker 3: If I could add, from the standpoint of Missouri, this is one thing that I actually agree with my consumer advocate counterparts in Missouri on. The legislature has not delegated that power to the regulatory commission in Missouri. If you're going to deal with those sorts of non-cost equity issues in the equation, it's got to be dealt with legislatively. So if the legislature wants to delegate that power, they can. But they haven't done so, so far.

Question: Listening to this whole discussion is really déjà vu all over again for me, because I started my utility career in DSM, now known as energy efficiency. Peter Bradford was chairman of the New York commission, and David Moskowitz was joined at the hip, and it was quite an interesting period. As to that history, there was a lot of really good detailed analysis which looked at decoupling in a larger context of incentive regulation, all of which is still relevant today. So whoever said, don't look at this in isolation, I agree with 1,000%.

There are a number of points I wanted to reply to you on, but I'm only going to pick one, because I cannot resist Speaker 1's invitation to spank him for suggesting that prices should be based on long run marginal cost. And I'm going to do that by reminding you that we got into this business the first time around because of the hubris of the central planner who said, "We know what's going to happen 20 years from now. We know what long-run avoided cost is going to be. We're going to do energy efficiency. You're going to sign these long-term IPP [Independent Power Producers] contracts. It was about ten years in a row of being consistently and persistently wrong that led to the restructuring of about half the industry in the United States, because the reality is--let's not forget this, people--nobody knows what the hell's going to happen. None of us do. Yes, we do long term planning, because we have to. We're capital intensive. So the issues are not that we know better, so I can set that price, and you the consumer don't know. The issues are, who gets to decide, who bears the risk and who pays? Those are the real policy decisions we can make, and let's not kid ourselves that we actually know where prices are going to go over the long run. So thank you. End of speech. Consider yourself spanked.

Moderator: Are you spanked? [LAUGHTER]

Speaker 1: I admit that I'm spanked. I actually don't agree, but that's OK. [LAUGHTER]

I understand your point. For me, restructuring in the United States is about allocation of risk, fundamentally. We actually were operating the system we had quite efficiently under our tight power pools--operations, yes, we were. (We can debate some things.) But my point was about the retail pricing that customers should see, and it goes to the notion that in the long run, all costs are variable. And if all costs are variable, then the prices I see should be avoidable. It had to do with the supposed argument that costs are fixed. I'm just making the argument that we should think about pricing in the long-term equilibrium sense, because these are long-term investments we make, whether we do it through centralized planning, as you referred to it, or through markets, because when people build power plants, they are still going to be around for 40 years--I'm just thinking that from a regulatory, stability, political, you can name all the "isms," long run marginal cost pricing has a lot of attractive features to it, and that means that the prices need to be avoidable by those who pay them.

Speaker 3: I'd like to add one question to the ones that were just raised, and I think it kind of gets to one of the things Speaker 1 said that I really liked, which is that all regulation is incentive regulation. And that question would be, what do we want the utility to do? The frustration I have as a utility executive right now, is that I have a lot of stakeholders in Missouri that are bemoaning the fact that we are constantly like 45th or 46th in the ACEEE energy efficiency rankings, but they're giving me no mechanisms by which to be part of the solution to change that. It's that dichotomy that just drives me crazy. You know--so figure out--if you want us to go after energy efficiency, it is fundamentally simple. Align our incentives with doing it. You know? Now, how we do that, maybe there's some complexity there, but the idea--and we've already got a law on the books that said they're supposed to do this. And we still can't get it done. And I've actually had Speaker 1's organization in to try to work with my stakeholders, to get us on the same page. I can't get it done. And 2011 is the year for Missouri, we're either going to stay with energy efficiency, or we're going to ditch it, as far as I'm concerned.

Question: My question was pretty much answered. I'm relatively new to this. But this conversation has been going on for apparently what is 20 years, and it still hasn't been figured out how to make these incentives workable, whether it's straight fixed or flexible or whatever name you want to attach to it. It seems to me that it's really a matter of semantics. I think what we should be focusing on—maybe I do have a question here for Speaker 4 and the other panelists—is who's got it right? Which jurisdictions have maximized on reaching that balance, where it is working? And energy efficiency in my view should be important from the perspective of just being able to provide the energy mix that we need to to keep this country going. We saw some statistics yesterday, where we're relying on energy efficiency as part of a portfolio anywhere from 30% to 20%. That's a huge part of our mix. So we have to figure it out. And I guess I'm just wondering what jurisdictions would you point to as models?

Speaker 2: Jurisdictions where there have been incentives provided, jurisdictions in which we've operated for over 20 years. And we earn incentives in all four of the states in which we operate. New York had a hiatus, and we're back again. The question is with decoupling is, as you ramp this up, for a while incentives were supposed to cover the lost sales, the lost revenues. But when you make this ratchet up, unless you want to ratchet up the incentives significantly, which has not happened, a more straightforward way to deal with it is to put the decoupling into place, and our four states are all heading in that direction, and there are many other states in the country going the same way.

Question: One point and question--well, maybe two quick ones. One is that I think there's no question that we need to be on the side of utilities making serious investments in energy efficiency. As a societal cost, both with regard to providing power, but also with regard to the externalities, it is a much cheaper resource than the other things out there. At the risk of agreeing with everything Speaker 3 said today, I think I'll disagree with one, which is that that graph I brought up earlier, I wanted a point of clarification to set myself up here now, which is that I think there's a really good chance that they're wrong about the forecast and changing the trend in ten years.

And it might keep going the other way. In which case, we have all the more reasons to get these incentives right, because if we don't, we're going to be grinding utilities to a halt, either in their energy efficiency programs, or everywhere else, just at the time we're also asking them to make really significant other investments in ramping up renewables and integrating electric vehicles and so forth, which are other real costs that we need to manage.

And the last point, which is that I think Speaker 4 made a good point that there may be real significant changes in the market right now with regard to return on equity, return on investment. But I don't think that there's a real connection--I haven't seen anybody make a connection between that and decoupling. And to the extent that there is a connection, then fine. If there's a demonstrated connection that actually reduces the cost of equity or cost of capital, then OK. But just to use it as a poison pill to say, "OK, well, you're getting one thing, and we're getting another,"-- I think we're getting enough by getting utilities to really significantly invest in the lowest cost resource to the extent that it might be actually reducing consumption. And let's not just forget, for decades, the utility business model has been about increasing consumption. And so, to the extent there's a risk shift here, we're talking about changing a business model to the idea where we're actually reducing all of the upside from continued increasing consumption. And granted, in 2008 and 2009, there were two years in a row where national electricity consumption fell. Point to any other two year period in the last 50 years where that's happened. And the business model has been based on that impact. So I don't know if there's any comments on that.

Moderator: Well, let me just say that, let's all pay tribute to the recession for being the biggest --

Question: Oh, absolutely. I'm not saying that wasn't the cause. I'm just saying, the business model is based on that not happening.

Moderator: Thank you. I don't know if there was a question, but we appreciate the comment.

Question: I'll take any comments on it.

Moderator: Anybody want to comment on it?

Speaker 3: Well, just one brief one. I mean, we are seeing, even without the recession, we are seeing that in our residential class, I think maybe because of the recession, we're seeing an uptick in our own programs. The load isn't coming back like we would have expected. So I think there's some systematic structural energy efficiency that's gone into our business segments, especially the residential, from the recession.